Business process patterns for improving social sustainability

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Abstract

Business process management (BPM) has the ability to boost transformations towards sustainable entities by innovating organizational structures. While the majority of existing BPM tools and methods focus on economic obligations, social sustainability is often underrepresented. This is problematic because it inhibits business improvement of people's quality of life (e.g., health and equity), fails to address changing customer demands beyond transactional excellence, and obstructs the consideration of new regulations. Based on a literature review and expert interviews, recurrent problems and best practice solutions for integrating social sustainability into business processes were collected. These were formalized into a set of process patterns and then evaluated through illustrative demonstrations, an applicability check, and interviews with process experts. The paper proposes ten patterns together with a series of examples to guide the analysis and improvement of processes in terms of social sustainability. They support both generating novel ideas and identifying weaknesses. In doing this, our work complements existing tools and methods from sustainable BPM, advances the current body of knowledge in this stream, and opens avenues for a more holistic consideration of sustainability in business processes.

Keywords: Business process redesign, Business process improvement, Responsibility, Process pattern, Social sustainability.

1 Introduction

The necessity of transforming people and businesses towards more sustainability is undisputed (UN 2015). Besides environmental or economic goals, information systems (IS) scholars have begun to pay particular attention to *social sustainability* which seeks "to promote compatibility across cultural and social differences, enhance people's quality of life, and manage business impacts on people" (Kotlarsky et al. 2023, p. 938). Hence, we frame social sustainability in IS research as a concept that leverages technology to, among others, contribute to healthy, equitable, and inclusive environments (Schoormann and Kutzner 2020; Troshani et al. 2022).

Due to its ability to transform organizational structures, business process management (BPM) is one of the key drivers in fostering sustainability (Seidel et al. 2011). Advanced BPM tools have been proposed to optimize business process efficiency, productivity, and conformance (Rosemann et al. 2023; Senderovich et al. 2020). While traditional BPM is driven by the economic paradigm, academia (e.g., Kotlarsky et al. 2023; Tan and Nielsen 2024), practice (e.g.,

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changing customer demands towards responsibility, Rosemann et al. 2023), and law (e.g., ESG framework for environmental, social, and governance) emphasize the need to generate environmental and social value as well.

However, particularly the notion of social sustainability is not sufficiently addressed in BPM, which is problematic for several reasons: First, today's managers need to reflect on social sustainability to responsibly balance social objectives with process effectiveness, for instance, when it comes to automating tasks or handling the diversity of employees. Factoring in social considerations attracts talent, fosters trust, and raises employee engagement (Rosemann et al. 2023; Senderovich et al. 2020). Second, it is crucial nowadays to adopt a broader perspective on the value and the stakeholder groups impacted by these processes. This allows organizations to respond to, for example, changing customer demands beyond purely transactional excellence (Rosemann et al. 2023) as well as increase customer loyalty, reputation, and attractiveness to new partners (Senderovich et al. 2020; UN 2021). Third, missing guidance on implementing social sustainability impedes being compliant with new regulations and reporting guidelines, including ESG criteria (Ketter et al. 2020), the EU taxonomy (Klessascheck et al. 2024), or the Australian Sustainability Reporting Standards (AASB 2023).

While promoting social value in processes is demanded, improving processes is among the most creative tasks in BPM (Zellner 2011). As part of the BPM research streams on sustainability (e.g., extending notations, Couckuyt and Van Looy 2019; Gohar and Indulska 2020), there is a growing interest in patterns to guide process improvement and analysis. Those patterns provide proven and generally applicable best practice solutions for recurrent problems (Fellmann et al. 2018) and pose a generalizable way to integrate sustainability into business processes. Following an emerging emphasis on the social dimension in IS research (e.g., Corbett et al. 2023; Kotlarsky et al. 2023; Sarker et al. 2019), we aim to advance BPM by *building business process patterns that contribute to social sustainability.*

In pursuing this goal, we follow the design science research (DSR) paradigm (Section 3). We conducted a literature review to identify existing BPM solutions and their potential to inform the design of our artifact (Section 4). Based on the status quo and the analysis of empirical data obtained through expert interviews, we iteratively designed patterns (Section 5). A total set of ten patterns were crafted capturing best practice solutions that help to analyze and (re-)design processes in terms of social sustainability. The patterns were verified by illustrating them with real-world cases as well as evaluating their applicability with 18 participants from a BPM course and investigating their practical usefulness via process experts (Section 6). Finally, we discuss the implications, limitations, and future efforts (Section 7), and conclude the paper (Section 8). In doing this, we complement existing patterns and tools from green/sustainable BPM, advance the current body of knowledge on BPM and sustainability, and open avenues for a more holistic consideration of sustainability issues in academia, practice, and law.

