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Abstract

Business continuity (BC) management is an organizational approach to preparing information systems (IS) for incidents, but such approaches are uncommon among small and medium-sized enterprises (SMEs). Past research has indicated a gap in approaches that are designed for SMEs since BC management approaches tend to originate from larger organizations and SMEs lack the resources to implement them. To fill this gap, and to respond to a practical need by an IT consultancy company, we employed design science research (DSR) to develop a BC approach for SMEs coined as the *thrifty BC management approach.* Jointly with the company's practitioners, we developed a set of meta-requirements for BC approaches for SMEs anchored in prior BC literature, practitioners' practical expertise, and the theories of collective mindfulness and sociotechnical systems. We evaluated our thrifty BC management approach with multiple SMEs. These evaluations suggest that the designed approach mostly meets the defined meta-requirements. Moreover, the evaluations offered ample opportunities for learning. The design process, unfolding in a real-world setting, was precarious, rife with contingencies and ad hoc decisions. To render the design process transparent, we adapted four writing conventions from the confessional research genre familiar to ethnographic research but novel to DSR. We offer a threefold contribution. First, we contribute to SMEs' BC with meta-requirements and their instantiation in a new BC approach (artifact); second, we contribute with four practices of confessional writing for transparency of DSR research; and third, we contribute with reflections on our theoretical learning from throughout the design process.

Keywords: Business Continuity, Small and Medium-Sized Enterprises, Design Science Research, Research Transparency, Thrifty BC Management Approach

1 Introduction

Because of organizations' dependency on information systems (IS), different kinds of incidents, from Fukushima (Sakurai & Kokuryo, 2014; Tapanainen & Kamioka, 2013) and the WannaCry ransom attack (Hern, 2017) to common component breakages and network outages, can cause operational business disruptions with significant impact, especially when affecting business-critical systems or processes. To prepare, organizations must develop their business continuity (BC), or the capability "to continue delivery of products or services at acceptable predefined levels following disruptive incidents" (ISO, 2012). While developing BC is challenging for all kinds of organizations due to the inherent unreliability of technologies (Butler & Gray, 2006), SMEs face challenges that emanate from their more limited pool

of resources (Botha & Von Solms, 2004; Heidt & Gerlach, 2018; Sullivan-Taylor & Branicki, 2011). Thus, it is not surprising that BC preparations are uncommon among SMEs (e.g., Herbane, 2013; Kato & Charoenrat, 2018).

While "IS research provides little guidance for managers … to enhance business continuity" (Butler & Gray, 2006, p. 218), practitioners tend to favor best practice-based BC management approaches such as ISO/IEC 27001 or ISO 22301, developed by the International Organization for Standardization (Hiles, 2011). These standard-based frameworks originate from larger companies (Backhouse et al., 2006), are geared toward such companies (Kinnunen & Siponen, 2018), and assume a more bureaucratic form of organizing than that typically found among SMEs (Bilili & Raymond, 1993). Further, such approaches are too generic for all organizations (Siponen & Willison, 2009), require extensive documentation (e.g., BC policies, plans, and strategies) (Freestone & Lee, 2008; Gibb & Buchanan, 2006; ISO, 2012), and assume niche expertise for implementation (Niemimaa & Niemimaa, 2019). Thus, the suitability of current BC approaches for SMEs is debatable.

Despite SMEs' importance for markets, scholars have provided little BC guidance tailored for SMEs (Botha & Von Solms, 2004; Herbane, 2019), and rigorous BC approaches designed specifically for SMEs are lacking (Herbane, 2019; Macpherson et al., 2015). The distinctiveness of SMEs stems from their limited formality and their relative lack of temporal, financial, and knowledge resources in operations, compared to large organizations (Heidt & Gerlach, 2018; Herbane, 2019). These SME-specific requirements present an interesting opportunity to explore BC management in the SME context, raising the following research question:

RQ: How can a BC approach for SMEs that considers their specific requirements, based on their limited available resources, be designed?

We approach this question through a practitioner-initiated design science research (DSR) project aimed at creating a BC approach for SMEs. The design of the artifact is anchored in theories of sociotechnical systems and collective mindfulness intended to strengthen the practically oriented BC literature (Niemimaa, 2015b). These theories facilitated the creation of meta-requirements for a BC approach, resulting in what we coin the *thrifty BC management approach*. The project responds to the scarcity of IS studies on this topic (Niemimaa, 2015a, 2017) and to calls for more guidance on BC for IS managers (Butler & Gray, 2006), especially regarding SMEs (Herbane, 2010a).

Following Kuechler and Vaishnavi's (2008) DSR model, this paper is structured as follows. First, we introduce the literature on BC management and provide background on the relevant aspects of BC for SMEs. Second, we describe our DSR approach. We then formulate the design problem and develop 10 meta-requirements for BC management approaches applicable in SMEs. Next, we present the *thrifty BC management approach* for BC as the design artifact and describe the design process. Finally, we outline the evaluation of the approach. We close with a discussion and conclusion presenting our contributions.

2 Knowledge Base: Business Continuity Management for SMEs

2.1 The Technical, the Social, and the Sociotechnical Business Continuity

Several approaches exist for BC management and planning (Niemimaa, 2015a) that provide guidance for organizations on incident preparations and quick recovery (Arduini & Morabito, 2010; Baham et al., 2017). Many of the approaches propose an organization-wide and holistic approach to BC (Geelen-Baass & Johnstone, 2008; Harris & Grimaila, 2008; Sambo & Bankole, 2016) that requires a considerable amount of work, produces heavy documentation, and is designed for larger organizations (Herbane, 2019; Kepenach, 2007; Smith, 2003).

To prepare IS for incidents, organizations need not only change the IS but must broadly change the social and technical fabric of organizing (Niemimaa, 2017). Typical technical measures for BC management are backup systems or high-availability solutions, whereas social measures comprise those such as documentation (e.g., recovery procedures, responsibilities, plans, etc.), organizational structures and responsibilities, as well as training and exercising (e.g., Gibb & Buchanan, 2006; Tracey et al., 2017).

Social measures are challenging to implement because of difficulties in translating policy imperatives into actual practices (Niemimaa & Niemimaa, 2017), but also because employees tend to not comply with such policy imperatives (Moody et al., 2018). Scholars have underlined the significance of *embeddedness* as an organizational quality when "strategic thinking and participation in the business continuity process … manifests itself throughout the organization" and "constitutes the organizational processes of leadership, commitment to which may be seen operating at individual and group levels." (Herbane et al., 2004, p. 442). Thus, embeddedness in this context relates to the organizational reliability culture (Sawalha et al., 2015) and to BC awareness rather than to social ties (Adler & Kwon, 2002). Research has indicated that each BC

planning phase contributes to achieving embeddedness (Niemimaa & Järveläinen, 2013), rather than being an outcome of the whole process (e.g., BS25999).

Considering further the social measures of BC, research indicates that collective mindfulness processes are significant to BC. Butler and Gray (2006) argued that organizational cultures in which employees can practice resilience and reliability embody processes of mindfulness. These processes focus on operations, a commitment to resilience, and openly considering the past (Weick et al., 1999). BC plans become secondary to such issues of context and culture that enable practicing resilience and reliability. Butler and Gray (2006) further argued for a dual role of collective mindfulness on technical measures in BC, which can be "enhanced by (moderation) collective mindfulness" (p. 219) or can increase their influence.

The sociotechnical perspective is broadly considered a suitable theoretical basis for BC research (Herbane, 2010b; Niemimaa, 2015, 2017). It makes little sense to carefully plan, organize, and practice effective procedures of data recovery without technical measures enabling and supporting them. Similarly, procedures must leverage their action potentials in case of data loss. A sociotechnical perspective on BC stresses the importance of both technical and social measures (Herbane et al., 2004).

2.2 Business Continuity Management in SMEs

Prior literature indicates that SMEs form a specific context and challenge for BC, possibly explaining their unpreparedness for contingencies (Herbane, 2019; Sarkar et al., 2017). For instance, Macpherson et al. (2015) found that small businesses used their networks, experiences, and combined coping mechanisms to survive crises, contrasting with more formal and bureaucratic mechanisms found in larger businesses. Further, Cumbie (2007) studied SMEs' use of disaster recovery approaches and found several felicitous managerial and operational practices—for example, managerial planning and geographical diversity.

A commonly shared view is that the approaches, in general, disregard considerations of company size (Bell & Gomez, 2011; Cumbie, 2007; Pinta, 2011). Approaches tailored to SMEs exist but their suitability is often not specified (e.g., Sambo & Bankole, 2016; Ueno et al., 2018). Botha and von Solms (2004) identify eight factors that distinguish SMEs from larger organizations and that have an impact on their BC planning, such as financial performance, management structure, infrastructure complexity, and SME conduct. While their approach suggests a localized management of BC risks (e.g., with back-ups

and disaster recovery), it also expects all SMEs to perform the same BC activities as larger organizations (e.g., conducting planning and business impact analysis activities).

Resource availability, a key differentiator between SMEs and larger organizations, is a significant barrier to SMEs' resilience (Sullivan-Taylor & Branicki, 2011) and influences SMEs' BC in several ways: limitations in financial resources, time, and know-how impact their security decisions (Heidt & Gerlach, 2018); managers in SMEs must assume several roles (Branicki et al., 2018); SMEs perceive a lack of necessary skills, knowledge, and information (Chen et al., 2007); and SMEs have limited resources to confront day-to-day threats (Branicki et al., 2018; Herbane, 2019), giving them a temporal focus on leadership (Heidt & Gerlach, 2018). Lastly, they lack formalism in planning for BC (Herbane, 2019; Kato & Charoenrat, 2018; Vargo & Seville, 2011), which may in fact contribute to their resilience rather than weaken it (Branicki et al., 2018; Macpherson et al., 2015). Thus, SMEs' preparations for incidents differ (Bell & Gomez, 2011), which calls for an SME-specific approach that can facilitate resource-considerate BC management (Bilili & Raymond, 1993).

To summarize, the prior literature lacks an approach for BC management for SMEs, although the need for one has been widely recognized. This research aims to fill this gap by designing a BC approach for SMEs.
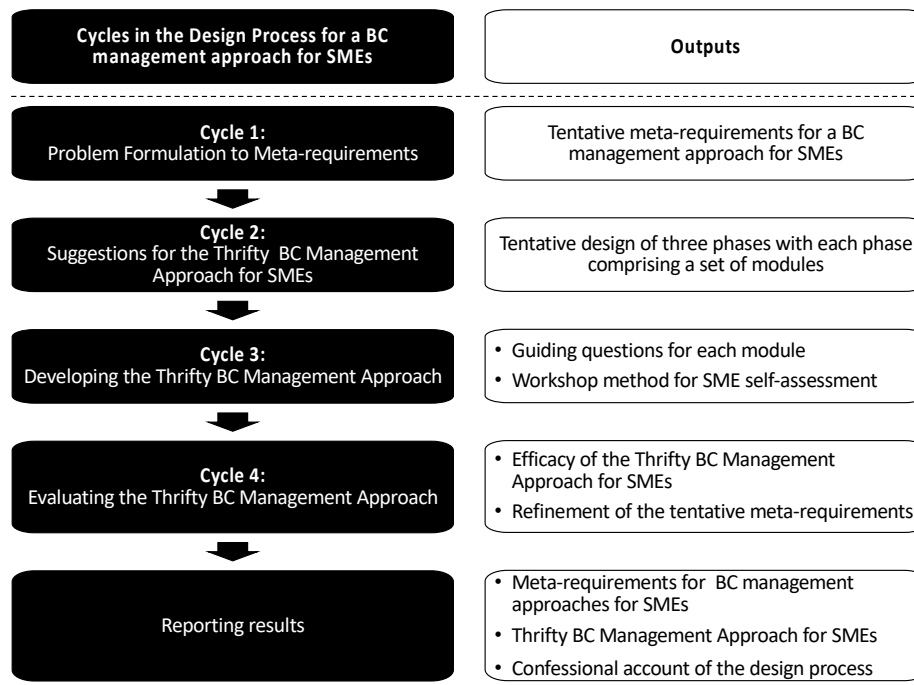
3 Research Approach

We followed a DSR approach to design a BC management approach as an artifact. In what follows, we outline the methodological details of the DSR project.

3.1 Design Process

Following Kuechler and Vaishnavi (2008), we analytically structure our design process in four design and reporting cycles (see Figure 1). The linearity of this and the following description are simplifications of the actual process in practice (Kuechler & Vaishnavi, 2008). The design project's first three cycles took place between September 2016 and January 2017. The evaluation cycle comprises four episodes, two completed in 2017 and two in 2020, which iteratively informed the artifact.

The *problem formulation to meta-requirements* cycle created problem awareness (Kuechler & Vaishnavi, 2008). This cycle started with a contact from an IT consultancy company (hereafter "IT Consultancy") offering IT services to SMEs, who knew the first author to be a BC expert because of earlier interactions.

Cycles in the Design Process for a BC management approach for SMEs	Outputs
Cycle 1: Problem Formulation to Meta-requirements	Tentative meta-requirements for a BC management approach for SMEs
Cycle 2: Suggestions for the Thrifty BC Management Approach for SMEs	Tentative design of three phases with each phase comprising a set of modules
Cycle 3: Developing the Thrifty BC Management Approach	• Guiding questions for each module • Workshop method for SME self-assessment
Cycle 4: Evaluating the Thrifty BC Management Approach	• Efficacy of the Thrifty BC Management Approach for SMEs • Refinement of the tentative meta-requirements
Reporting results	• Meta-requirements for BC management approaches for SMEs • Thrifty BC Management Approach for SMEs • Confessional account of the design process

Figure 1. Cycles and Outputs of the Design Process (adapted from Kuechler & Vaishnavi, 2008)

The company's customers struggled with existing BC approaches that they perceived to be laborious and resource intensive. The first author initiated a DSR project involving our research group (comprising the first author and two additional researchers), as well as three employees from IT Consultancy as the design partner. After initiation, we developed our problem awareness in meetings with the members of the design partner. They provided feedback on practical relevance, while we shared our research knowledge and assessed research relevance using prior literature (see Appendix A). Through this, we established a shared problem awareness, which we captured in meta-requirements (MRs) as classes of design imperatives that describe an artifact's scope, boundaries, and goals (Arazy et al., 2010; Gregor & Jones, 2007). These MRs serve as the basis for an artifact's creation and evaluation and ensure its practical relevance (Lins et al., 2019).

In the *suggestions for the thrifty BC management approach for SMEs* cycle, we created design alternatives by building on the MRs that materialized the justificatory knowledge gained from the literature and through the design process (Gregor & Hevner, 2013; Iivari, 2020). In regular meetings, we suggested alternatives to the design partner (Kuechler & Vaishnavi, 2008) and modified them based on their feedback (Gregor & Jones, 2007). This resulted in a potential design, which required further elaboration (Kuechler & Vaishnavi, 2008).

The *developing the thrifty BC management approach for SMEs* cycle focused on elaborating the potential design through an iterative process in which we

transformed the MRs into material form, resulting in an approach with three separate phases, each with modules for relevant BC activities. With the design partner, we developed guiding questions for each module and advice for executing the approach (see Appendix B).

The *evaluation of the thrifty BC management approach for SMEs* cycle comprised a field study involving five SMEs. Its goal was to evaluate the designed approach against the MRs and to revise it based on the learnings gained from its evaluations. Table 1 provides details on our project members and their role in each cycle of the design process.

3.2 Data Collection

Throughout the design process, we drew on common recommendations for qualitative research to collect data on the real-world problem, the artifact's design, and the design process. The resulting data set originated from multiple sources but with different foci depending on the design cycle (see Table 2). Tasked with the artifact's design, we gained and produced firsthand knowledge on the design of the thrifty BC management approach. We created illustrations of the approach and compiled documentations on its design, linking the approach to existing BC literature. We each kept our own set of design and reflective notes. While design notes capture suggestions or reasoning for certain design aspects in relation to existing knowledge, reflective notes discuss the design process, relation to the design partner, and our problem understanding as well as design activities.

Table 1. The Design Science Research Project Members and their Role in the Design Process

	Role in the design process by cycle	
Project members	**Research group:** Robin, a scholar with extensive experience in BC research; Kim, an experienced information security consultant who has conducted doctoral research on BC and published several research articles on the topic; and Alex, an organizational change management consultant currently pursuing doctoral studies. Prior to the project, we all had received formal DSR training from prominent IS DSR scholars, but none of us had completed a full DSR research cycle in practice.	**Design partner:** One executive (Jude) and two employees from IT Consultancy with years of practical experience advising SMEs on information security and business continuity
Cycle 1: Problem formulation to meta-requirements	• Review justificatory knowledge provided by existing research (for the details and results of the review of existing BC literature see Appendix A) • Formulation of MRs	• Provide initial problem awareness • Provide justificatory knowledge stemming from their observations and experience of addressed practical problem • Evaluate the understanding of our problem
Cycle 2: Suggestions for the thrifty BC management approach for SMEs	• Suggesting design alternatives • Iteratively develop a BC management approach for SMEs	• Evaluate our design alternatives • Provide feedback on design alternatives
Cycle 3: Development of the thrifty BC management approach for SMEs	• Development of the design suggestions into a full-fledged BC approach	• Assist and contribute in developing the tentative design
Cycle 4: Evaluation of the thrifty BC management approach for SMEs	• Evaluate the designed thrifty BC management approach in a field-study with SMEs • Improve artifact design based on the field-study evaluation • Report designed artifact	• Facilitate access to IT Consultancy's customer SMEs for evaluation

Table 2. Summary of Data Collection

Design process cycle	Data collection focus	Main data collection sources
Cycle 1: Problem formulation to meta-requirements	• Understanding the real-world problem • Assessing prior knowledge	• Artifact illustrations and documentation • 7 internal meetings in research group • 9 meetings with design partner • Design and reflective notes • Emails exchanged with the design partner and internally • Literature review (see Appendix A)
Cycle 2: Suggestions for the thrifty BC management approach for SMEs	• Derive alternative designs from MRs (i.e., prior knowledge) • Design partner's feedback on tentative designs	
Cycle 3: Developing the thrifty BC management approach for SMEs	• Design partner's expertise in conducting effective BC • Existing guidelines for effective BC	
Cycle 4: Evaluation of the thrifty BC management approach for SMEs	• Criteria to assess the designed thrifty BC management approach's efficacy • Learnings from field-study settings to improve the artifact's design	• 2 feedback sessions • 9 workshops with SMEs

During the first three cycles, meetings with the design partner were an important data source. We received feedback on our alternative designs from members of the design partner regarding whether and how they addressed their practical problem. We prepared for these meetings by crafting topics of interest and concern in relation to the real-world problem. The design partner's role in these meetings evolved from providing feedback in the first two cycles to actively engaging in design activities in the third. We took notes during these meetings instead of audio recordings due to the sensitivity of the information shared on the BC practices of the design partner's customers. We emailed the design partner in between the meetings to give updates on the design process, to plan for upcoming meetings, and for clarifications, follow-ups, and alternative design suggestions. We stored these and our internal emails to keep a record of the design and its process.

In the fourth cycle, when evaluating the designed approach, we collected data through feedback sessions and field-site workshops with SMEs. We held discussions with BC or information security experts after presentations of our thrifty BC management approach to understand and establish general awareness of the SMEs' business context. Testing the approach, we conducted nine workshops with the involved SMEs that we documented as field notes: one researcher moderated and facilitated the workshops; a second researcher kept notes and assisted with follow-up questions. We refrained from audio recording the interviews and workshops for sensitivity.

3.3 Data Analysis

Data analysis took part during and after completing the design process. During the four design cycles, we analyzed our notes from internal meetings and meetings with the design partner for clues on a *thrifty BC management approach for SMEs*. Since this analysis occurred spontaneously, we did not systematically code the collected data, but studied our notes and prior literature for hints and recommendations on solving the practical problem.

After completing the design, we analyzed the collected data in order to reconstruct the design process, including design decisions and key learnings from the evaluation following common recommendations for qualitative data analysis (Miles & Huberman, 1994). For this, we created an extensive tabulation comprising all events (Miles & Huberman, 1994). Recorded events include our research group meetings, meetings with the design partner, email conversations (both among ourselves and with the design

partner), interviews, and evaluation workshops with SMEs. We noted the dates of these events to order them chronologically and studied each event for its content—for example, who attended, what was discussed, which decisions were made, or knowledge created on the artifact's design. We also analyzed our notes for learnings on the design process and the reflections on the design partner's role and captured the results. Table 3 illustrates the resulting tabulation including data excerpts.

When outlining each cycle's findings, we borrow ideas from confessional writing as an alternative genre and present our findings as a narrative of our design activities interlaced with descriptions of the artifact (Schultze, 2000; van Maanen, 2011). Confessional writing originates from ethnography and seeks to expose the researcher as a "research instrument … rendering their actions, failings, motivations and assumptions open to public scrutiny and critique" (Schultze, 2000, p. 8). Adopting this genre, we seek to overcome the division between the neat and mechanistic descriptions that often characterize DSR and the reality of the messy and precarious process (cf. Schultze, 2000; van Maanen, 2011), along which research may proceed in practice. While one researcher typically performs an ethnography, we formed a research group of three, jointly conducting this DSR project. Although ethnographers writing confessionally express solely their personal experiences, we explicated and discussed our individual experiences and reflections to find consensus on the design process at the research-group level. Most importantly, we explicated the context, as well as our choices, concerns, and reflections that led to the presented artifact, in addition to the hiccups and the contingent parts in our design process (Burton-Jones et al., 2021; vom Brocke et al., 2021). Writing confessionally, we brought forth our role as part of the research apparatus, translating existing knowledge and practical experience into design knowledge. To express the different voices involved in the design process, we [1] report our design study using pseudonyms for the research group ("Robin," "Kim," and "Alex") and the executive member of the design partner ("Jude") (see Table 1).

4 Designing the Thrifty BC Management Approach

In this section, we present the four cycles of our DSR project as narratives that seek to capture the artifact-in-the-making rather than merely the artifact. We describe the final artifact and its use in Appendix B to facilitate practitioners in adapting the artifact for self-assessing and developing their BC.[2]

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[1] The use of "we" refers to the research group comprising Robin, Kim, and Alex. It excludes the design partner, i.e., Jude and two employees from IT Consultancy.

[2] The designed artifact will also be published on a website (after the peer review of the article) to allow for artifact transparency and ongoing development of the artifact based on feedback from practitioners.

Table 3. Excerpt from the Tabulation Created during Analysis

Date	Event type	Content summary	Design reflection	Process reflection
Oct 20, 2016	Internal Meeting	• Robin outlined design partner's contact, interest, and goal (what was shared by the design partner) • Discussion of the alleged problem area • First ideas for possible solutions (defining the solution space)	Approach needed to: • make SMEs' infrastructure visible in order to design BC for it • be lean (assumption that SMEs face resource scarcity) • as a first step, create awareness of BC	• We prepared based on the information given by the design partner (i.e., we coined our assumptions and solution space) • We note that we depended on the design partner to test the approach
Nov 24, 2016	Meeting with design partner	• We presented the tentative design to the design partner • Design partner provided feedback on the tentative design	• Design partner claimed that the tentative solution offered little to them. They stressed the practical problem of how to build BC from a workshop such that it is resource-efficient and covers the necessities	• Design partner's feedback on the tentative artifact was feedback on the understanding of our problem
Jan 19, 2017	Meeting with design partner	• Joint workshop with the design partner to formulate lists of possible actions for BC management in each module	• Notion of breaking down modules into actions for BC management that SMEs should consider per module	• The new design of the approach built on the modules the design partner introduced on Dec 16, 2016. They thus reflected their idea of the new approach.

4.1 Cycle 1: Problem Formulation to Meta-Requirements

The first cycle of the design process evolved around forming and formulating a common understanding of the research problem and drafting MRs that could satisfy the identified problem. Next, we narrate through this process and expose the glitches, hiccups, and contingencies that characterized our iterative and occasionally messy process of the artifact design.

4.1.1 Getting Set: Clarifying What to Design and How

Our initial discussions with the design partner led us to believe the problem was straightforward: the current BC management approaches, such as ISO 22301 and the relevant parts of ISO 27001, COBIT, and ITIL are too laborious to be applicable within the SME context. We also knew this was an issue that resonated with the BC literature (De Haes et al., 2016; Devos et al., 2012; Mijnhardt et al., 2016) but had not been satisfactorily solved. In particular, Jude was concerned that existing approaches stipulated the creation of a significant number of documents, normative processes, and formal management systems that conflicted with SMEs' way of organizing. For Jude, this was both a practical and economic problem, as implementing and selling the existing approaches to the design partner's customers was deemed infeasible.

A different picture of the problem progressively started to emerge. Jude saw that, in lieu of existing BC approaches, what they actually needed was an approach that enabled them to show their clients the potential and significant points of failure. Quoting Jude, "they [the SMEs] talk about BC problems related to material supply issues and such but fail to realize that their most critical IT server is placed under a coffee machine" (meeting notes). According to the design partner, the problem was that their SME clients were "unaware of their dependence on IT infra" (quote from a slide set). Kim took these considerations as indications that IT Consultancy did not face issues of unfitting BC approaches but of BC awareness. Awareness has been extensively studied in the information security context (e.g., Lebek et al., 2014), but not within the context of BC, despite its ties to embeddedness (Herbane, 2010b) and collective mindfulness (Butler & Gray, 2006). Seeing that the solution should aim at "building awareness and consequently mindfulness" (quote from a slide set), Kim and Alex started crafting an approach.

Butler and Gray's (2006) seminal work on IT reliability and collective mindfulness affected the crafting of the approach, as it is one of the few IS studies proposing theoretical foundations for BC (Niemimaa, 2017). While our extensive review of the literature also showed that mindfulness has been extensively used as an explanatory theory on how organizations achieve reliability with technologies (Dernbecher & Beck, 2017; Salovaara et al.,

2019), these studies could not directly provide the prescriptive knowledge required for designing an artifact. Kim and Alex started drafting a tentative solution, consulting Robin for feedback and ideas.

The design of the tentative solution was formed around empowerment (of employees) and active socialization, which have been found effective for enhancing collective mindfulness (Sutcliffe et al., 2016). We assumed that these processes of collective mindfulness could be instilled into an SME through a workshop for facilitating the emergence of traits of collective mindfulness (Vogus & Sutcliffe, 2012) by enabling the integration of expertise and knowledge across different organizational functions and levels (Kendall et al., 2005), organizing socialization and discussion around IT infrastructure as an object of interest. Further, these ideas derived from collective mindfulness connect well with BC management by creating opportunities for improving workshop participants' awareness of and commitment to BC (i.e., embeddedness (Herbane et al., 2004). Table 4 elaborates the results of this into preliminary meta-requirements for the artifact.[3]

To present our tentative solution, Robin organized an online meeting with Jude and the design partner's other two representatives. However, despite our best efforts to understand the problem upfront and propose a solution that to us aligned with the design partner's experiences, our solution was ill-received and did not resonate with their expectations. In hindsight, we realized more active communication with the design partner would have made sense.

In contrast to our expectations, Jude commented with annoyance that they know how to run workshops and that awareness is a nice idea but would not result in palpable and concrete outcomes that they viewed as necessary conditions to demonstrate the value of the approach for their customers, thereby providing justification for the monetary compensation of their services. Kim pointed out that the design partner had wanted a generic approach to SMEs' BC but now it felt that the approach should be specifically tailored for them to provide BC management to SMEs as a service. Jude started claiming that there should be no difference whether BC management is implemented in-house or with an external service provider such as IT Consultancy. What Jude had missed was Kim's point that BC may engender a conflict of interest if provided by an IT service provider (as in the case of IT Consultancy). For instance, for SMEs' BC it makes sense to acquire IT services from several companies to ensure redundancy, but business-wise it would make

little sense for IT Consultancy to recommend such redundancy to their customers. Nevertheless, Kim decided to acquiesce to Jude in an effort to not engender further conflict with the design partner.

4.1.2 Reconsidering Theories as Meta-Requirements

During our post-meeting reflections, we all felt frustration and disappointment toward the members of the design partner, who seemed to have little interest in revising their expectations. In this moment of frustration, Kim expressed a view that had developed within her. The design partner was into this project to get a "scientific" stamp on the BC approach, which would make sense for them marketing-wise, but they were looking to get the stamp without going through all the research effort required. The effort was clearly much more than what they seemed to have been accustomed to. Kim's view resonated well with Robin and Alex, leading the project to a precarious state and raising the question of what should be done next.

We agreed to clarify and explicate our perception of the practical problem and communicate it cogently to the design partner. What we had missed in the heat of the design was how we all had little experience in joint DSR projects; thus, our expectations of the design partner's methodological understanding of requirements for a rigorous DSR project were likely overstated. Indeed, we already had a misunderstanding at the project's beginning when we explained the need to evaluate the BC approach with their customers to be in accordance with DSR guidelines. To our surprise, Jude seemed hesitant and reluctant to agree to such evaluations. Later, we learned that Jude thought we intended to test some of the *existing* BC approaches to understand how they fail in the context of SMEs. Understandably, this caused significant concerns for Jude on how amateurish we might seem to the design partner's customers but, even more so, what damage such failures might inflict on their existing customer relations.

After discussions with Robin, Kim emailed Jude and explained that we understand the practical problem as twofold: (1) there is a lack of awareness, and (2) "SMEs perceive the current approaches as too heavy." Further, we clarified some methodological aspects of DSR, making sure we shared an understanding of the evaluation of the artifact. Finally, Jude seemed to agree not only with our problem definition but also agreed to provide us with SMEs for evaluating our solution.

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[3] The design process around the workshop-based approach continued for several weeks until we felt that we had a suitable solution to be presented for IT Consultancy. We do not provide a full account of the design of this first tentative

solution but focus only on the aspects relevant to the subsequent design, i.e., on our interpretation of collective mindfulness in the context of the BC management approach.

Table 4. Preliminary Meta-Requirements for the Tentative Solution Derived from the Processes of Collective Mindfulness

Processes of collective mindfulness	Explanation of the process	Preliminary meta-requirements for tentative solution
Preoccupation with failure	"Operating with a chronic wariness of the possibility of unexpected events that may jeopardize safety by engaging in proactive and preemptive analysis and discussion" (Vogus & Sutcliffe, 2007, p. 48).	The solution should encourage organizations to proactively and preemptively (Herbane, 2010b) attend to analyzing and understanding potential future sources of contingencies (Gibb & Buchanan, 2006).
Reluctance to simplify interpretations	"Taking deliberate steps to question assumptions and received wisdom to create a more complete and nuanced picture of ongoing operations" (Vogus & Sutcliffe, 2007, p. 48).	The solution should facilitate an understanding and awareness of what matters organizationally, even when it conflicts with organizationally accepted wisdom, e.g., to question the precedence of material supply over IT systems and infrastructures for BC.
Sensitivity to operations	"Ongoing interaction and information-sharing about the human and organizational factors that determine the safety of a system as a whole" (Vogus & Sutcliffe, 2007, p. 48).	The solution should facilitate collaborative and participatory development of BC (Herbane et al., 2004; Kendall et al., 2005) through information sharing and learning to transgress fragmentation and boundaries of knowledge to create a joint view of organizational BC.
Commitment to resilience	"Developing capabilities to detect, contain and bounce back from errors that have already occurred, but before they worsen and cause more serious harm" (Vogus & Sutcliffe, 2007, p. 48).	The solution should not only focus on past and current incidents but should aim to facilitate conditions for participants to collectively improvise in unexpected situations (Weick et al., 1999) and develop resilience through the redundancy of resources (Bajgoric, 2006b; Herbane et al., 2004).
Deference to expertise	"During high-tempo times (i.e., when attempting to resolve a problem or crisis), decision-making authority migrates to the person or people with the most expertise with the problem at hand, regardless of their rank" (Vogus & Sutcliffe, 2007, p. 48).	The solution should require that decision-making on BC-related matters is founded on expertise (Niemimaa, 2015a) rather than hierarchical position. The expertise should not only include BC-related domain-specific expertise but also, for example, business or work practice expertise.

Based on Kim's initiative, we felt that it was not possible to proceed with mere incremental changes to the tentative solution but that it was imperative to reconsider and refine our fundamental assumptions about its design. After all, while design is grounded in practical problems (Hevner, 2007), it is also founded on theory (Gregor & Hevner, 2013; Gregor & Jones, 2007), which holds certain assumptions that foreground some aspects of the design while eclipsing others (Iivari, 2020; Iivari & Kuutti, 2017). These reflections led us to reconsider the descriptive theories in our design.

Our earlier design decision to center the approach on awareness also meant that our focus was almost solely grounded on the "social" aspects of BC (Butler & Gray, 2006), leaving out a key insight from the literature on the sociotechnical nature of BC. This focus was reinforced by the fact that despite the frequent references to sociotechnical phenomena in the BC literature (Herbane et al., 2004; Niemimaa, 2015a), we had no prior examples that explicated their actual implementation in BC approaches. Turning to the literature on sociotechnical systems, we identified the joint development of the social and the technical, as well as inclusive decision-making, as the theory's key premises (Bostrom & Heinen, 1977; Mumford, 2006). While this caused us to turn our attention toward accounting for both technical and social improvements, the collective and participatory effort (discussed below) guided us to design an artifact that is both inclusive of employees and emphasizes collaboration and participation rather than designing an artifact to be used solely by IS managers alone. While we operationalized these theoretical insights as meta-requirements for the artifact, the generic theories provided us little in terms of the actual substance of BC. We still needed specific MRs to define the artifact's objectives—that is, what BC management approaches for SMEs should achieve.

4.1.3 Crafting Business Continuity Meta-Requirements

In developing the MRs, we integrated the fragmented BC literature (Niemimaa, 2015b) into coherent requirements adapted for the SME context. Robin took the lead to develop the requirements while others in the

research team joined in by suggesting additions. We also took advantage of ad hoc prototyping during workshops with the design partner. Thus, the MRs and crafting the artifact were reciprocally related. The MRs were written as explicit and imperative statements and took their final form only after several iterations of a posterior revisions to the actual artifact design.[4] Next, we present the MRs and anchor them into related justificatory knowledge.