2 Research Background

2.1 Social Sustainability in Information Systems Research

Sustainable development aims to ensure fair and livable conditions for the next generations (Brundtland et al. 1987) and is manifested in a growing amount of policies, such as Corporate Social Responsibility (CSR) and the ESG framework (Corbett et al. 2023; Ketter et al. 2020). IS research has predominantly focused on environmental impacts, leaving room for future

studies aimed at the social dimension (Kotlarsky et al. 2023; Veit and Thatcher 2023). In attempting to respond to that, we see emerging IS streams that broaden the focus: special interest groups on social sustainability (Kranz et al. 2022), digital sustainability (Kotlarsky et al. 2023; Christmann et al. 2024; Pan et al. 2022), digital social innovation (Tim et al. 2021), social inclusion (Wass et al. 2023), and digital responsibility (Lobschat et al. 2021). However, the plurality of approaches requires adaption to the BPM field, and while the strong digital component is beneficial, it might not be essential for improving organizational structures. We therefore seek to build upon the broader concept of social sustainability.

The concept of social sustainability is generally perceived as more vague (McKenzie 2004; Missimer et al. 2017; Vallance et al. 2011). In this paper, we follow Kotlarsky et al.'s (2023) general definition that social sustainability aims to "*enhance people's quality of life, and manage business impacts on people*" (p. 938). This is in accordance with other social criteria and goals, including the establishment of healthy, equitable, and inclusive communities (e.g., McKenzie 2004; Schoormann and Kutzner 2020; Troshani et al. 2022; UN 2021).

Nonetheless, even though the IS discipline has set out on the path to promote social concerns, additional research is needed to advance our understanding of how to incorporate them into organizations (Tan and Nielsen 2024). To this end, we draw on the well-known stream of BPM research acting as a driver for change toward sustainability and aim to leverage the design of social business processes (Rosemann et al. 2023; Senderovich et al. 2020).

2.2 Sustainable Business Process Management

The BPM discipline is concerned with designing, implementing, and monitoring how work is performed (Dumas et al. 2018; Recker and Mendling 2016). As business processes need to respond to sustainability challenges, Green BPM arose as a BPM research stream to respond to sustainability challenges (Couckuyt and Van Looy 2021; Ghose et al. 2010; Sohns et al. 2023; vom Brocke et al. 2012). Green BPM is "the sum of all IS-supported management activities that help to monitor and reduce the environmental impact of business processes" (Opitz et al. 2014, p. 3812). To guide process designers, research proposed approaches for monitoring environmental indicators (Cleven et al. 2012) or extending modeling notations for emissions (Recker et al. 2012). Overviews of BPM extensions can be found in (Gohar and Indulska 2016; 2020; Schoormann et al. 2017).

In line with the discussion above, some scholars explicitly refer to sustainable BPM to improve economic, environmental, and social performance (Ahmed and Sundaram 2012; Rozman et al. 2015). The key idea of social sustainability in this context refers mostly to a broader consideration of stakeholder groups from employees to society and a broader understanding of value from process executions. An emerging stream is concerned with socially aware process redesign techniques to explore how to allocate tasks (Senderovich et al. 2020), process guidelines for social good to go beyond economic metrics of success (Rosemann et al. 2023), or social topics in BPM in general (Breitenbach 2020).