Despite the reaction to our tentative solution, the importance of increasing both organizational members' awareness of and commitment to BC ("embeddedness") (Herbane, Elliott, & Swartz, 2004; Niemimaa, 2015a) was jointly perceived as a requirement for the artifact. We kept this basic premise of our tentative solution and formulated it as MR1:

MR1: Facilitate embeddedness—Commitment to and awareness of BC should develop within the SME.

Scholars have emphasized that one size does not fit all organizations (Sullivan-Taylor & Branicki, 2011) and accounting for the context when planning BC measures is important (Halonen & Koutonen, 2010; ISO, 2012; Lindström et al., 2010b). Botha and von Solms (2004) argue that the size of the organization is a significant contextual factor. During the workshops, the design partner also highlighted the importance of accounting for SMEs' existing BC measures and resources (see also Gibb & Buchanan, 2006; Tracey et al., 2017). BC not only depends on the use of new or additional technologies (Bajgoric, 2014) but can also benefit from using existing technologies and resources differently (for example positioning the IT server somewhere other than under the coffee machine). We thus formulated MR2 as:

MR2: Pay attention to context—BC measures should be sensitive to the specificities of a particular SME and its existing BC preparedness.

The BC literature suggests that BC management approaches should be iterative (Geelen-Baass & Johnstone, 2008; ISO, 2012; Shropshire et al., 2009) to ensure continuous development similar to management systems (ISO, 2012). Instead of being a one-time event, the iterating continuous nature of BC is also well-established among practitioners (Hiles, 2017). As Gibb and Buchanan (2006) state, BC has to be maintained as accurate and up-to-date since the organization's risk environment might change. Occasionally, strategic changes of business models necessitate significant reevaluation of the whole organizational BC (Niemimaa et al., 2019). With the support of the scholarly and practitioner literature, we defined MR3 as:

MR3: Maintain accuracy—BC measures should be up-to-date and accurate.

Our discussion with the design partner led us to conclude that BC management should not be a "big bang" approach but one that is developed gradually. We also found support for this requirement from the literature in the form of a maturity model for BC (Lindström et al., 2010b) and as a cyclic approach (Botha & Von Solms, 2004). Such a gradual process allows SMEs to stretch resource use over time by first preparing for incidents that threaten the most critical business process(es) and gradually develop the BC management of the same or other processes (Botha & Von Solms, 2004; Reuter, 2015; Tammineedi, 2010). Thus, while gradual development does not necessarily save SMEs resources, a BC approach should help the SMEs prioritize and stretch the development over time. Hence, we defined MR4 as:

MR4: Develop gradually—BC measures should be developed gradually over time and based on the consideration of SMEs' financial and other realities.

A low degree of formalism (e.g., low organizational structure, informal roles/responsibilities, lack of formal documentation, and planning) is a typical trait of SMEs (Herbane, 2019; Vargo & Seville, 2011). BC approaches for SMEs should avoid imposing extensive documentation requirements, which can increase bureaucracy and formalism, straining SMEs' resources (Herbane, 2019). Further, the extensive documentation required by some of the current BC approaches (Freestone & Lee, 2008; Gibb & Buchanan, 2006) may not be sensible and meaningful within the SME's context. Thus, we defined MR5 as:

MR5: Minimize documentation—Documentation should be kept to an essential minimum.

SMEs rarely have access to the domain-specific expertise required for BC management (Freestone & Lee, 2008; Niemimaa & Niemimaa, 2019) because of their insularity from niche expertise (Chen et al., 2007) and lack of financial resources to acquire it (Bilili & Raymond, 1993; Kinnunen & Siponen, 2018). During a workshop, Jude suggested the SMEs should be able to use the artifact alone or with the support of their consultants and that the artifact could present a "baseline" for BC (i.e., recommended minimum measures to be implemented). This idea of a baseline connected well with the requirement that the artifact needs to provide SMEs with detailed guidance to self-assess, plan, and implement BC measures (Hendela et al., 2017; Shropshire et al., 2009; Sullivan-Taylor & Branicki, 2011). We defined MR6 as:

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[4] Some of this development took place during the journal revision process. We would like to thank the anonymous

reviewers for their critical comments and review efforts that pushed us to clarify and improve the formulation of the MRs.

MR6: Enable self-assessment and development—Guidance for the BC approach should be detailed enough for SMEs' independent self-assessment and development of their BC.

Reflecting on our learning from the design, the practitioners' experience, and the prior literature, we came to realize that the BC approach should consider both the social and the technical aspects of BC. Accordingly, we defined MR7 as:

MR7: Develop the social and the technical jointly—Both the social and technical aspects of organizing should be developed.

The participatory development of BC enables the integration of knowledge across organizational boundaries and the combination of substance matter expertise. Participatory development, traditionally including democratic decision-making, has also been recognized as a key aspect of the sociotechnical perspective (Mumford, 2006). In the BC context, participation requires that employees are actively engaged rather than mere informational sources in the planning process (e.g., Devargas, 1999). The requirement for participatory development also became apparent through our empirical observations, as Kim was invited to attend a workshop the design partner had organized to show how they work with their customers in a participatory manner. We thus defined MR8 as:

MR8: Facilitate collective and participatory development—Develop BC as a collective organizational effort by involving employees and managers.

While the sociotechnical perspective emphasizes participation, from mindfulness theory we learned that high-reliability organizations base their decisions on expertise rather than on, for example, hierarchy (Weick et al., 1999). Further, hierarchical decision-making is depreciated since those with domain-specific knowledge do not necessarily hold high hierarchical positions. We thus formulated MR9:

MR9: Revere substance expertise—Base BC decisions on expertise (rather than hierarchy).

Both the literature on BC and theory on collective mindfulness underline the necessity of forward-looking preparations. While learning after incidents can be valuable (Lindström et al., 2010a), scholars and practitioners generally agree on the importance of making a priori preparations. Such an attitude was also echoed by Jude, and the requirement for proactivity had been one of the key catalysts of this design project. We thus defined MR10 as the following:

MR10: Attend proactively—Ensure that BC measures are developed proactively prior to incidents.

In Figure 2 we summarize the ten MRs derived from the literature and from our interactions with the design partner to create a BC management approach for SMEs.

4.1.4 Comparing Meta-Requirements to Prior Literature and Approaches

After formulating the meta-requirements, we analyzed the existing BC management approaches on whether they already fulfill the MRs. Our analysis showed that existing approaches fulfilled seven MRs at most (Järveläinen, 2016; Lindström et al., 2010b); Nosworthy, 2000; Gibb & Buchanan, 2006; Iyer & Bandyopadhyay, 2000), but none met all the MRs (see Appendix A, Table A1 for a detailed comparison of prior literature and MRs). The MRs derived from SMEs' constraints (MR4: Develop gradually; MR5: Minimize documentation; MR6: Enable self-assessment and improvement) were rare in the literature, whereas MR7 (develop the social and the technical jointly) and MR8 (facilitate collective and participatory development), which are derived from kernel theories were more frequently fulfilled.

Our analysis confirmed that SMEs should be considered more carefully in BC approaches. Many studies have emphasized comprehensiveness (e.g., Cerullo & Cerullo, 2004; Harris & Grimaila, 2008; Sambo & Bankole, 2016) or firm-wide implementation (Arduini & Morabito, 2010; Merhout & Havelka, 2008; Wan et al., 2009) and thus contradict our idea of a resource-considerate BC management approach for SMEs. Furthermore, some articles mentioned that current approaches did not suit SMEs, since small businesses require cost-effectiveness (Cumbie, 2007) or because small businesses do not have crisis management teams or centers (Bell & Gomez, 2011). Further, we observed that the earlier approaches were largely atheoretical. Based on these observations, we concluded that designing a BC management approach for SMEs can make meaningful practical and research impact.

4.2 Cycle 2: Suggestions for the Thrifty BC Management Approach

After the first cycle, which resulted in a set of MRs, the focus moved to jointly brainstorming a new BC management approach for SMEs, which we coined the *thrifty BC management approach for SMEs.* Next, we narrate through this process of design resulting in an approach with three high-level phases, each phase having several modules.
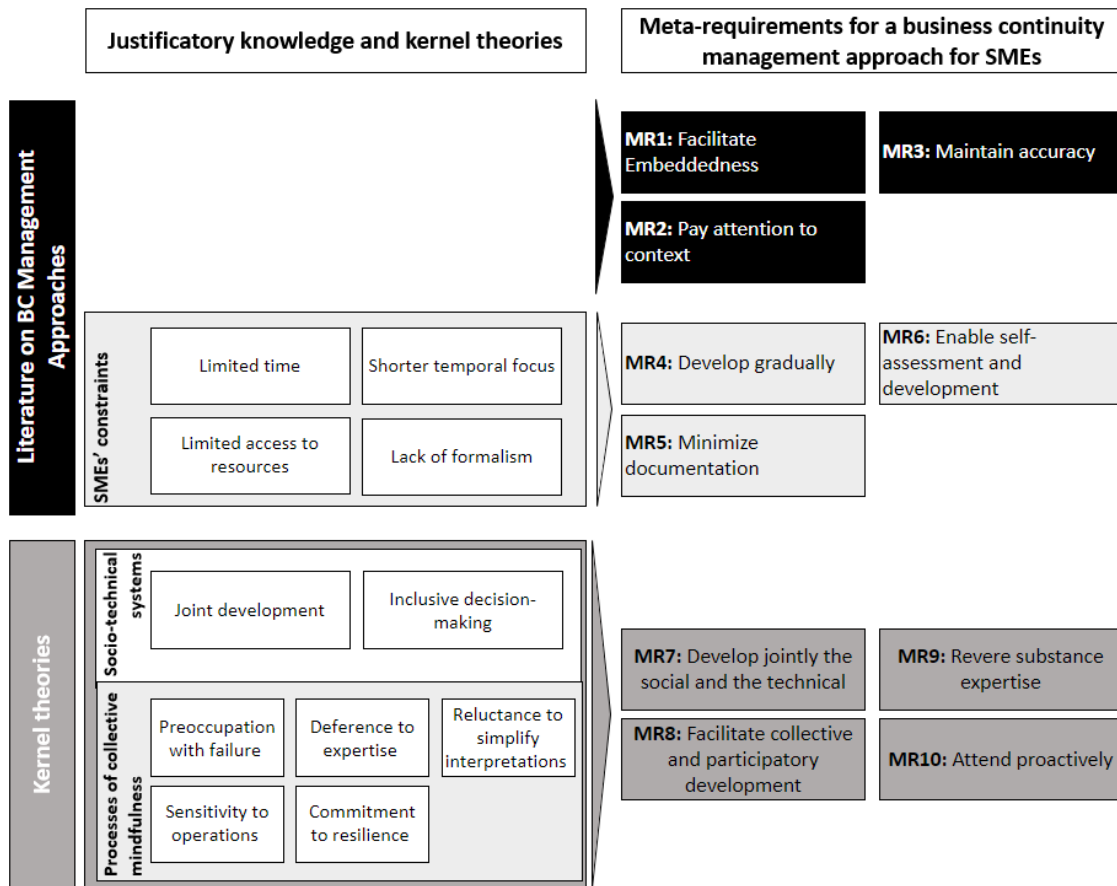
Figure 2. Meta-Requirements (MR1-MR10) for a BC Management Approach for SMEs.

4.2.1 From Meta-Requirements to a Tentative Solution

Alex consulted existing approaches for inspiration. Comparing multiple approaches, she concluded that while they differ in many respects, they share some components and parts and could thus be considered a "baseline" for a new approach. She sketched a cyclic process, which starts with a baseline—including mandatory components—that can be gradually extended with modules to build SMEs' BC management. In a joint discussion, Kim and Robin considered the new design suggestion a leap in the right direction. Robin contacted Jude to set up a new meeting to discuss the new design.

In the meeting, Jude seemed very fond of the "baseline" of modules and the cyclic process with different phases and modules. He promptly started drawing rectangles as a form of ad hoc prototyping. These rectangles were placed into a cyclic process that contained titles of mandatory and optional BC measures such that "each phase would have modules consisting of actions, which address certain BC issues" (quotation from meeting notes). We realized later that this form of process-like arrangement of phases and modules also matched well with the design partner's

way of working with their customers. Robin proposed that Jude share the drawing portraying the modules he considered mandatory and optional so that we could take over the design again and prepare suggestions for organizing these modules in phases.

4.2.2 Three Phases of BC Management: Map-it, Design-it, Continue-it

Alex sat down and reorganized the modules. First, she reviewed the MR as well as Jude's drawing and told Robin and Kim to merge similar modules. Second, considering MR4, she found inspiration in the plan-do-check-act cycle (ISO, 2012) and outlined three phases, map-it, design-it, and continue-it (see Figure 3). Afterward, she allocated the modules to these three phases. Further, in our internal meeting, we sat down to discuss the different modules' definitions. We intended to concisely describe each module's content and goal to sharpen their presentation by reducing ambiguities or overlaps. We continued this design activity in our next face-to-face meeting with the design partner. In addition, we asked Jude and his colleagues to suggest concrete sociotechnical development measures for each module to provide actionable recommendations to SMEs in a short action plan (MR5).
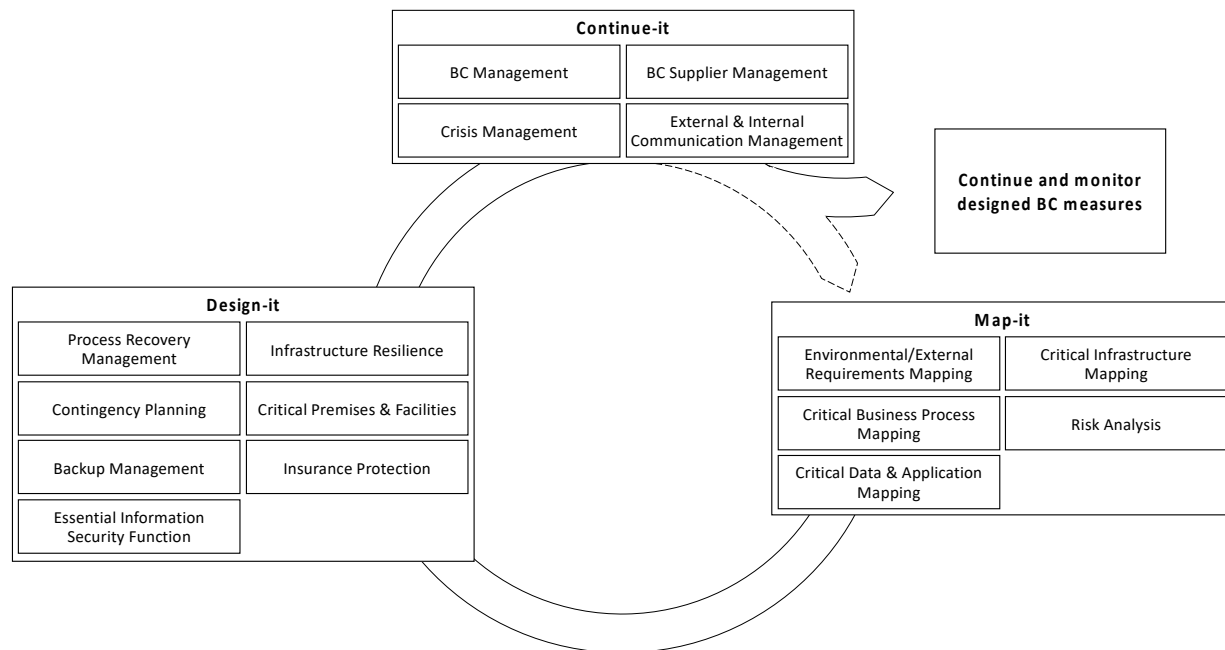
Figure 3. Process and Modules of the Thrifty BC Management Approach

For the first phase—map-it—we decided to include modules that focus on *mapping* SMEs' contexts (MR2), facilitating embeddedness, and building awareness about their environment (MR1). This phase starts with establishing the current environment and continues by identifying SMEs' most critical business processes. Concerning gradual development (MR4), we devised the idea of the SME choosing one of the most critical business processes for closer examination to also incorporate operational sensitivity (MR2) and an awareness-inducing (MR1) atmosphere. In the subsequent examination, the critical partners (e.g., outsourcing partners) (Järveläinen, 2012), data, applications, and infrastructure supporting the chosen critical business process and the risks for all of these elements were investigated. We agreed that a thorough analysis of the environment, regardless of whether some parts of it are outsourced or not, is an essential starting point. Other critical business processes can be included iteratively to extend the scope of BC management and thereby gradually develop BC (MR4). Table 5 describes the modules in the map-it phase.

For the second phase—design-it—we included modules that craft an action plan for SMEs to develop their preparedness, by embedding the BC into the organization (MR1). We observed that existing approaches usually have design and development steps (Cerullo & Cerullo, 2004; Iyer & Bandyopadhyay, 2000; Lindström et al., 2010b). The action plan was intended to push SMEs to perform the do-stage based on the plan-do-check-act process (Fani & Subriadi, 2019; Idrees et al., 2019; ISO, 2012), that is,

implementing the designed BC measures with minimal documentation (MR5). We thus defined the action plan as an executable summary that captures the concrete BC measures that an SME designs during this phase rather than abstract definitions of what a measure should achieve. Table 6 describes the modules of the design-it phase.

For the third phase—continue-it—we chose to focus on managing BC in the future with a proactive orientation (MR10). In this phase, the modules center on the defined action plan's implementation and its operation, evaluation, and gradual development. Our plan was to encapsulate the idea of maintaining accuracy (MR3) in this phase because it stresses the importance of monitoring BC and gradually developing BC management with the help of three trigger points: gradual development, reevaluation, and major updates. We discussed with Jude how these trigger points initiate consecutive cycles of the thrifty BC management approach.

Alex first considered reevaluation triggers comprising operational changes in SMEs' IT or business environment that require partial updating of the existing BC action plan. For example, if key personnel changes, only the communication management may require a reevaluation and update. Other examples of reevaluation triggers are new ISs, changes in key suppliers, and changes in a subprocess (see also Appendix B, Table B4). We thought that if this trigger point occurs, SMEs should reiterate the design-it and continue-it phases for the affected processes and respective BC measures.

Table 5. Modules and Their Descriptions in Map-it Phase.

Module name	Description	Prior literature support
Environment/external requirements mapping	Documentation of critical partners, their contact persons, and how they support the organization's critical business processes.	External requirements from laws, suppliers, and partners are often drivers for business continuity initiatives (Järveläinen, 2013)
Critical business process mapping	Identification and mapping of an organization's critical business processes including the information (systems) these processes use, people involved as well as interfaces to other processes, suppliers, or customers. Choosing one process for further study.	Analyzing the key business processes is essential in many BC approaches (Gibb & Buchanan, 2006; Winkler et al., 2010) and value chain analysis is recommended (Arduini & Morabito, 2010) to prepare for impacts elsewhere in the business.
Critical data & application mapping	Mapping the critical business data and applications supporting the chosen process and the business processes relying on these applications. Furthermore, recording who is responsible for these applications.	Determining connections of the business process to technology, i.e., data and applications, is the goal of IS-focused BC (Baham et al., 2017).
Critical infrastructure mapping	Mapping an organization's infrastructure (e.g., application servers, internet connection, power supply), which is essential for operating the critical business process. Additionally, ascertaining information about these infrastructure components and their operation.	Determining connections of the business process to technology, i.e., infrastructure, is the goal of IS-focused BC (Baham et al., 2017).
Risk analysis	Identification of potential risks for the data, application, and infrastructure; assessment of their potential business impact; definition of adequate risk treatment (avoid, mitigate, transfer), and documentation of the results.	Identifying possible risks and their impacts are essential parts of many BC approaches (Tammineedi, 2010; Wan, 2009)

Table 6. Modules and Their Descriptions with Literature Support on Design-it Phase.

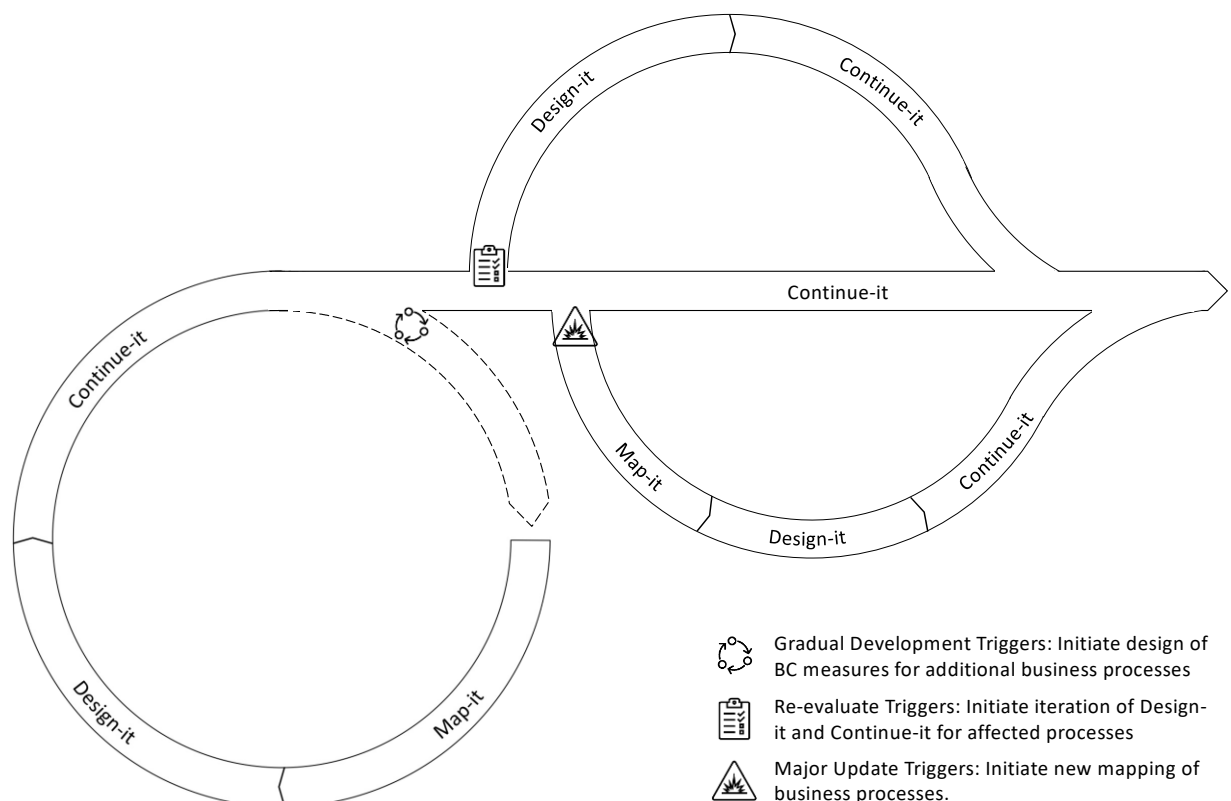| Module name	Description	Prior literature support
Process recovery management	Definition of recovery plans for critical business processes including time goals for their recovery	Recovery time/point objectives as well as minimum tolerable period of disruption are common in BCM (Ahmad et al., 2012; Bajgoric, 2014; Tammineedi, 2010)
Contingency planning	In order to sustain a minimum level of business operation, this module contains actions that should be taken to define alternative processes and procedures enabling an organization to continue with business at a minimum in the event of a disruption.	Redundancy in business processes offer contingency (Ahmad et al., 2012; Peterson, 2009).
Backup management	Definition of processes dealing with the creation of backups and their restoration.	Basic continuity process includes backups (Botha & Von Solms, 2004; Turetken, 2008)
Essential information security functions	Implementation of essential information security functions to protect the business from both information security incidents and business disruptions caused by such incidents.	Information security is one possible threat to continuity (Cerullo & Cerullo, 2004; Lindström et al., 2010b)
Infrastructure resilience	Contains measures/actions and guidelines to increase an organization's infrastructure resilience.	Infrastructure failures are common reasons for continuity disruptions (Sakurai & Kokuryo, 2014) and therefore the technological focus of BCM is popular (Niemimaa, 2015a)
Critical premises and facilities	Guidelines and possible measures/ actions for organizations to develop their facilities' preparedness for business disruptions caused by an event affecting these facilities.	Pitt and Goyal (2004) emphasize that critical facilities and premises should also be protected by BC.
Insurance protection	Definition of possible measures/actions to successfully transfer identified risks and their potential (financial) impact on insurance.	Transferring risk, along with mitigation and absorption of risk, is a basic risk management strategy (e.g., Altman, 2006; Gibb & Buchanan, 2006)

However, Kim understood that major updates should have trigger points too. Sometimes SMEs have significant changes that require a new mapping of their crucial business processes and subsequent design of a BC action plan (e.g., merger and acquisitions, new product, switching from proprietary software to cloud computing). In case of a major update trigger, SMEs should conduct the entire cycle for the affected processes.

Then, Robin proposed a third trigger point: gradual development triggers. Besides the most crucial business process, additional processes present gradual development triggers that initiate consecutive cycles of the map-it, design-it, and continue-it phases. However, we later noticed in the evaluations that having several critical processes is likely to be rather uncommon, especially among smaller SMEs.

Organizations should define which events are relevant trigger points for maintaining and updating their BC management using this classification of trigger points. Defining business context-specific events using this classification supports the contextual development of

BC management (MR2). In Figure 4, we present a tentative implementation sequence for different trigger points. Discussing possible trigger points preemptively, the company representatives become aware that the approach is cyclical and requires gradual development, continuous maintenance, or even updating, depending on the respective trigger point (MR3 and MR4). In contrast to prior literature's recommendation of time-based maintenance of BCM (e.g., annual or bi-annual updating on an extensive level) (Botha & Von Solms, 2004; ISO, 2012), we considered these trigger points to introduce need-based maintenance (MR3). These trigger points turn the BC action plan into a living rather than static document.

Further, we added the modules of crisis and communication management to this phase, as the reactive measures taken during a business disruption fall into this phase. Since SMEs outsource IT services, they also need to consider and manage outsourcing risks for BC. This is addressed in the BC supplier management module. Table 7 describes the modules of the continue-it phase.

Figure 4. The Thrifty BC Management Approach Implementation Sequence with Gradual Development, Reevaluation, and Major Update Trigger Points

Table 7. Modules and Their Descriptions Connected to Prior Literature.

Module name	Description	Prior literature support
Crisis management	Appointing a crisis management team and defining each member's responsibilities in the event of a crisis	Crisis team is often recommended in prior literature (Pinta, 2011; Tammineedi, 2010)
External and internal communication management	Definition of rules and guidelines for both internal and external communication in case of a business disruption	In crisis situations, both internal and external communication is important (Bell & Gomez, 2011; Braun & Martz, 2007)
BC management	Definition and implementation of measurements and controls monitoring the performance and effectiveness of business continuity measures as well as identification of trigger points for reevaluation of BC measures	Prior literature recommends updating the BCP in regular time intervals (Gibb & Buchanan, 2006; Lindström et al., 2010b).
BC supplier management	Definition of requirements that partners supporting critical business processes must fulfill (e.g., their own BC measures, provision of a contact person, etc.)	BC has to be considered also in interorganizational IS relationships according to prior literature (Järveläinen, 2012)

4.3 Cycle 3: Refining the Thrifty BC Management Approach

While we had defined the abstract phases and modules, the thrifty BC management approach lacked, clear instructions for SMEs to self-assess and develop their BC (MR6). Next, we narrate the development of guiding questions and workshop guidelines for implementing BC management.

4.3.1 Formulating Guiding Questions

In our research group meeting, Robin noted that the tentative solution provides little guidance for SME self-assessment and BC development BC (MR6). Alex came up with the idea that we could translate the descriptions of measures into questions. Questions would provoke SMEs to rethink their BC in relation to their own context and determine whether they require a specific module and its BC measures (or not). Alex argued that instead of defining backups as one BC measure, the BC approach should ask whether a business process requires backups for its continuity. Respective questions would foreground the contextual need rather than providing a list of means. Alex and Robin started translating BC measures into guiding questions and tabulated these questions in relation to the three phases and their modules on a spreadsheet.

Robin organized two workshops to jointly develop the questions. Jude attended physically while his colleagues joined the workshop virtually. For the first workshop, Jude had prepared a presentation of suggested measures and questions. During the workshops, Robin screen-shared the spreadsheet with the guiding questions, allowing us to gather feedback from our design partner and adjust the questions as needs arose. Afterward, Alex submitted edits of each module's measures and the respective questions to Robin, and once they were complete, we presented the BC approach, including all

its modules, measures, and guiding questions, to Jude. Exemplarily, we illustrate the content for the "critical business process mapping" module.

The critical business process mapping module comprises three goals (see Table 5). Alex and Robin defined Goal A: "Identify critical business processes and the different functions performed in these processes." However, Robin, observing one of our design partner's client workshops, noticed that this client's business processes built on pivotal subfunctions. Thus, she extended Goal A to also identify "the different functions performed in these processes." To facilitate SMEs in achieving Goal A, we formulated Guiding Questions 1 and 2 (see Table 8).

Considering MR4, Alex proposed that once SMEs had identified their critical business processes, they should further prioritize these according to business impact in case of a disruption (Järveläinen, 2012; Wang et al., 2010). We captured this notion in Goal B: "Choose the most critical process for further examination" and in Guiding Question 3.

Robin, drawing on Arduinini and Morabito's (2010) value chain analysis and external service provider effects for BC (Järveläinen, 2012), argued that SMEs should also map critical interfaces that can cause potential BC issues. This corroborated Kim and Alex's learning from the design partner's client workshop because the respective client often seemed to have little knowledge about important supplier processes and their BC state.

We thus formulated Goal C: "Identify interfaces to other processes, stakeholders, and responsibilities (process owner)" and Guiding Questions 4-7. Table 8 illustrates the "critical business process mapping" module with its goals as well as the respective guiding questions. After agreeing on each module's goals and guiding questions, we all felt the approach was ready for evaluation with the design partner's clients.

Table 8. Exemplary Module with Goals and Guiding Questions to Define BC Measures for Accomplishing These Goals

Goals of the module: Critical business process mapping	Guiding questions
Goal A: Identify critical business processes and the different functions performed in these processes	1. What are the most critical business processes, without which your business would not survive? A disruption of which business process would immediately (in 2 hours, 1 day, after 1 day, etc.) terminate your business? 2. What are the key functions in this critical business process?
Goal B: Choose the most critical process for further examination	3. Which processes are customer-facing processes (if critical to the company)?
Goal C: Identify interfaces to other processes, stakeholders, and responsibilities (process owner)	4. Which other processes might be affected if this critical business process (function) is disrupted? 5. Who is responsible for this critical business process (process owner)? 6. Is this critical business process supported or used by any external party (supplier/customer)? 7. On which of your premises is this process performed?

4.3.2   Trialing the Approach in Practice

Before testing the approach with the design partner's customers, we conducted tabletop testing to assess its applicability in a workshop setting. Kim had ethnographically studied an SME's business continuity for several months and we decided to leverage her knowledge to simulate our approach. We sat in a meeting room with Robin and Alex posing questions to Kim on the SME's business processes and IT infrastructure. Running through the designed approach yielded three learnings.

First, we noticed that visualizing participants' answers to the guiding questions facilitates discussions. Previously, Jude had suggested using their company's visualization tool, which Robin and Kim felt to be too simplistic in its level of detail. Alex also thought that it would impede interaction because only one person would be able to control the software tool, thus violating MR8. Similarly, we were concerned that it would complicate self-assessment (MR6) and resource consideration because it ties the approach to a specific software. We decided to use sticky notes so that all participants could participate in visualizing the discussion by drawing, taking notes, and reorganizing or connecting them.

Second, we realized that SMEs require further guidance for applying the approach in a workshop setting. For example, Kim felt that after three hours of mapping, one may experience fatigue, which could possibly affect the engagement and the results of the mapping. Therefore, Alex suggested modifying our initial workshop-based design. She pointed out that the design partner discarded it because it focused on awareness and not on guiding SMEs through a workshop.

Thus, we adopted the initial workshop idea, allocating the three phases to two workshops. The first workshop would focus on the map-it phase and last approximately 2.5 hours. The second would continue with the design-it and continue-it phases over a similar period of time.

Third, we reflected on who in SMEs should participate in these workshops. Jude recommended inviting SMEs' top management for buy-in and employees with the required expertise and knowledge of the critical business processes and IT operations. Robin and Kim agreed because if several key managers and experts attended these workshops, it would create BC awareness (MR1), constitute a collective and participatory effort (MR8), and involve expertise (MR9). However, we suggested limiting the number of participants in order to enable detailed and engaged discussions toward a concise action plan for BC management.

4.4 Cycle 4: Evaluating the Thrifty BC Management Approach for SMEs

The fourth cycle was centered around the evaluation of the developed thrifty BC management approach. We evaluated the approach with five SMEs over nine workshops. Table 9 summarizes the evaluations performed during this cycle. In what follows, we narrate the evaluation process.

4.4.1   Struggling with the First Evaluation of the Thrifty BC Approach: Company A

During the design process, we never received a clear and explicit "yes" from Jude for evaluating the artifact with the design partner's customers, but we also did not receive a clear "no." We suppressed our concerns about the evaluation amid more pressing issues during the first cycles. When the time arrived to agree on the evaluation, Robin approached Jude several times until he finally informed us that Company A was willing to be a part of the evaluation.