2.3 Patterns for Sustainable Business Processes

Improving processes is a complex and creative endeavor that requires guidance (Zellner 2011). Process patterns offer such guidance. Although there is some ambiguity in the definition (Fellmann et al. 2017) and there are closely related terms, such as design guideline (Rosemann et al. 2023), heuristic (Frank et al. 2020), or practice (Reijers and Mansar 2005) (see overview in Appendix D), we adhere to the generic notion of pattern. Patterns provide proven solutions to

common problems and capture (re-)design guidance (Smith and Williams 2000). Research on patterns was originally introduced in the domain of architecture by Alexander (1977, p. 247) who argued that a pattern "expresses a relation between a certain context, a problem, and a solution". They codify knowledge about best practices and present solutions that can be contextualized within an individual situation. Drawing on these ideas, Gamma (1995) proposed software design patterns, which pose a starting point for exploring patterns in further disciplines such as BPM. According to Fellmann et al. (2018, p. 976), a process model pattern is a "description of a proven solution to a recurring problem that is related to the creation or modification of business process models in a specific context". Patterns play a pivotal role in BPM (Winter et al. 2009) to effectively and efficiently analyze and (re-)design processes (e.g., Medicke and McDavid 2004; Russell et al. 2016).

While we can observe a great interest in process patterns and a growing number of patterns for economic improvements, there is room for patterns addressing social sustainability in particular. Based on their extensive review, Fellmann et al. (2018) argued that they "expect that patterns in categories being less considered […] will evolve in the future" (p. 992). This is also emphasized by Rosemann (2020) who argued that in contrast to common response patterns in exploitative BPM, "explorative BPM with its focus on adding new value to business processes, lacks an equally mature, deductive set of design patterns"(p. 349). Following this, our overall goal is to advance socially sustainable business process designs.

3 Research Method

DSR is applied as the overarching method to build our pattern set. It is strongly practice-oriented and seeks to generate solutions to real-world problems (Gregor and Hevner 2013; Goldkuhl and Sjöström 2018). In line with its socio-technical nature (Sarker et al. 2019), it is appropriate for our endeavor which covers people, technology, and tasks in the form of business processes. DSR has also been applied to build artifacts capable of guiding process redesign and improvement (e.g., Rosemann et al. 2023; Zellner et al. 2011). We choose patterns as artifacts because they represent abstract solutions and encode design-relevant knowledge that guides process designers (Gregor and Hevner 2013). We followed Peffers et al.'s (2007) DSR methodology to rigorously ground, build, and evaluate our artifact (see Figure 1).

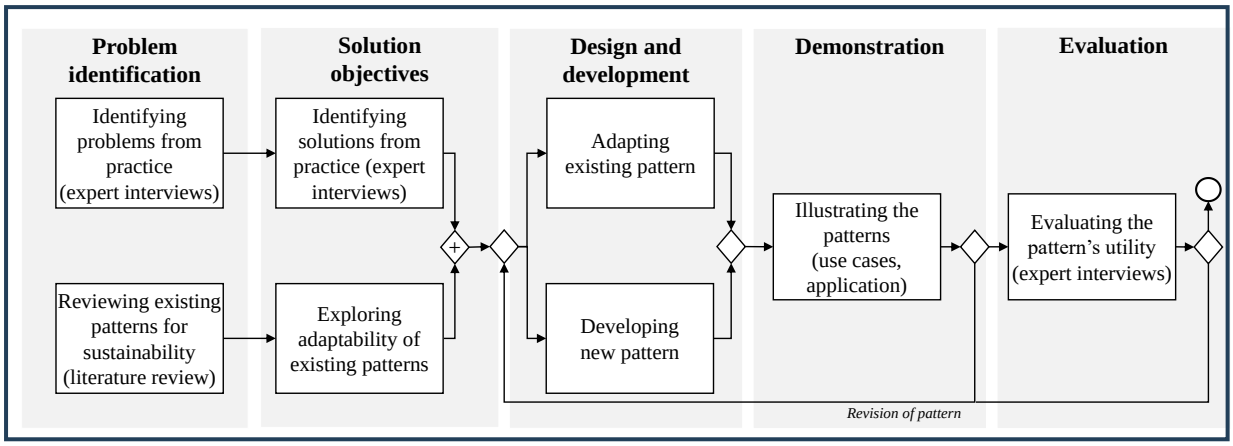


Figure 1. Research process

3.1 Problem Identification and Solution Objectives

First, we conducted a systematic literature review to (a) identify the potential for adapting existing patterns to our context as well as (b) spot for gaps (Schryen 2013). Based on the evaluation of several keywords and combinations, we iteratively specified our search phrase as follows: *("Green Business Process*" OR "Sustainable Business Process*" OR "Social Business Process*") AND (pattern OR practice OR heuristic OR "design guideline")*. Among the search sources were leading IS conferences and journals covered by AISeL and the AIS Senior Scholars' List of Premier Journals, the business process management journal (BPMJ), and the International Conference on BPM to consider process-related research, as well as Google Scholar and Scopus to respect interdisciplinary research. Drawing on the collected paper sample, a keyword search, and evaluation of titles and abstracts were conducted (Webster and Watson 2002). We eliminated papers that did not meet our research purpose or were duplicates and verified the remaining papers by examining the full text (n=152). Therefore, we coded if concrete process patterns including their common components (i.e., specific problems, specified solution approaches, and/or examples), practices, heuristics, or design guidelines are covered. Besides, we extracted statements on the actual need to address social sustainability in processes. In doing so, we found 48 relevant papers (see Figure 2); details are provided in Appendix A. The search was initially performed in 2019 and updated in 08/2024; Scopus and the BPM conference were added during the paper revision in 02/2024 and updated in 08/2024.

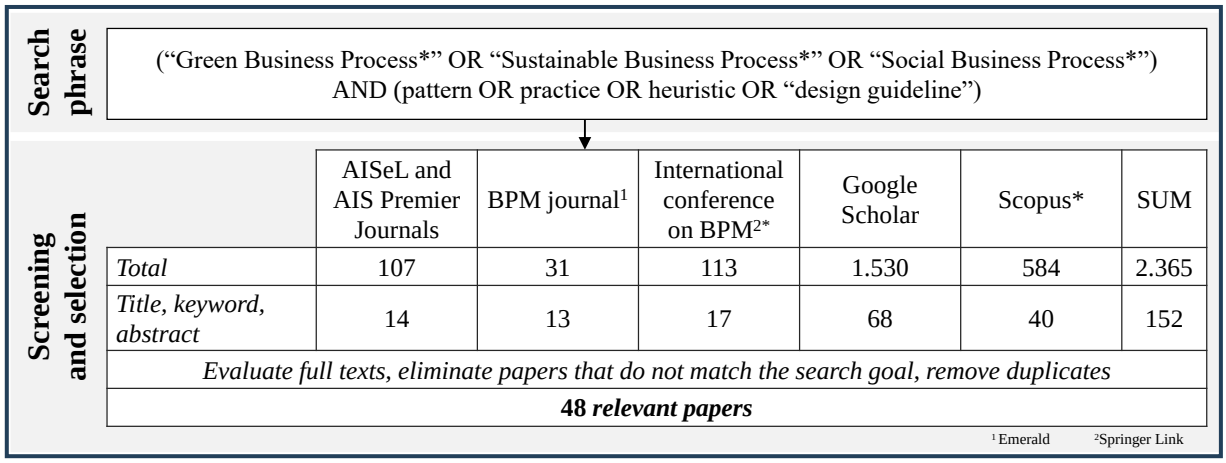


Figure 2. Literature Review Process

Second, we carried out semi-structured expert interviews to collect practical real-world challenges and insights into which efforts businesses perform to achieve social sustainability. This allowed us to gather data face-to-face in a guided way but also to leave room for additional comments. The experts needed to meet two criteria: the company covers aspects of social sustainability (e.g., on their website or in reports) and comprises at least one expert who is employed for sustainability-relevant issues (e.g., in a CSR department). Following this, several potential interview partners were contacted and four experts located in a European country with varying industries and company sizes[1] participated (see Table 1). While this may be relatively limited, our expert selection offers an expansive space for gathering diverse data from various contexts and experiences. The interview guide was structured along with three

[1] European Union: Small (11-50 employees), Medium (51-500 employees), Large (>501 employees).

main parts and pre-tested with Master-leveled students: (i) the interviewee has been introduced to the topic and general demographic data of the expert was collected; (ii) questions related to sustainability were asked, for instance: *Do you implement social sustainability? How important are social aspects compared to economic and environmental aspects? What are the prerequisites for implementing social sustainability?* (iii) questions concerning strategies that are successfully implemented to solve social challenges, for instance: *What has led to the implementation of social aspects in your company? What concrete problems did you aim to solve in your organization? Which solutions did you apply to contribute to social sustainability? How is this reflected in your (daily) processes?*

ID	Role	Industry	Company size	Duration
E1	Sustainability manager	Retail	Large (> 200.000 employees)	23 min.
E2	Sustainability manager	Logistics	Large (~ 2.000 employees)	09 min.
E3	Sustainability consultant	Energy	Large (~ 2.500 employees)	22 min.
E4	Sustainability manager	IT, hardware	Small-medium (~ 400 employees)	38 min.