Table 9. Summary of the Thrifty BC Management Approach's Evaluation

Evaluation environment	Type of evaluation	Evaluation scope	Key learnings
Research group	• Summative simulation	All phases of the thrifty BC management approach	• Guiding questions are in a meaningful order • Guiding questions facilitate a comprehensive assessment of BC management • The content is distributed across the three phases and modules such that it supports gradual BC management
Company A • Finnish power distributor • 26 employees	• Naturalistic and summative field study • One workshop	Map-it phase	• Documenting map-it phase using colored post-it notes gives an arts-and-crafts appearance → More visual tool would be required instead (mind-map) • Significant expertise required to map critical infrastructure → Invite IT staff with expertise in critical infrastructure
Company B • Finnish IT service provider for healthcare sector • 217 employees	• Formative evaluation • Open discussion	All phases of the thrifty BC management approach	• Approach facilitates understanding of BC management, especially if top management is involved → Continue testing → Requires decision makers in the discussion
Company C • Finnish graphic design company • ~10 employees	• Naturalistic and summative field study • Two workshops • Qualitative interview	All phases of the thrifty BC management approach	• Significant expertise required to map critical infrastructure →Invite IT staff with expertise in critical infrastructure • 1.5-2.5 hours were sufficient for map-it phase → Half-day workshops sufficient for map-it phase
Company D • Finnish manufacturer of agricultural machinery • 160 employees	• Naturalistic and summative field study • Three workshops	All phases of the thrifty BC management approach	• Requires commitment from top management → Introduce the process and intended schedule in the beginning and emphasize the meaning of varied expertise to encourage decision-maker participation
Company E • Finnish marketing company • 46 employees	• Naturalistic and summative field study (self-assessment) • Three workshops	All phases of the thrifty BC management approach	• The concept of critical business process as something other than a technical issue is vague → Improve the workshop guidance with definitions and goals of the process

Before the evaluation with Company A, Jude made a request to simulate the workshop setting with them, but the request made it clear that he was only interested in using the design partner's own information system to run and document the workshop with Company A. Kim compiled a note: "I started feeling unsure whether they had started to exclude us as workshop organizers and instead put us in the passengers' seat."

Robin, who shared the concern, contacted Jude to confront the issue, which ignited a heated email exchange. Jude answered Robin's email very abruptly: "In my opinion this post-it stuff is inefficient and we get needed results when we use information systems" (email). This caused us to have concerns about the remaining time for us to evaluate the thrifty BC management approach as well as the evaluation rigor (if Jude were to run the workshop). Our thinking was that we should evaluate the approach, modules, workshop, and guiding questions before handing the approach to practitioners. After several emails, Jude finally agreed that Robin could facilitate the workshop and that we could use the approach we had designed.

Jude continued to have noticeable concerns about what impact the evaluation might have on the design partner's customer relationships. Only a few hours before the workshop, Jude sent an email to all workshop participants, stating that the workshop would be somewhat different than what they might

expect based on previous workshops, but reassured them that despite us running the workshop, he would be in the background ensuring effective documentation for their information system. We were all rather surprised and puzzled by his message because we assumed that we finally agreed on the design of the approach design (as described in Cycle 3). Regardless, we began the workshop, which allowed us to finally test the approach in practice.

Our reception at the workshop with Company A was warm and friendly but neither enthusiastic nor curious. The participants, as expected, were managers from different business units (MR8), but to our surprise, the IT experts were missing (MR9). It was only then that we realized that Company A had already outsourced its IT operations to IT Consultancy. Jude had not invited any of IT Consultancy's own IT experts to the workshop, since he expected that they already had all the necessary information on that front. With Robin leading, Kim was able to document Company A's critical business functions during the two-hour workshop, which ran smoothly. Yet we were unable to discuss any technical details because Jude felt these could be obtained later at IT Consultancy, impeding the facilitation of embeddedness among Company A's participants (MR1).

After this partially successful workshop, Robin contacted Jude and Company A several times to organize a second workshop. However, they could not agree on a date. After half a dozen emails, she concluded that Company A had no real interest in continuing the process. Several months later, we learned that a large company had acquired our design partner and that Jude left the company shortly thereafter. We surmised that this all explained the "radio silence" leading to the abrupt end of the design partner's involvement in the DSR project.

4.4.2 Learning Points from the Evaluation: Company A

We derived three learning points based on these conflicts of interest with our design partner. First, we should have emphasized the importance of inviting IT staff with expertise in the IT infrastructure rather than only business managers (MR9). The design partner's behavior during the workshop in terms of interrupting questions related to the IT infrastructure hampered the workshop process and the evaluation of the map-it phase. It was clear that the design partner considered these discussions a waste of Company A's time because they already had this information. However, interrupting discussions around the IT infrastructure also meant that the participants could not develop an awareness (MR1) of their environment, which might have revealed weak spots in their IT infrastructure and thus how IT Consultancy operated it.

Second, the workshop process, including the choice of visualization tool, is essential for creating awareness. To raise awareness (MR1), we intended to include participants from different organizational levels using a visualization method that invites interaction (MR8). Jude only invited managerial actors and wanted to continue using their existing system and approach as before. We found that this approach would not solve the awareness creation problem raised by the design partner when they initially contacted Robin. Our hesitation about using our research collaboration as a quality stamp reemerged.

Third, we learned that managing the involved parties'—both researchers and the design partner—expectations toward the shared project, is crucial. While we were striving for a rigorous evaluation, Jude focused on the business relationship with the design partner's client. With the artifact's design completed, the design partner's interest in the DSR project and in being evaluated faded.

4.4.3 Evaluations with Companies B to E

Although the collaboration with our design partner ended abruptly, we were able to continue the evaluation process. While we did consider quitting the whole research project, we felt that we had already made good progress, and despite the difficulties we faced, we had positive experiences when using the approach.

Unaware of our design project, Company B, an IT service provider for hospitals, approached Robin to discuss BC. We were anxious to seize this opportunity and organized a meeting to discuss their BC concerns and to also present our approach. After a workshop with the company, Company B reported that they found our approach promising but continuing cooperation became impractical because Company B appointed our contact to a new position. Later, the contact person messaged us: "If you could discuss business continuity matters with our biggest client, I personally would be very grateful." This indicates that they considered the designed approach to be useful.

When the problems in evaluating the approach with Company A emerged, we sought other potential SMEs and identified Company C. In Company C, Kim interviewed the CEO during the map-it workshop, and Robin, based on our learnings from Company A, took notes using a mind-map tool. For the design-it and continue-it workshop, the CEO invited two experts to join (MR8, MR9) because he wanted them to understand the risks and participate in the design (MR1). In these workshops, we had sufficient time to discuss both social and technical details (MR7). Since Company C already had insurance protection, we excluded the respective module from the assessment (MR2). During the map-it workshop, we learned that

detailed mapping of the critical infrastructure requires context-specific knowledge, highlighting the importance of collective and participatory development (MR8). Shortly after the workshop, Robin translated the mind-map notes into an action plan containing the relevant information of all three phases (a four-page document, with half a page for future actions [MR5]). Later, Robin interviewed Company C's CEO, who found the process "good, necessary, [and] reminded us, what kind of issues one should ponder on once in a while" (field note). Further, the CEO informed us that they had successfully passed a quality audit that included requirements for good BC practices that were a precondition for a new customer contract. Finally, based on the created action plan, Company C mitigated a potential BC problem (server breakdown) by replacing vulnerable technology with a more reliable solution (MR3, MR4).

Company D participated in a cybersecurity research project, so Robin asked whether they would be interested in evaluating the approach. After they agreed to it, Robin completed all three phases within six hours at Company D. In the first workshop (map-it phase), the CEO, IT manager, and a business unit manager participated and two research assistants took notes (MR1). After identifying the company's critical process, the CEO excused himself, leaving the IT manager to dominate the discussion because of his technical expertise (MR9). To Robin's surprise, only the IT manager showed up to the second and third workshops. The IT manager demonstrated good awareness and knowledge of the BC risks that the company faced, but seemed ignorant of the fact that he was the only employee with access to all the critical IT assets, and the only employee with an understanding of the "bigger picture" of the company's BC, which made him, as the "key person," Company D's greatest BC risk. While the short time needed to run the workshop testifies to the thriftiness of the approach (timewise), it also indicates the importance of having participants beyond the IT manager. This reinforced our earlier learnings on the importance of having multiple people in workshops for collaborative learning and creating BC awareness (MR1, MR7).

In Company E, we evaluated whether SMEs could self-assess their BC using the thrifty BC management approach (MR6). Robin was in contact with one of Company E's employees, who was also an IS MSc student at her university at the time, and Robin told her about the approach under design. The employee seized the opportunity to run the workshop with her employer for data collection. After a short introduction to the approach, the employee independently conducted the approach with her employer. She held three workshops that took approximately six hours in total. Afterward, Robin collected feedback from the employee, who said

that the participants had difficulties with the concept of "critical business process." They seemed to "grasp it often as something technical such as internet" and therefore they had to "rewind back in the discussion from some technical issue, which had no connection to anything" (quotes from emails). Company E was able to identify issues in their BC and, later on, initiated projects to improve their BC measures based on these identified issues. Based on this evaluation, we improved the workshop process description—in particular, definitions of concepts and goals.

Our summative simulation and field study evaluation of the designed thrifty BC management approach suggest that the approach is both applicable and functional.

5 Discussion and Conclusions

Our design process generated three theoretical contributions (Baskerville et al., 2018). First, we contribute to BC management with ten MRs, which form classes of objectives for BC management approaches for SMEs. Further, we instantiated these MRs in the thrifty BC management approach to assess their feasibility and usefulness. Second, we contribute to DSR rigor by introducing and arguing for research transparency through confessional writing. Third, we provide insights into our theoretical learnings derived from the application of collective mindfulness and sociotechnical systems when designing the approach.

The thrifty BC management approach is readily accessible to practitioners—for example, IT or BC managers. The approach aims to facilitate BC development by introducing agility and less formality through guiding questions for self-assessment, minimal documentation, and trigger points to spark the further development of BC. The guiding questions, along with the workshop guidelines in Appendix B, make the thrifty BC management approach even more accessible to practitioners.

5.1 Meta-Requirements and the Thrifty BC Management Approach for SMEs

Our first contribution stems from the ten formulated MRs underpinning a design theory for thrifty BC in the SME context and their instantiation in the thrifty BC management approach. While the MRs can serve as classes of design objectives for designing further BC management approaches for SMEs, the instantiated thrifty BC management approach illustrates their usefulness for design tasks and solves the underlying practical problem. Further, we derived the MRs from the existing knowledge base, practitioner experiences on BC management, and instantiation feeds back to BC management literature.

The three phases—map-it, design-it, and continue-it—of the designed approach have similarities with other BC management approaches that begin by setting the scope, that is, deciding on which business processes BC management should focus on and then assessing these processes' business impact in case of a business disruption (Gibb & Buchanan, 2006; Tjoa et al., 2008; Torabi et al., 2014).

The evaluative field study to assess whether the designed approach solves the underlying practical problem revealed that the artifact supports SMEs in BC management and thus solves the formulated problem, illustrating its practical impact (Baskerville et al., 2018; Peffers et al., 2018). Next, we describe in detail how the designed approach incorporates the ten MRs, thereby highlighting its contribution to the BC management literature.

MR1 (facilitate embeddedness) focuses on creating BC awareness. The designed approach proposes to combine awareness creation and training with planning to facilitate the embeddedness of BC measures in organizational processes (cf. Spears & Barki, 2010), instead of requiring a separate training phase (e.g., Lindström et al., 2010b).

MR2 (pay attention to context) contributes to prior BC literature by being sensitive to SMEs' existing BC preparedness and designing SMEs' contextual BC measures (1) by focusing particularly on the most critical business process (instead of all critical business processes), (2) by allowing SMEs to choose suitable modules based on identified risks allowing them flexibility in process and documentation, and (3) by considering SMEs' existing risk management measures, which they may not have recognized as BC management. Building on these, the approach reduces the amount of resources needed to design and implement BC measures from scratch (cf. Gibb & Buchanan, 2006; Pitt & Goyal, 2004; Tracey et al., 2017).

The goal of MR3 (maintain accuracy) was to update BC measures. The approach encourages workshop participants to discuss triggers (i.e., gradual, reevaluating, and major update) for reevaluation of BC measures to ensure continuous but thrifty development of BC, in contrast to the periodic updating of BC (e.g., (bi-)annually, etc. (Botha & Von Solms, 2004; ISO, 2012)). Instead of treating BC management as a one-time project (Gibb & Buchanan, 2006; Lindström et al., 2010b), the approach encourages continuous but need-based updating of BC measures through trigger points that introduce flexibility to BC management. Further, in contrast to Botha and von Solms (2004), the designed approach does not stipulate a priori which

measures or processes should be implemented but leaves the decision to the local context (assisting decision makers with relevant supportive questions).

MR4 (develop gradually) stresses the selection of the most critical business process and extension to further processes in additional iterations. This enables organizations to focus on the important processes and to thriftily spread resource use over time. The approach builds BC gradually by (1) gradually implementing the action plan, and (2) starting with measures for the most critical process, which are then extended to the second-, third- (etc.) most critical process (if needed). However, if a medium-sized company has several critical business processes, it is possible to gradually develop BC measures also for them as well.[5] This ensures reuse, helps in prioritizing resources, and allows for learning from previous cycles. Instead of implementing BC in a big-bang manner (Gibb & Buchanan, 2006; ISO, 2012), a gradual process starting with the most critical process and continuing, if necessary, with other processes helps to prioritize SMEs' limited resources.

MR5 (minimize documentation): The designed approach produces a single, short action plan not requiring any formal template, but focusing on SMEs' contextual needs to suit the SMEs' level of formality in their operations (Vargo & Seville, 2011). An action plan lists the selected critical process(es), actions for developing BC of the critical process(es), and trigger points for revising the action plan. In contrast, ISO22301 (2012) lists 14 different documents from policy to management reviews; Botha and von Solms (2004) expect plans for each cycle they propose.

MR6 (enable self-assessment and development) prescribes providing detailed guidelines for BC self-evaluation in SMEs. The approach contributes to prior literature by providing guiding questions to facilitate practitioners in the self-assessment and development of BC, formulated with the help of practicing BC consultants (see Appendix B), thereby filling the void of BC guidance for managers (Butler & Gray, 2006). Thus, practitioners can use the approach without external expertise, which SMEs may find difficult to obtain. Prior BC management literature (Lindström et al., 2010b) and existing standards (ISO, 2012) are abstract and require SMEs to spend resources on BC experts to translate as well as apply these standards (Niemimaa & Niemimaa, 2017). Prior literature is lacking in such guidance (cf. Siponen & Willison, 2009) and it renders our artifact transferable to other contexts featuring the same class of problem (Hevner et al., 2004).

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[5] The option to extend the BC management to a second critical business process was not evaluated in our field evaluations, since all companies claimed to have only one critical business process.

MR7 (develop the social and the technical jointly): The designed approach evaluates the technical infrastructure requiring BC measures, but also guides SMEs to select responsible people for different tasks, recognize key personnel risks, etc. The approach aims to facilitate socialization and discussion around SMEs' IT infrastructure as an object of interest and provides a practical application of the sociotechnical in the context of BC, although there are examples of developing both the social and technical aspects of BC in the prior literature (Arduini & Morabito, 2010; Hendela et al., 2017). However, some studies focus only on technical aspects (Baham et al., 2017) or emphasize the combination of business and technical measures (Fani & Subriadi, 2019).

MR8 (facilitate collective and participatory development) aims to ensure that relevant people are involved in BC development. The designed approach uses workshops involving participants from different organizational levels and departments to map the environment, design BC measures, and decide on the action plan. Prior literature has often focused on top management involvement (Sambo & Bankole, 2016; Sarkar et al., 2017), but sometimes a multifunctional development team is called for (Järveläinen, 2016) that engages, for example, legal experts, accountants, etc. (Nosworthy, 2000). Our approach presents an instantiation of collective and participatory development, extending the role of participants (e.g., employees) from mere informational sources (Haghighi & Torabi, 2019; Idrees et al., 2019) to co-designers.

MR9 (revere substance expertise) prescribes the use of expertise-based decision-making. The designed approach encourages the use of various experts who know the context of the BC development to formulate the BC action plan. While BC expertise is likely to be a rarity within SMEs, experts who intimately understand the particular SME's business context should be easily found within the company. Furthermore, the responsibility for implementing the actions is discussed in the workshop. While similar ideas are apparent in the prior literature, in these studies, the final decision maker is expected to be, for example, a BC manager (Tammineedi, 2010) or top management (Nosworthy, 2000).

MR10 (attend proactively) requires that BC measures should be developed prior to incidents. The thrifty BC management approach follows other BC management approaches and prior BC literature in aiming for proactive BC measure design. Thus, our design provides further evidence for its importance.

As such, our MRs provide abstract and generalizable imperatives as a form of design theory (for the full anatomy of the design theory see Appendix C). We have also shown that both the design problem and the artifact are important for practitioners.

5.2 Research Transparency and Rigor through Confessional Practices in DSR

By borrowing from alternative research genres (Avital et al., 2017), we contribute to DSR transparency (Burton-Jones et al., 2021) by adapting four writing conventions used within the confessional genre (Schultze, 2000; Van Maanen, 2011). We argue that the confessional genre can add rigor to DSR through research transparency. Next, we reflect on and discuss the learnings we gained by applying the writing conventions to our DSR project.