Table 1. Expert Interviews for Grounding the Patterns

From the interview recording, 92 minutes of transcript data were created. For transcription, we aimed to focus on the actual content, and thus, do not transcribe pauses, non-verbal expressions, and linguistic emphases. Following qualitative content analysis, we described the material in our own words. Afterward, headlines were assigned to the material and consolidated (Meuser and Nagel 1991). Drawing on this, common challenges in implementing social sustainability (see Section 5.1) and successful approaches that are already applied could be investigated (see Section 5.2).

3.2 Design and Development

Grounded in the insights from the literature review and the expert interviews, we built a novel artifact (Petter et al. 2010), namely process patterns for social sustainability. Following Nowak's (2014) pattern development approach[2], two approaches of 'adaption' and 'development' can be differentiated. The first approach makes use of existing patterns and translates them into another context; the latter designs completely new patterns. We began with analyzing whether and how patterns from prior literature can be adapted to address the problem statements about social sustainability. Two researchers independently determined the key ideas that help to enhance social issues (i.e., generalizing from a specific instance to a more abstract understanding) and compared these ideas with existing patterns. In case we did not find any potential for adoption, we designed patterns from scratch based on practical insights.

Our pattern presentation captures a title, a short description, and example initiatives, as well as specifies the origin of each pattern and illustrates possible changes in a process structure based on a simplified notation (see general notations in Falk et al. 2013). We structured the patterns along four categories to take into account that some patterns are more likely to apply to certain organization types (e.g., value chain aspects are not important to all organizations): basic, resource, value chain and ecosystem, and human-centric (see Section 5.3).

[2] Nowak (2014, p. 152) steps: Identification of specific characteristics (domain knowledge and existing patterns), identification of problems and solutions, analysis and selection of patterns, abstraction of problem and solution, documentation of patterns.

3.3 Demonstration and Evaluation

Although evaluation is an important part of creating new artifacts, Fellmann et al. (2018) pointed to limited pattern evaluation in existing literature. To address this, we carried out three evaluation episodes: first, we applied the patterns to existing use cases extracted from sustainability reports. We demonstrated that the patterns can be used in practice as well as disclosed practical solutions to refine and extend our solution (see Section 6.1).

Second, we drew from research on applicability checks to gain data on the pattern's *importance* (i.e., does it address real-world issues), *accessibility* (i.e., is it understandable and readable), and *suitability* (i.e., does it provide guidance for usage) (Rosemann and Vessey 2008). Therefore, as part of a voluntary exercise (anonymously and not related to course grades) within a bachelor-level course in the summer of 2023, we confronted the participants with four steps: (1) the introduction of the patterns and task instructions which asked for improving social issues in a fictive process scenario (10 minutes), (2) the generation of ideas to improve the scenario (divergent, 15 minutes), (3) modeling their most promising ideas with BPMN (convergent, 25 minutes), and (4) fill out a questionnaire (10 minutes). The questions were adapted from Iivari et al. (2020) who transferred them to the field of evaluating design knowledge. Following this, we translated 'suitability' to 'actability' to focus on the pattern's ability to guide redesign. The adopted items were assessed by using a 5-point Likert scale where 5 indicated strong satisfaction and 1 indicated strong dissatisfaction, which has already been applied in the field of business process redesign (e.g., Frank et al., 2020). 18 students with basic experiences in BPM participated of which 15 students filled out the questionnaire (see Section 6.2).

Third, we investigated the practical usefulness of the pattern set through seven additional expert interviews (see Table 2) with a total of 252 minutes. Each interview was structured along (1) demographic data, (2) an introduction to the patterns, (3) questions about current problems in the expert's organizations/experiences, (4) a discussion about our pattern, and (5) the usefulness. They were performed virtually, lasted between 29 and 43 minutes, as well as had a moderator (navigated through the interview) and observer (took notes, added missing questions). Afterward, two authors transcribed and analyzed the interviews (see Section 6.3).