5.2.1 Research Transparency for Design Process Rigor

While scholars have acknowledged the importance of research transparency for DSR (Burton-Jones et al., 2021; Pratt et al., 2020), much of the discussion on DSR transparency has focused on the *artifact's* transparency. We, on the other hand, contribute to the transparency of the design *process*; transparency of the artifact relates to the practices of publishing the product of the design, and transparency of the process relates "to the practice of being open about how a piece of research has been undertaken and its implications." (Burton-Jones et al., 2021, p. iii). We thereby align with and respond to authors arguing for greater transparency when reporting the design process that produced the artifact (Vom Brocke et al., 2021). To establish the transparency of the artifact, we provide the designed artifact in Appendix B.

Transparent accounts of the design process allow others to see how the artifact materialized. We argue that such accounts can strengthen the rigor of DSR projects. Indeed, strict adherence to methodological guidelines or the attempt to align reporting with these imperatives do not qualify as a necessary or sole condition for rigor (Siponen et al., 2021). Any real-world design is bound to evolve through moments of contingencies and happenstances. By rendering transparent these moments of epiphanies, serendipity, dead ends, and trial and error that went into designing the artifact, researchers create credibility, authenticity, and trustworthiness of their descriptions (Lincoln & Guba, 1986), and through this, establish rigor (Hevner et al., 2004; March & Smith, 1995). The confessional genre can help researchers to achieve this.

We found that, at times, existing DSR methodologies' sequential and structured nature contradicted the messy and emergent nature of our actual design process. The conflicts of interest with the design partner and the sudden changes in the design partner's organization were some of the unexpected events that impacted and became implicated in the designed artifact. In lieu of attempting to align dogmatically with the methodological prescriptions to achieve rigor,

we adapted conventions of the confessional genre to reconstruct the process as we experienced it: murky, messy, and emergent. That is, we argue that these conventions can enable authors to achieve *rigor through transparency* rather than seeking to achieve *rigor through obscurity*—that is, honestly and truthfully reporting the actions, events, and mistakes *as they occurred* rather than seeking ways in which they can be made to fit the steps and cycles of established guidelines. Thus, we propose that the confessional genre can be enacted in DSR to transparently report the design process for establishing *process* transparency in DSR research.

5.2.2 Four Confessional Practices for Research Transparency in DSR

In reporting this study, we adapted and extended four conventions of the confessional genre, which are well-known within the ethnographic community (Schultze, 2000; van Maanen, 2011), to DSR research as practices for transparently reporting the design process. While DSR and ethnography certainly have very different goals (i.e., design versus understanding), they both take place in a real-world setting where the researcher often has very little or no control over the exact course of events, as our narratives illustrate. We extend the confessional conventions of self-revealing writing, presenting different points of view, interlacing, and naturalness (Schultze, 2000; Van Maanen, 2011) by adapting and contextualizing them as four practices for transparently reporting the DSR process. We next present these four practices:

Practice of self-revealing designer(s): Researchers should reveal the details about themselves as designers of the developed design artifact. This practice requires them to expose details about themselves, their background, and their prior experience, but also to honestly report details, which others might view as problematic or even as mistakes that influenced the design process (cf. Schultze, 2000; van Maanen, 2011). To establish this, researchers may choose to introduce pseudonyms for the different actors and use personal pronouns. The use of pseudonyms enables the researchers to enact a degree of anonymity without resorting to abstract and unspecified collectives or passive voice for the façade of objectivity. Through the practice of self-revealing designer(s), researchers become visible as designers, as part of the research process and shaping the resulting artifact—research does not *do* design, researchers do.

Practice of interlacing design and confession: Researchers should report their design and confessions in *one* study. Confessional statements differ from the prescriptive statements on the design artifact. Yet instead of reporting the confessional material separately, this second practice suggests interlacing the confessions relevant to the design process and artifact

with the prescriptive design knowledge (cf. Schultze, 2000). This interlacing illustrates how the design emerged from the contingencies, trial and error, and unexpected events that constituted the design process. Interlacing renders visible and salient the spontaneous omissions and commissions during the design process. Thus, it facilitates interpreting the design knowledge and its grounding in prior knowledge and the design process.

Practice of designer-researcher stance: Researchers should expose different points of view on their design process and design artifact, especially when these points of view conflict or tell different stories. In a DSR study, researchers are also designers, which requires them to shift between a designer and a researcher stance (cf. Van Maanen, 2011). This practice accordingly suggests that researchers need to maneuver between their designer and researcher roles, demonstrating that they possess the ability to distance themselves from the designed solution while being immersed in the abductive search process for this solution (Gregory & Muntermann, 2014). Researchers render transparent the different interests underlying the design process and design artifact.

Practice of artless ingenuity: Researchers should illustrate the naturalness of the design process that produced the designed artifact (cf. Van Maanen, 2011). This means showing that they developed the design artifact leveraging prior knowledge (including the methodological guidelines) when addressing the problem space and normalizing the messiness and contingent conditions of the design process as reflecting the nature of DSR studies in a real-world setting.

These practices contribute to complementing the existing methodological guidelines for DSR, not to overthrowing or replacing them. Existing guidelines focus on providing idealizations of how to conduct DSR (Siponen et al., 2021), but only limited guidance exists on how to present the DSR process transparently, even if the process is recognized as a key part of the "anatomy" of DSR research (Gregor & Hevner, 2013). The four practices offer researchers guidance in how to transparently report how they confronted and dealt with the messiness of their design process through creative and generative application of existing methodological guidelines for conducting DSR. As our study testifies (Appendix D presents an evaluation of how we applied these practices against a list of criteria for each practice), these four practices render the DSR process transparent by dissecting the ideal design process as depicted by methodology guidelines and the actual design process happening in the real world with all its contingencies. Thus, as practices for reporting DSR transparently, they extend and complement existing methodological DSR guidelines.

5.2.3 Implications of DSR Process Transparency through Confessional Practices

The transparency of the design process resulting from these practices contributes to DSR in four ways. First, transparency of the DSR process allows for reconstruction and evaluation. We acquiesce to Pratt et al. (2020) that it would be detrimental to extend the notion that research transparency increases repeatability for all types of research. We argue that this notion conflicts with the naturalistic, contingent, and emergent nature of DSR and that transparency must respect the plurality of IS research (Burton-Jones et al., 2021). We posit that the transparency of the DSR process can help our peers to reconstruct and assess the design process; not to repeat and verify it, but to conceive and evaluate the circumstances under which the design proceeded. Thus, both the researchers themselves and those who need to evaluate their work can directly benefit from confessional practices as a way for authors to report their study transparently and for reviewers to expect the researchers to do so.

Second, transparency of the DSR process creates accountability. DSR aims to be practically relevant, seeking to make an impact on the world through design. As Schultze et al. (2020) argue, "accountability [is] an individual's liability to give an account of his or her judgment, actions, and omissions during the research process. To be accountable is to be answerable for decisions made, actions taken, and effects produced." (p. 815). Hence, we see that through transparency of the DSR process, researchers can gain accountability for their design.

Third, transparency of the DSR process serves pedagogical aims. The smorgasbord of DSR guidelines in journals and conferences "make[s] it difficult and costly to carry out DSR projects" (Peffers et al., 2018, p. 130) and can be particularly daunting for students and newcomers who take up the task of a DSR study. We posit that thorough reading of others' design struggles can demystify DSR as a methodology and convey the design process reality in lieu of presenting a hygienic process that portrays a trajectory not unlike the ones in idealized guidelines. Such transparency illustrates that we become designers by designing, by creating artifacts in interaction with the field, practitioners, and the real-world problem, and that there are likely to be as many ways of doing DSR as there are DSR scholars (and DSR projects). Thus, the transparency of the DSR process demystifies the methodology by conveying its application in a real-world context to students, newcomers, researchers, and reviewers.

Finally, transparency of the DSR process can contribute to methodological improvements. While there are several methodological guidelines available to DSR scholars, we lack the evidence and the process

through which these guidelines were constructed. Indeed, they give accounts of idealized ways of conducting DSR. Such guidelines have been criticized on the basis that they lack empirical evidence but also because they do not establish the necessary relationship between the guidelines and good research (Siponen et al., 2021). Increased transparency of the process can provide empirically founded descriptions of how the design took place in practice, which can serve as the basis for empirically founded methodological guidelines and practices.

In addition to the positive implications, we must also confess the pitfalls of confessional practices: length versus relevant detail and clear artifact presentation. The required detail to achieve process transparency can increase the length of a respective DSR report. Since some journals have strict length limitations, this pitfall poses a challenge for publishing. Through multiple revisions, we continuously adjusted the level of detail to find a balance between length versus relevant detail. We do not suggest sacrificing transparency for publishability. Rather, when writing accounts of the DSR process, we suggest that authors reflect on what details are relevant to achieving process transparency by considering whether those details made a difference on the resulting artifact. Other details to enliven the text can be added if space permits.

Our writing practices, particularly the practice of interlacing design and confession, can explicate the evolutionary nature of the designed artifact. At times, this may entail that confessional writing requires the presentation of an intermediate design to add process transparency. The presentation of multiple design stages, however, impedes the presentation of a clear artifact. Addressing this pitfall, we decided to present the artifact's final design and complementary descriptions in a single appendix (Appendix B). This allowed us to describe intermediate design stages to explicate important design decisions and present the artifact's final design clearly. We acknowledge that this structure violates the suggested structure for DSR papers (Gregor & Hevner, 2013), but we deemed it suitable for our particular research and artifact. Others will need to decide which structure serves their research aims.

5.3 Theoretical Learnings on Collective Mindfulness and Sociotechnical Perspective

Besides the practical need it addresses, this DSR study offered us opportunities for theoretical learnings on the sociotechnical perspective, on collective mindfulness, and on their interrelation in BC (Butler & Gray, 2006; Niemimaa, 2017). After extensive review of the BC literature (see Appendix A), we found that our study is the first to provide a theory-based design of a BC

management approach. While only a small contribution to theory, the theory-based artifact makes an important contribution to the area of BC to help establish it as a more mature and rigorous research domain.

The design process and the design artifacts provided three learnings in relation to collective mindfulness in BC. First, the DSR project revealed synergies between collective mindfulness and the sociotechnical perspective. MR7 (develop the social and the technical jointly) and MR8 (facilitate collective and participatory development) were influenced by the sociotechnical perspective, but also could have been drawn from collective mindfulness theory. The sociotechnical perspective has a strong interventionist focus (Mumford, 2006) and thus embodies certain prescriptions on how development should proceed. Further, it included a strong value stance during its initial development (Cherns, 1976). BC's sociotechnical nature has been recognized in past literature (Herbane, 2010b) but has tended to tilt either toward the social or the technical (Niemimaa, 2015a) and remained largely at the level of abstract statements. Within broader sociotechnical discussions, participatory development assumes that employees should be able to participate in discussions concerning changes to their organization's technical fabric. We found this particular stance to be insufficient with regard to BC. As collective mindfulness argues, most decisions on preparing for the unexpected should not be merely democratic (nonhierarchical) decisions but founded on expertise—whether the expertise concerns knowledge on BC or more broadly domain- and work-specific knowledge. Thus, we found that the sociotechnical perspective and the emphasis of mindfulness on expertise provide complementary perspectives in the context of BC.

Second, the design process surfaced considerations between the social and the technical, especially in MR7. The processes of collective mindfulness (Table 4) focus on the social aspect. The design partner's feedback on the workshop-based approach challenged the adequacy of collective mindfulness as a basis for our artifact. While the literature has established that collective mindfulness contributes to the reliability of technologies (Butler & Gray, 2006) and that the use of technologies can facilitate and hinder mindfulness (Valorinta, 2009), we found that the theory tends to fade technical aspects into the background as inconsequential or at least invisible in themselves and consequential only through social processes. We realized the detrimental effects such focus could have for organizational incident preparations, which are a key aspect of any successful BC. Viewing technologies as inherently and invariably unreliable (Butler & Gray, 2006) overshadows the fact that some technologies are indeed inherently more reliable than others, which suggests that conscious and meaningful developments on the organizational

technical fabric can contribute to BC (Bajgoric, 2006a). The insights we derived made us recognize the need to treat the social and the technical simultaneously as distinct yet interrelated in BC.

Finally, regarding our learning on the facilitation of collective mindfulness through interventions (Sutcliffe et al., 2016), our primary interest was to fulfill practical needs (i.e., to design a BC management approach, which considers SME-specific requirements emanating from their limited available resources). Accordingly, we did not specifically focus on measuring or evaluating changes in collective mindfulness. Nevertheless, our observations and post-design reflections suggest that during the artifact's evaluation, participants grew aware of their organizational infrastructure (MR1), shared information across hierarchical echelon and knowledge boundaries (MR8), engaged in expertise-driven decision-making (MR9), and took proactive orientation to incident preparation (MR10)—all of which are characteristics of collective mindfulness. Yet, we observed how limited participation and insufficient knowledge of the IT infrastructure tended to encourage contemplation and inactivity, which were visible as participants' willingness to externalize responsibility (to external IT partners) and revere expertise, as well as their disinterestedness toward preparations visible through their "everything is already taken care of" attitude. Obtaining both business and IT experts simultaneously in a workshop requires top management commitment to BC. While we have no conclusive evidence on the effects of the artifact on collective mindfulness, these observations provide further support for existing discussions (Sutcliffe et al., 2016) and propose that visualizations of the organizational infrastructure can foreground the "invisible background" (Star & Ruhleder, 1996) and encourage a commitment to resilience and a reluctance to simplify interpretations.

6 Limitations and Future Research

Designing a BC approach, which facilitates expert-based decision-making but could be used independently by SMEs, posed a dilemma between theory and practice. BC requires substantive expertise, which is rarely available within SMEs, and acquiring such resources can be difficult or even out of reach for them. We solved this dilemma, generating guidance on how SMEs can use the artifact independently. However, we acknowledge the risk and problematic nature of such guidance becoming "checklists" for BC, encouraging the mindless ticking-off of outlined actions (Siponen & Willison, 2009). Therefore, we formulated the guidance as supporting questions, which can, at least partly, inspire reflection and learning among participants, thereby encouraging

mindful use of the provided guidance. Further evaluations offer a starting point to assess and improve the offered guidance to solve this dilemma.

Further evaluations should also span testing of the designed artifact's instantiation of MR3 (maintain accuracy). While we provide justificatory knowledge for MR3, our naturalistic field evaluation offers little insight into how this MR plays out when using the designed approach. The nature of the companies that took part in the project limited opportunities for evaluation, as small companies, they only had a single critical process. Future research should look into SMEs with multiple critical processes for evaluating additional cycles of BC development.

Finally, we acknowledge that the evaluations we have conducted do not span all possible SME contexts. The design partner's involvement created practical expectations and relevance for the approach within their different clients' contexts. Based on this, we decided to design a comprehensive but readily usable approach for these clients' contexts. We decided to focus on relevance over rigor. This dichotomy—rigor vs. relevance (Hevner et al., 2004)—became salient when the artifact's increased complexity contradicted a systematic evaluation of its application in various SME contexts. We felt that systematic evaluation would hold back an artifact that had already proved relevant within the assessed SME contexts. Yet we considered this emphasis on relevance to be acceptable because future applications of the approach will continue to inform its design.

Acknowledgments

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Appendix A: An Overview of Prior Business Continuity Approaches

Business continuity as a subject has close ties to practice and practitioners as well as being highly multidisciplinary (Niemimaa, 2015). In order to find essential literature for our purposes, we conducted a systematic literature review. We searched the Web of Science (WoS), Scopus, and AIS eLibrary databases with search terms "business continuity management" or "business continuity plan*" and "information system*". With no time ranges, we found 41 articles from WoS, 104 articles from Scopus, and 234 from AIS eLibrary, which amounted to 257 in total after checking for duplicates. In order to have a more manageable stack of papers, we decided to include scientific journal articles and books as well as conference papers from ICIS, ECIS, PACIS, and AMCIS (but exclude others, unless they contained some of the search terms more than three times in the main text and their reference list was scientific). After this search term frequency checking, we found 95 papers, which were screened more carefully to find papers with requirements for models of business continuity management or planning, which left us with 36 papers. Papers that were discarded focused, for example, on technical details (such as sensor networks), information security, or described disaster recovery cases (e.g., after Hurricane Katrina).

After this, we checked the scientific papers from Niemimaa's (2015b) literature review focusing on models that develop IS continuity for the same requirements. From this, we found nine more papers, which stated some requirements for models of business continuity management or planning. In Table A1, we present the papers included in the literature review and the requirements they posed for BC management and planning models.

Table A1. Literature Posing Requirements for BC Management or Planning Models (in the order of most fulfilled MRs).

Paper	Focus	Research approach	MR1: Facilitate embeddedness	MR2: Pay attention to context	MR3: Maintain accuracy	MR4: Develop gradually	MR5: Minimize documentation	MR6: Enable self-assessment and improvement	MR7: Develop the social and the technical jointly	MR8: Facilitate collective and participatory development	MR9: Revere substance expertise	MR10: Attend proactively	Other criteria
Järveläinen, 2016	Integration of BCP and ISP	Conceptual	x	F	x				x	x	x	x	Involving experts and end users from business units
Lindström et al., 2010b	BC planning methodology	Case	x	P	x	x			x	x		x	Organizational and departmental approaches, targeted for senior management
Nosworthy, 2000	Practical BCM approach	Conceptual	x	P		x		x	x	x		x	Consistent, manageable, cost-effective, organization-wide
Gibb & Buchanan, 2006	Step-by-step approach for BC	Conceptual		F	x	x			x	x		x	Enterprise-wide activity, credible, relevant, cost-effective, specific, measurable, attainable, relevant, time based
Iyer & Bandyopadhyay, 2000	DR & BCP for healthcare sector	Conceptual	x	F	x				x	x		x	Structured for the survival and development of an organization as a whole
Arduini & Morabito, 2010	BC in banking industry	Conceptual	x	P	x				x	x		x	Firm-wide scope, aiming for crisis prevention/avoidance

Baham et al., 2017	DRP in enterprise architecture	Case	x	P			x			x	x	x	Efficiency of recovery, targeted for large organizations
Botha & von Solms, 2004	BC planning	Conceptual	x	P	x	x			x			x	Scalable for all organizations
Butler & Gray, 2006	Achieving reliability in IS with mindfulness	Conceptual	x	P					x	x	x	x	Not only routine based, but individual and collective mindfulness are needed for reliable IS.
Kepenach, 2007	BCP design	Conceptual		P	x	x			x	x		x	Holistic
Tammineedi, 2010	Standards-based BCM	Conceptual	x	P	x	x			x	x			Holistic (all business units) and integrated
Halonen & Koutonen, 2010	Implementation of BCP for large company	Case		F	x				x	x		x	Applicable for manufacturing firms too
COBIT 2019 (Manage Continuity) ISACA, 2018	Controlling IT service management	-	x	P	x				x			x	Holistic, focused on all IT service management with extensive instructions
Dynes et al., 2009	Medium-sized hospital	Case		P		x	x		x	x			Clear and simple plans that could be used effectively, any time by different staff. Enterprise-level plan from integrated unit plans.
Geelen-Baass & Johnstone, 2008	Generic BCM framework	Case	x	P	x				x			x	Simple process, holistic, and organization-wide
Niemimaa, 2015a	Practicing continuity	Conceptual	x	P	x				x			x	Plans, technological solutions, or social ingenuity is not enough, BC practices essential
Peterson, 2009	BCM guidelines	Conceptual		P	x	x			x	x			Can be a costly endeavor to undertake, requires attention of almost everyone in an organization.
Smith, 2003	BCM model	Conceptual	x	P	x				x	x			All-embracing in nature (business-wide, not IT focus, documentation should not be "too heavy to lift'
Motevali Haghighi & Torabi, 2019	Risk assessment method for a hospital	Case		F					x	x		x	Practical and quantitatively measurable
Bell & Gomez, 2011	BC for small businesses	Conceptual		P	x			x				x	Provide sense-making capabilities and training for small companies

Cerullo & Cerullo, 2004	BCP for IS management	Conceptual		P	x			x			x	Comprehensive
Fani & Subriadi, 2019	Implementation of BCP	Multiple cases		P	x		x				x	Applicable for all companies regardless of size, activity, or sector
FitSM (ITEMO, 2019)	Lightweight standard for IT service management	-		P	x			x			x	Holistic, focused on all IT service management with extensive instructions
Harris & Grimaila, 2008	IT contingency planning	Conceptual		P	x			x			x	Comprehensive
Hecht, 2002	BCM	Conceptual	x	P	x						x	Costs and risks should be balanced
Hendela et al., 2017	Risk scenarios for small businesses	Multi-method		P			x	x			x	Structured and simplified, scenario based
Idrees et al., 2019	BC IS for educational institutes	Surveys		P	x			x		x		
ITIL 4 Foundation, Module 4 & 5 Study Guide, 2019	Governance framework	-	x	P	x						x	Comprehensive, focused on all IT service management with extensive instructions
Labus et al., 2017	E-business continuity management	Multiple cases		P	x		x				x	Simple
Morgan et al., 2015	BCM in blood services	Multiple cases		P	x			x		x		
Morisse & Prigge, 2017	Resilience in Industry 4.0	Case	x	P				x		x		
Pinta, 2011	DRPs in BCM	Conceptual	x	P	x			x				For smaller organizations, one plan of continuity may be quite sufficient.
Shropshire et al., 2009	DRP construct creation, IT service	Literature review			x		x	x				Offering guidance for practitioners
Ueno et al., 2018	Maturity model for IT service continuity	Survey		F	x	x						
Braun & Martz, 2007	Mindfulness and BC	Conceptual		P						x	x	Company-wide effort
Cumbie, 2007	DRP in small businesses	Delphi study		P				x			x	Cost-effective for small businesses
Paton, 1999	Staff role in business continuity	Conceptual		P				x			x	Commitment from staff through training
Sarkar et al., 2017	SME resilience from CEO perspective	Q methodology		P				x	x			Some SMEs prefer routines and plans whereas others may focus on mindfulness-

													based resiliency strategies.
Merhout & Havelka, 2008	IT auditing	Conceptual + short case								x		x	For entire organization
Sakurai & Kokuryo, 2014	Resilient IS after a disaster	Case		F					x				Frugality, creative responses, and swift recovery after major disaster
Bajgoric, 2014	BCM framework, system level	Conceptual		P								x	Systemic implementation, technical focus
Morisse & Prigge, 2014	BC in networked organizations	Literature review		P								x	In networked organizations, formal BC manager and sharing information during disruptions are needed
Sambo & Bankole, 2016	Reasons behind disruptions with BCP in place	Case		P	x								Comprehensive and rigorous
Wan et al., 2009	Service impact analysis	Case		P									Business-wide, integrated with DRP (IT service continuity management), dynamic
Total			17	42	28	9	2	6	31	17	4	33	

Note: P = partially met, considers the company context ($n = 35$), F = fully met, considers both context as well as existing BC measures ($n = 7$).

Appendix B: The Thrifty BC Management Approach

This appendix presents the designed thrifty BC management approach to assist practitioners in self-assessing and developing their BC Management (MR6). It consists of two parts. First, we present the approach itself including material already presented as part of the research article (e.g., an overview of the process and modules) and supplementary material (e.g., guiding questions for all modules) to offer practitioners a hand-guide-like description of the artifact in a single place. Second, we describe a workshop approach that practitioners can adopt for implementing the thrifty BC management approach.

Process Model, Trigger Points, and Guiding Questions

The thrifty BC management approach comprises three phases and, in total, 16 modules (see Figure B1). The first phase is the map-it phase. Its modules comprise guiding questions for assessing SMEs' business context including their most critical business process (see Table B1). The second phase, design-it, involves modules focusing on defining BC measures. Table B3 presents respective guiding questions assisting SMEs with designing BC measures. In the third and last phase, continue-it, SMEs decide on how they operate and monitor the designed BC measures (Table B4 presents the respective guiding questions) and when as well as how they continue with subsequent iterations of the thrifty BC management approach. For this, the approach uses a set of three trigger points: gradual development, reevaluation, and major update (see Table B5). We suggest that companies define which events are relevant trigger points for maintaining and updating their BC management using this classification of trigger points. Illustrating the implementation process, and particularly, how these trigger points entail an iterative BC planning process, we provide Figure B2.
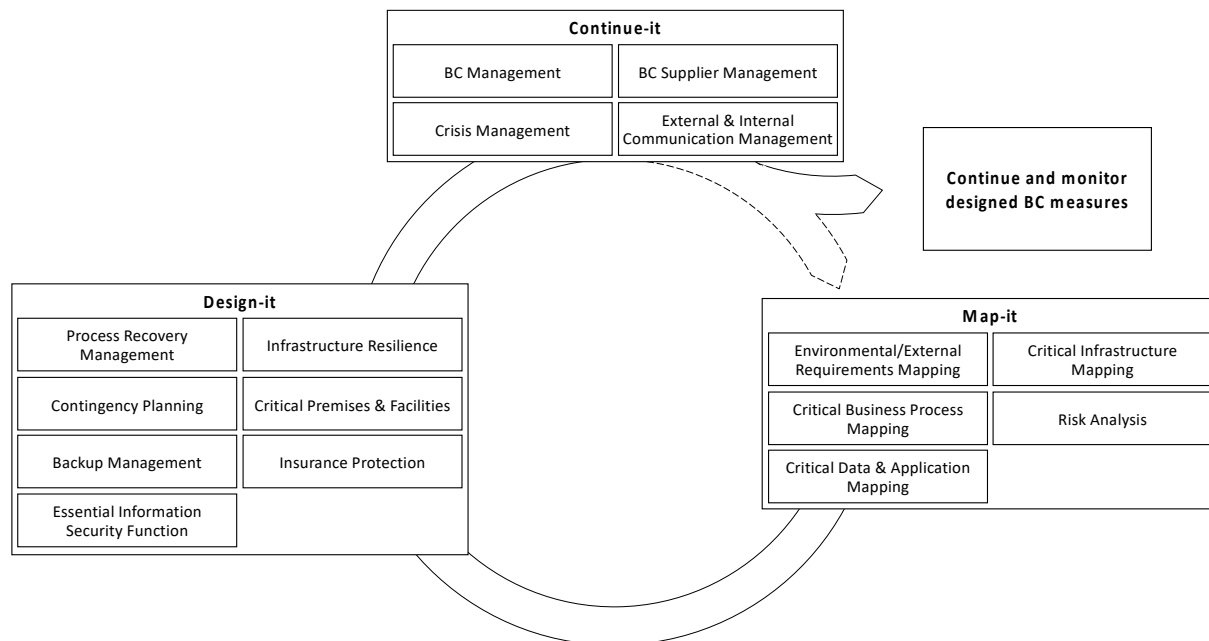
Figure B1. Process and Modules of the Thrifty BC Management Approach

Table B1. Goals and Guiding Questions for Map-it Phase

Module: Goals of the module	Guiding questions
Business continuity environment mapping • Listing all critical external and internal factors such as suppliers, (key) customers, and their requirements, legislation, and company strategy	• Which suppliers support your critical business processes? Which role do these suppliers take in your business process? • Which key customers depend on your critical business processes? What requirements do they have of your BC? • Do you have any legal requirements of your BC? • How is your company strategy related to your BC (value preservation)? How are these factors influencing your business and/or BC? How critical are these factors (esp. suppliers/customers) for your business?

Critical business process mapping • Identify critical business processes and the different functions performed in these processes • Choose the most critical process for further examination • Identify interfaces to other processes, stakeholders, and responsibilities (process owner)	• What are the most critical business processes, without which your business would not survive? A disruption of which business process would immediately (in two hours, one day, etc.) terminate your business? • What are the key functions in this critical business process? • Which processes are customer-facing processes (if critical to the company)? • Which other processes might be affected if this critical business process (function) is disrupted? • Who is responsible for this critical process (process owner)? • Is this critical business process supported or used by any external party (supplier/customer)? • On which of your premises is this process performed?
Critical data and application mapping • Identify all the applications and data on which your critical business process relies on • Map these applications, their connection to other applications, external stakeholders, information assets, and responsibilities	• Which applications is this critical business process relying on? To which other applications (information systems) are these applications connected? Who is responsible for these applications (information systems)? • Which data are those applications relying on? Which information is crucial to conduct the critical business processes? • Are there customers or suppliers who have access to this system to use or maintain it? Are some of these information systems external services?
Critical infrastructure mapping • Identify the infrastructure on which your applications and critical business process relies on • Map your infrastructure components, locations, external stakeholders, and responsibilities etc.	• On which IT infrastructure (e.g., servers, networks, firewall, computers, and other devices, etc.) are the critical process and supporting applications relying? Which IT infrastructure component failure would disrupt your critical business process? • In which facilities is your IT infrastructure located? • Where is this infrastructure maintained in your company or outside your company (supplier)? Who is responsible for these infrastructure nodes? Are there customers whose processes rely on your infrastructure?
Risk analysis • Risk identification • Risk assessment • Risk treatment • Risk mapping • (Risk matrix; risk event per process, sorted by relevance (P*I), depicted in a matrix; see Table B2 for an exemplary risk matrix)	• Which events (hazards; use a risk catalogue as facilitation) could cause a disruption of your critical business processes? • What impact (e.g., financial, reputational damage, etc.) would it have if these events occurred (low = 1, moderate = 2, high = 3)? How likely is it that this risk occurs (risk probability: unlikely = 1, likely = 2, very likely = 3)? • What are possible risk strategies to handle these risks? (Avoid, mitigate the likelihood of occurrence or transfer) Consider the cost/benefit ratio for the different strategies; How much are you willing to pay for the risk treatment?

Note: There may be overlapping questions across the phases, which can be ignored during the workshop if already discussed.

Table B2. An Exemplary Risk Matrix

Risk name	Impact	Probability	Risk severity
IT service provider does not handle the incident quickly (less than a week)	1	1	1
Production system is interrupted (e.g., malware, flood, fire)	3	2	6
Confidential data leaks from the production system	1	1	1
Power outage damages the production system	1	3	3
The critical server breaks	1	2	2
Backups cannot be used for recovery	1	1	1
Malware damages the critical systems	1	1	1
Major fire	3	1	3
Confidential information is leaked because of breaking and entering	1	1	1
Personnel risk	3	1	3
Note: Impact—1: minor, 2: moderate, 3: significant. Probability—1: small, 2: medium, 3: large.			

Table B3. Goals and Guiding Questions for Design-it Phase.

Module: Goals of the module	Guiding questions
Process recovery management • Define time goals for process recoveries and discuss required developments for current recovery plan • Outline plans for recovering the critical business processes • Assign responsibilities and contact persons • Testing of the process recovery (against time goals)	• What kind of losses would you suffer if your critical business process was disrupted for X hours? • What kind of actions and/or processes are required to recover a system and/or process after a disruption (e.g., alternative process, skipping a process phase, manual process)? • Who should be informed about the disruption? What information should be communicated (for how long will it be disrupted; time of updates; alternative processes)? • If no interruption can be tolerated, do you need a hot site, clustering/mirroring, other redundancy, or alternative processes, or can you manage with backups and their recovery? How much are you willing to pay for this recovery time objective? • Who should be responsible for the recovery action/process? How could you train employees or exercise for a disruption?
Contingency planning / alternative processes • Define redundant processes and minimum required process functionality • Define when to switch to alternative processes • Choose a person to prepare the alternative process	• What are the essential operations that need to be performed to continue your business? • If you need alternative processes for this critical process, how could it be managed? Is an alternative system for a system essential for the critical process? Do you need alternative key persons? • What is the minimum process/system functionality? When should you start using the alternative process/system? Who should be responsible for preparing this alternative? (Testing and communicating of the alternative processes)
Backup management • Definition of a backup policy containing information regarding backup management (backup restoration process, retention time for backups) • Physical protection of backup (location and process safety level) • Testing of the backup restoration	• Is there some data that have to be up-to-date all the time? How often should data be backed-up (frequency of backups)? • Where and when should it be backed-up? How (and where) are backups restored? At which time of the day are backups created? • How often should the recovery of backups be tested? For how long should backups be stored (backup retention time)? Transporting backups to physical storage location: how safe is the transport process? • Who should be responsible for backup processes?
Essential information security functions • Malware protection/endpoint protection/patching • System access control (end user rights management, login control) and monitoring log files (i.e., admin login and critical application log controls) • Network security (firewall, encryption, segregation, monitoring of critical devices, etc.) • Information security policy (obligatory in work contracts but also during recruitment)	• Considering the identified information security-related risks toward your critical business processes: • Are your critical information systems protected against malware? Do you have a system access control in place? Do you regularly monitor the log files for critical systems? Is your network protected against, for example, eavesdropping or unauthorized access? • Do you have a patching routine for your information systems, applications, and operating systems (e.g., servers)? From a change management perspective, do you test software updates or patches before releasing them? • Do you have a security or data protection statement included in your HR processes (e.g., recruiting)? • Who should be responsible for making required changes to essential information security functions?
Infrastructure resilience • Eliminate single points of failure • Designated secured and protected facilities for critical infrastructure and geographically considered placement of recovery assets • Action in case of a power outage (e.g., backup power) • Testing of the resiliency measures	• How can you access your infrastructure (network)? Is your network built as a circle or a star? • Can you identify any single points of failure in your infrastructure (servers, networks)? Which component's failure would interrupt a vast number of dependent components? How could you avoid/treat such single points of failure? • Have you prepared for power outages? If not, how should you? • How often do you test that these preparations actually work? Are there at least three persons who can do the recovery procedures? • Who should be responsible to make required changes to infrastructure?
Critical premises and facilities • Development of physical safety • Note special protection of IT infrastructure rooms in general (no sprinklers, no flammables)	• Where (in which facilities) is your IT infrastructure (e.g., servers) located? Are these locations specifically protected (e.g., against fire, flooding, etc.)? Are there any benefits or threats caused by the geographical location of your IT infrastructure?