ID	Role	Industry	Work experience	Duration
I1	Strategy and corporate development	Banking	6-7 years	39 min.
I2	Process manager	Consulting	3 years	34 min.
I3	Business development executive	Public administration	25 years	37 min.
I4	Organizational development (process manager)	Consulting	2 years	32 min.
I5	Climate change agent	Mobility	3 years	38 min.
I6	Process manager	Consulting	6 years	29 min.
I7	Process manager	Consulting	5 years	43 min.
				252 min.

Table 2. Expert Interviews for the Evaluation (Evaluation Episode 3)

4 Existing Research on Process Patterns for Sustainability

Following the literature review procedure (see problem identification), we obtained 48 papers that – to a varying degree – met our purpose and determined different categories of prior research along with environmental and social-oriented aspects. Overall, despite the progress concerning the integration of sustainability in process patterns, there is still a deficit of research that considers societal concerns. Following our research method, we could only extract our preliminary work that provides important inputs for new patterns (Schoormann et al. 2019; Schoormann and Kutzner 2021). Nonetheless, some papers identified in the literature review deal with the idea and/or emphasize the potential of process patterns: Couckuyt and Van Looy (2019) stressed the role of patterns as a capability area for modeling and confirmed the primary environmental viewpoint of existing patterns. Stadtländer et al. (2019) explored how software tools support sustainable BPM and only found limited features for using and adding patterns. Wesumperuma et al. (2011) developed a framework for process optimization that draws on common GHG emissions frequency patterns. Schreiber (2020) argued that patterns can be employed to check whether processes comply with sustainability criteria. In addition, papers in our sample point to the importance of more abstract guidance to improve business processes. This includes, for example, the adoption of approaches from Green IS (e.g., Hassan et al. 2019; Hu et al. 2016; vom Brocke et al. 2013), environmental businesses (Watson et al., 2010), sustainable business processes (e.g., Rozman et al. 2015; Seidel and Recker 2012), data collection for sustainability (Ahlers et al. 2017), sustainable aware BPM (Betz and Caporale 2014), and Green IT (Seidel and Recker 2012).

Category	Description (examples)	Implication(s)
Statements about social sustainability in business processes	• *Social value* requirements for processes, for instance: skills training, employing disabled people, sponsoring social events, social gatherings, and awareness programs (Dewan et al. 2012) • Achievement of *social goals* (Schweizer et al. 2017) • *Social impact* of processes (Anjaria 2024) • *Social responsibility* (Watson et al. 2010) • Sustainable business processes, encompassing economic, *social*, and environmental dimensions (e.g., Magdaleno et al. 2017; Graves et al. 2023) • *Social sustainability* within operative but also strategic processes (Schoormann and Kutzner 2020)	Relevance for socially responsible processes
Patterns for social sustainability	• Schoormann et al. (2017) called for more work on integrating social sustainability via process patterns • Schoormann et al. (2019) – our prior papers – provided an initial set of social business process patterns, which served as a foundation for this advanced paper	Relevance of creating social process patterns and initial findings
Benevolent business process design guidelines	Rosemann et al. (2023) derived design guidelines (including patterns) to reflect the overall notion of 'doing good' through the concept of benevolence. They provide four basic principles, each with two guidelines: • Being fair: adequacy and awareness • Do right: prevention and compensation • Say yes: acceptance and tolerance • Be humane: attentiveness and empathy	Relevance of social aspects in processes and potential for adoption to solve the identified problems in our paper.

Table 3. Overview of Solutions Related to Social Sustainability

To enable designers to consider shared values (vom Brocke and Sinnl 2011) as well as social goals, such as well-being, equity, workplace safety, and civic engagement (UN 2015; Vinuesa et al. 2020), this paper aims to develop patterns for socially sustainable business processes. The overview of both patterns in the realm of social sustainability and responsibility (see Table 3) and patterns from adjacent fields such as Green BPM (see Table 4) served as valuable input for designing a new pattern set (i.e., transferring existing ideas into new forms). In doing so, a robust grounding can be ensured, and patterns might be easier to understand for designers who are already familiar with existing ones.

Category	Description (examples)	Implication(s)
Green business process patterns	Based on work from Nowak et al. (2011), Nowak et al. (2012), Nowak and Leymann (2013), and Nowak (2014) green business process patterns are proposed which provide opportunities and solutions for improving the environmental performance of processes. For instance: • 'Green compensation' to reduce negative impacts on the environment without changing process structure • 'Green variant' to introduce alternative paths • 'Green resource change' to substitute resources	Potential for adapting to the social dimension
Ecological workflow patterns	Lübbecke et al. (2016) derived workflow patterns to support the ecological performance of processes. For instance: • Data perspective – avoid the state transition and reduce resources, such as paper and ink • Operational perspective – use a video player with less energy demand during the playback of videos	Potential for adapting to the social dimension
Ecological weakness process patterns	Lübbecke et al. (2017) present patterns to improve processes in terms of environmental objectives. 26 weakness patterns have been derived: For instance: • Replace printing of documents via sending emails • Avoid redundant document storage	Potential for creating social anti-patterns
General process patterns and practices	• Best practices for process innovation (Goni and Van Looy 2022), process improvement (Zellner 2011), process redesign (Mansar and Reijers 2007) (e.g., eliminate unnecessary tasks, consider alternative tasks, use results of a trusted party) • IoT improvement patterns (Stoiber and Schönig 2024), such as authentication and authorization. • Attack pattern to ensure security (Seid et al. 2014)	Relevance for practices, patterns, heuristics, etc.; Potential for adapting to the social dimension

Table 4. Overview of Solutions from Adjacent Fields

Also, there are several papers on 'social BPM' focusing on how to support collaboration and integrate social media, such as Brambilla et al. (2012) who proposed social patterns that aim to enhance participation, and Bögel et al. (2014) who demonstrated collaboration patterns. However, social BPM refers to jointly executing processes and, thus, it does not share our core understanding of social sustainability which is why they are not considered for this work.

5 Design and Development

5.1 Identification of Practical Problems

Based on the analysis of the first four sustainability expert interviews (see solution objectives), we derived seven main problems (**P**) in the form of needs and challenges (see Table 5).

ID	Problem title	Problem description
P1	The challenge of limited process adaptability	Altering core process structures is challenging when most business processes are well-established, compliant with regulations, and economically successful. This is evident, for example, by Expert 4 from a small-medium company who stressed that they often do not have the capacity to adjust their processes in the short term. Therefore, core procedures cannot be transformed.
P2	Need to preserve employee performance	Processes and resources are selected based on economic concerns. Social sustainability needs to be considered as well to sustain the long-term performance of the employees and the entire business.
P3	Need to be compliant with social regulations	As new regulations concerning working conditions are specified, "regular checks for compliance with working conditions and social standards" (Expert 1) of the business processes need to be performed.
P4	The challenge of justifying socially sustainable effects	Acting in a socially sustainable manner presumes changes across the entire business that cause costs. Organizations need to communicate these aspects transparently and explain, for example, why costs are different from other services/products. In the words of Expert 1, "the stories behind an actual product and its production need to be told".
P5	The challenge of insufficient infrastructure	While make or buy questions are typically related to economic goals, organizations need to start reflecting on this question for social sustainability too. They may not have the appropriate capacities and knowledge to perform processes socially. Expert 4: "[We] outsourced activities to external firms when there is a financial benefit. This is changing, as social aspects become more and more important".
P6	The challenge of global value chains	Value chains are often distributed around the globe and standards are differentiating between countries. Therefore, monitoring the social sustainability (e.g., working conditions) of processes is challenging. Expert 1: "[performed] with vendors from other countries which may have both different internal and external regulations."
P7	Need to leverage individual strengths	As employees have different backgrounds (education, physical capabilities, etc.), processes should be aligned with individual needs to best possibly leverage their strengths. This issue is stressed by Expert 4: "[because] of the standardized processes, it is hard to integrate different people and to generate a value based on their strengths and abilities".