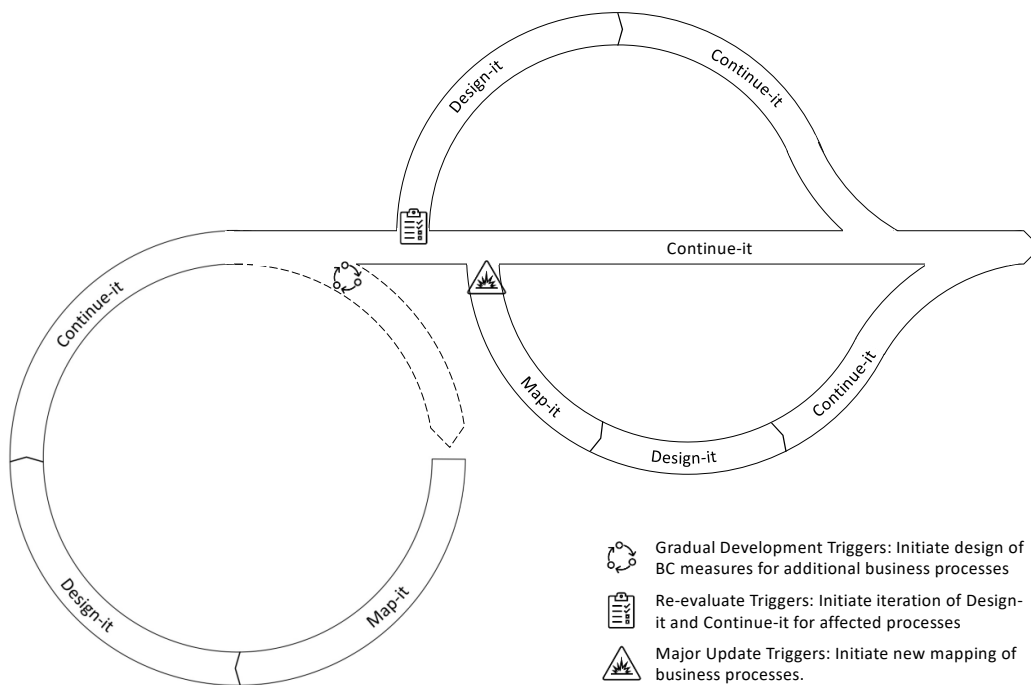|	
• Redundant storage of business-critical, paper-based documents • Ability to support virtual, remote, or distributed work completion • Protection of premises against fire and flood hazards • Maps and plans of all premises (i.e., for emergency evacuation)	• Where are your critical paper-based documents stored? Are these locations specifically protected against fire or water damage or theft? Do you keep redundant copies of critical documents in two distinct places? • Do you have the possibility to perform work tasks remotely/virtually? • In general, what kind of safety measures do you have for your premises regarding: fire, flooding, evacuation, or other disasters? Do you have adequate protection against fire and flooding? • Are you prepared to evacuate if necessary (i.e., are emergency exits highlighted and maps accurate)?
Insurance Protection • Check existing insurance policies, contract new insurance • Insurance should cover: expenses regarding premises, expenses made for handling the disruption. (Considerable: protecting against nondelivery of services/goods due to a business disruption; Sensible: against the loss of key staff.)	• Considering the identified risks: Are there risks that could be transferred by insuring against financial damage caused by these risks? • Do you have insurance for financial damage due to fire, water, etc.? • Do you have insurance against the loss of key staff? • Do you have insurance that covers financial damage caused by a business disruption? • Do you have insurance against non-delivery of services/goods due to a business disruption?
Note: There may be overlapping questions across the phases, which can be ignored during the workshop if already discussed.	

Table B4. Goals and Guiding Questions for Continue-it Phase

Module: Goals of the module	Guiding questions
Crisis management **(Roles for a crisis team: Process/application owner, system administrator, head of crisis team)** • Create a list of contact details and responsibilities (also 2 redundant responsibilities) • Include information on responsible persons for system, application, process, communication, etc. • Training of the crisis team • External ad hoc contacts adding internally missing expertise	• When an interruption happens with the most critical process, who should be responsible? Does your organization need a preplanned crisis team? • What actions should be taken and when? Who should be responsible for those actions? If somebody in the defined crisis team is not available (on business trip, holiday, etc.) who could instead cover the responsibilities? • Can some of the responsibilities be outsourced or is there external expertise that might be required? • How should the crisis team communicate in the team/company? When should the crisis team start working? Should there be some training for the crisis team?
External and internal communication management • Define an internal communication plan when an event occurs during or out of office hours • Define an external communication policy containing guidelines on how to handle the customers, media, and/or officials • Consider special requirements for communication in case of major incidents • Update contact lists	• How should interruptions be communicated in the company? When the network is down? • After office hours, is it necessary to contact (some) employees? • What information should be communicated? (Which system is down? When will it be up again? Schedule for further updates? Will an alternative process be performed?) • In which cases should communication also be external (what are the triggers)? When should customers be informed, how, of what message, and by whom? When should officials be informed, how, of what message, and by whom? • Where can contact details be found and are they updated (how could the contact details be always up-to-date)?
BC management • Defining suitable metrics monitoring the correct functioning of the BC modules (e.g., backups, system health) • Testing the effectiveness of the designed BC modules • Identifying required training • Identifying triggers for reassessment and redesign of BC modules (e.g., changes to the business setup) • Identifying changes to external threats	• What metrics could monitor the correct function of your designed BC? Considering the designed BC actions modules: • How could you test whether your crisis team is prepared to handle a business disruption? How could you monitor whether backups are performed correctly? How could you train your employees against security risks? What tools could you use to monitor your system health? (Are patches done? Sufficient disk space? Service availability?) • How can you ensure that BC is considered when a new process/service/product is developed and introduced? • What events could change your current business processes and/or underlying IT systems and infrastructure? What events (e.g., key staff leaves the company, new hardware, system, etc.) could affect the configuration of the designed BC modules?

BC supplier management	• Based on the assessment, which changes to BC should you discuss with your suppliers or customers?
• Define supplier requirements for BC to ensure their preparedness for business disruptions • Identify changes to BC requirements that should be communicated to external parties	• Which events should trigger a reassessment of whether your suppliers fulfill your required BC? • How do you evaluate your suppliers' BC? How do you monitor changes to required standards and regulations? How frequently should you evaluate your suppliers' BC? • What requirements for BC do your customers demand you fulfill? Are there any audits you need to fulfil? What legal regulations are you required to fulfill?

Note: There may be overlapping questions across the phases, which can be ignored during the workshop if already discussed.

Table B5. Description, Use, and Purpose of the Trigger Points Initiating Consecutive Iterations of the Thrifty BC Management Approach.

Trigger point	When	What	Purpose
Gradual development	When an SME has more than one critical business process, each additional critical business process presents a trigger for gradual development	Initiation of consecutive cycles of the map-it, design-it, and continue-it phase for the additional critical business process	Gradual development, i.e., process by process, of the BC management for SMEs
Reevaluate	When changes in an SME's operation or business environment occur that require partial updating of the existing BC action plan (e.g., key personnel changes, new ISs, changes in key suppliers)	Reiterate the design-it and continue-it phase for the affected processes and respective BC measures	Maintaining the BC action plan, i.e., the designed BC measures.
Major update	When significant changes require a new mapping of SMEs' crucial business processes (e.g., merger and acquisitions, new product, switching from proprietary software to cloud computing)	Conduct the entire cycle (map-it, design-it, and continue-it) for the affected processes	Maintaining the BC action plan, i.e., the designed BC measures

Gradual Development Triggers: Initiate design of BC measures for additional business processes

Re-evaluate Triggers: Initiate iteration of Design-it and Continue-it for affected processes

Major Update Triggers: Initiate new mapping of business processes.

Figure B2. The Thrifty BC Management Approach Implementation Sequence with Gradual Development, Reevaluation, and Major Update Trigger Points

Guidelines for Implementing the Thrifty BC Management Approach within a Workshop Setting

The thrifty BC management approach is designed to facilitate discussion on business continuity (BC) management in SMEs. BC has been defined as the "capability of the organization to continue delivery of products or services at acceptable predefined levels following disruptive incident" (ISO, 2012). BC management focuses on the entire organization, not only the IT function (Merhout & Havelka, 2008; Tammineedi, 2010) and thus, top management commitment is essential for successful BC (Lindström et al., 2010b; Peterson, 2009). For implementing the thrifty BC management approach, that is, for creating the BC action plan, we suggest a workshop approach. A workshop approach reflects the notion of people participating and discussing the BC management plan using the guiding questions presented in the previous part (part 1) of Appendix B.

Our evaluative field study suggests that two workshop sessions of 1.5 to 2.5 hours are sufficient to complete one cycle of all three phases. The first session focuses solely on the map-it phase, while the second session integrates the design-it and continue-it phases.

SMEs' top management and employees with the required expertise are recommended to participate in these workshops. The latter should be responsible and knowledgeable in the organization's critical business processes and IT operations. Business processes are a set of logically related tasks performed to achieve a defined business outcome" (Davenport & Short, 1990) and in some companies, even a short interruption in a critical business process will have a significant impact on operations. Inviting employees with described expertise is crucial in avoiding the risk of lacking sufficient knowledge about the principles of business processes or IT infrastructure details (Weick et al., 1999). Thus, they are required to determine the existing level of BC preparedness. However, the number of participants should be limited to ensure thriftiness and to enable detailed as well as engaged discussions leading to a concise action plan for BC management.

The workshop's goal is to develop the BC preparedness of a company by identifying risks for critical business processes and the data, IT applications, or IT infrastructure supporting the process following the thrifty BC management approach. When the potential risks have been identified and assessed, workshop participants will decide which risks should be managed and identify possible risk management solutions and a person responsible for continuing the risk management planning. The outcome is an action plan describing what risk management solutions the company has chosen and who will be responsible for planning and implementing the solutions as well as chosen trigger points when a reassessment of risks should be done. We have noticed that an initial structure for the action plan is easy to create after the first workshop to list identified assets and risks, which can be used later as the starting point for the second workshop session focusing on design-it and continue-it.

Once the three phases are completed, SMEs should define events that present trigger points for gradually developing or maintaining their BC action plan. The approach is thus designed to be iterative and gradual.

Appendix C: The Anatomy of the Design Theory for BC Management Approaches for SMEs

Table C1 presents the anatomy of the presented design theory. The design theory provides design knowledge for BC management for SMEs. Outlining the theory developed in this study, Table C1 draws on the eight components, which Gregor and Jones (2007) suggest, from a design theory.

Table C1. The Anatomy of the Presented Design Theory for BC Management for SMEs

Components of a design theory	Design theory for thrifty BC management for SMEs
Purpose and scope (What the system is for)	BC management for small and medium-sized enterprises. The design theory provides a set of ten MRs defining the purpose and scope of BC management approaches for SMEs.
Constructs (Representations of the entities of interest in the theory)	BC management, small and medium-sized enterprises, map-it phase, design-it phase, continue-it phase, BC management modules
Principle of form and function (The abstract "blueprint" or architecture that describes the artifact)	The BC approach takes a cyclic, continuous as well as gradual approach to designing, implementing, and maintaining business continuity management in SMEs. It comprises multiple modules, which form a modular structure.
Artifact mutability (The changes in the state of the artifact anticipated in the theory)	The approach builds on a modular structure allowing for artifact mutability. The modules are not mandatory but dependent on SMEs' context (map-it phase). Thus, the approach's modular structure allows for artifact mutability; the modules can easily be adjusted, removed, replaced, or complemented (i.e., new modules added) and thus, the approach anticipates possible changes to BC management knowledge and practice as well as delivers SMEs' BC management needs.
Testable propositions (Truth statements about the design theory)	The BC approach facilitates SMEs to design their BC management thriftily compared to approaches designed for large corporations.
Justificatory knowledge (The underlying knowledge or theory … that gives a basis and explanation for the design)	The justificatory knowledge comprises prior literature on BC management, Sociotechnical theory, and mindfulness. The sociotechnical theory and mindfulness-informed design assumptions that contributed to the formulation of the ten MRs. In addition, MRs stem from existing BC approaches outlined in prior BC management literature.
Principles of implementation (A description of processes for implementing the theory (either product or method) in specific contexts.)	The thrifty BC approach model (map-it, design-it, and continue-it), the guiding questions per module, and workshop template (Appendix B) facilitate implementation.
Expository instantiation (A physical implementation of the artifact that can assist in representing the theory)	The field evaluation provides examples of the thrifty BC approach's instantiation.

Appendix D: Evaluating this Study against the Four Practices for Confessionally Reporting Design Science Research

In this appendix, we evaluate how our own study meets the adapted practices for confessionally reporting DSR against a set of criteria (see Table D1). We adapted these criteria from the conventions for confessional ethnography (cf. Schultze, 2000; Van Maanen, 2011). Evaluating our own study, we illustrate the feasibility and usefulness of the four practices for rendering the process in DSR transparent. However, our use of the practices and their criteria serves only to illustrate one possible way of their application. We expect the criteria to be relevant to (1) editors and reviewers when they need to assess confessionally reported DSR research; (2) researchers required to meet the expectations for research transparency when conducting and reporting their study (Burton-Jones et al., 2021; Hevner & Parsons, 2021; Pratt et al., 2020); and (3) for students who want to learn about DSR processes.

Table D1. Evaluation of this Study against the Four Conventions for Confessionally Reporting DSR

Practice for confessionally reporting DSR	Practice's criteria	Implementation in this study
Self-revealing designer(s) Personalized reporting of the design study including details about designers, design activities, evaluation activities, and decision-making. (cf. Schultze, 2000; van Maanen, 2011)	• Using personal pronouns and pseudonyms for the research team and design partner to explicate differing opinions, agency for design decisions, and how the research team reached these decisions • Providing details on the research team and design partner that are relevant to the DSR study (e.g., age, educational background, experience, expertise, etc.) • Exposing honestly and truthfully even unflattering details of the design process, e.g., mistakes made in the design • Sharing details on the messy and less-than-optimal conditions of the design process	• We report the design study using pseudonyms for the research team and design partner • We provide details on the research team and design partner's educational background, prior experience, expertise, and interests • We share unflattering details on the collaboration between the research team and the design partner including conflicts of interest and the design partner's actions, suggesting lack of confidence in the research team's abilities to interact with the design partner's customers • We share details on our initial struggles to understand and address the posed problem and its connection to prior literature as well as messy parts and conflicts of interest between the research team and the design partner during design and evaluation activities
Interlacing design and confession Reporting the confessions on the design process, design artifact, and design evaluation not separately but in one compound report. (cf. Schultze, 2000)	• Interlacing self-reflexive and confessional details with descriptions of the design artifact and its evaluation, i.e., process and product (artifact) • Interlacing methodological guidelines for DSR with descriptions of the actual design- and research process • Confine self-reflections and confessional details to accounts relevant to the design artifact's emergence	• We reveal details on our own and the design partner's actions, interests, considerations, and mistakes as part of our description of the design process and the resulting design artifacts. • In the results section, we interlace the design process and artifact descriptions with confessional accounts relevant to the respective descriptions • In the research approach and findings section, we interlace definitions of core concepts of DSR and methodological guidelines with descriptions of how we used and followed these concepts and guidelines as well as how we reconciled tensions between textbook advice and the unfolding of the actual design and research process
Designer-researcher stance Shifting between the attached designer viewpoint and the detached researcher viewpoint. (cf. van Maanen, 2011)	• Describing the preunderstanding of the design problem and defining the eventually addressed design problem • Describing the research interest • Presenting new design knowledge and the design artifact convincingly and in detail while showing the ability to maintain criticality to one's own design.	• We describe our initial problem understanding as well as how our problem understanding developed in interactions with the design partner. These accounts reveal how we continuously shifted between a designer/researcher stance when considering the problem and possible design solutions • We revealed our research team's research interest as well as our considerations on what seemed to be the design partner's interest in the DSR project • We present the BC approach for SMEs in great detail, illustrating that it fulfills the defined MRs and providing details for its application and use. At the same time, we evaluate it critically and share details on this evaluation, including its critical parts and pinpoint future improvements.

| **Artless ingenuity**

Demonstrating that the design artifact emerged from a design process that features the murkiness and messiness typical for DSR.

(cf. van Maanen, 2011) | • Illustrating that the design rests on prior knowledge, the practical problem space, and the experimental nature of the design process

• Providing the relevant details on data collection and analysis (e.g., mode of data collection, length of project, access to data, closing the DSR project, and different participants' roles)

• Presenting the confessional and design artifact details within the structure of a canonical DSR process

• Aligning less than-optimal conditions for solving the faced design problems with common, everyday experiences | • We illustrate that the design partner approached us about defining the practical problem space and that we grounded the MRs for addressing this problem space in prior knowledge about BC and BC within SMEs.

• In the Research Approach section, we provide details on the data collection techniques and how we analyzed the data. We describe how we gained access via the design partner, which role we and the design partner assumed and how we continued the DSR project once the design partner considered the artifact mature.

• We present our design process, the design artifact, and the confessional details on their emergence within the structure of an acknowledged and well-established DSR process model (Kuechler & Vaishnavi, 2008).

• We express how we tackled the struggles and conflicts of interest with the design partner, providing reflections on the design process and elaborating our actions and the trade-offs between sustaining the collaboration and rigor. |

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