Table 5. Synthesis of Practical Problems

5.2 Identification of Best Practice Solutions

Besides the actual problems, we sought to gather best practice solutions that are successfully applied in the real world. By drawing on the *interview data*, nine solutions **(S)** could be derived: *Compensation*—providing further offers for employees to compensate for physical work (***S1***), for example, via additional staff that is concerned with healthy lifestyles, free gyms, or healthy food (Expert 1, 3). Also, activities to compensate for negative effects on the society level can be made (***S2***), such as establishing foundations, making donations, or offering employees participation in social projects (Expert 4). *Path alternatives (**S3**)*—introducing additional process paths that enable customers to make choices. For instance, companies integrate a fair trade product in addition to a basic product to allow customers to select between two variants (one more socially sustainable than the other). *Resource replacement (**S4**)*—replacing resources that cause health problems by creating an ergonomic working place like changing working equipment such as height-adjustable desks (Expert 1, 3). *Certification (**S5**)*—using labels and certificates to create transparency for the customer and to communicate social effects (Expert 1, 4). *Process outsourcing (**S6**)*—outsourcing single activities or entire processes to make use of competencies from external organizations, which can carry out processes in a more socially sustainable manner (Expert 4). *Responsible procurement management (**S7**)*—performing

responsible procurement management to ensure social aspects are integrated already at the early stages of a value chain (Expert 2). *Value chain auditing (**S8**)*—using audits to verify compliance with internal regulations (i.e., from certain businesses) and external regulations to contribute to socially sustainable value chains (Expert 1, 2, 3). *Process individualization (**S9**)*—adapting processes to best fit the individual background of employees – i.e., inclusiveness – to enable revealing the strengths of every employee (Expert 4).

During the illustration of the patterns based on *sustainability reports* (details in Section 6), these solutions could be verified but also extended. Four additional solutions were collected: *Resource reuse (**S10**)*—considering possibilities to reuse resources, especially concerning the availability of and access to resources that are scarce in some regions. For instance, implementing an "effective water management [to] recycle and enable multi-use of water" (translated from Hochtiefbau, p. 138, see all cases in Appendix B). *Accessibility (**S11**)*—designing working environments that allow all people regardless of their backgrounds to participate in processes and corresponding resources. For instance, for people with hearing impairments, "[providing] subtitles in videos and transcription that can be read out loud during the usage of a computer" (translated from Siemens, p. 18). *Education and awareness (**S12**)*—establishing mechanisms and activities that shape awareness for possible hazards in the working environment but also during the use of the produced goods as well as train people to responsibly perform processes. For illustration, "[implementing] a comprehensive competence management to ensure that workers always have the knowledge required to be able to meet working, health, and environmental protection standards" (translated from Robert Bosch, p. 60) as well as providing topic-related newsletters, wikis, blogs, and online community's to be regularly sensitized the staff about important information. *Team spirit (**S13**)*—allowing people to jointly stand up for social issues and goals. While this solution is comparable to the compensation, this is about performing activities by themselves instead of providing donations. For example, about 20.000 employees of IBM participated in a walkathon challenge for scholarships (IBM, p. 36).

5.3 Formulation of Process Patterns

We derived process patterns for improving social sustainability based on the solutions proposed in the literature, the problems and best practices from the experts, and the evaluation episodes. The results in this section are subject to multiple design iterations (see Appendix C) and therefore capture the final stage of our process pattern set.

For adapting patterns to this paper's context (*adaption approach*), we mainly draw on the set of green business process patterns as proposed by Nowak (2014) which synthesizes a series of prior-developed patterns (e.g., Nowak et al. 2014; Nowak and Leymann 2013). Because our goal is to provide approaches that create awareness and guide designers toward more socially sustainable processes, we argue that Nowak's work with its focus on opportunities and solutions for improvement provides a suitable foundation. As a result, 6 of 10 patterns (#***SP1*** to #***SP6***) are initially grounded in existing patterns. As an example, we transferred the idea of 'green compensation' (compensating negative environmental impact) to the social context in which negative impacts on people and society are taken into account. Among the other adaptions are: 'green variant' (introducing a new process path) to social alternative paths, 'green feature' (adapting the appearance of a product or service to emphasize environmental properties) to social labeling, and 'insourcing' (reducing communication effort through centralization of certain process components) to social sourcing.

Practical problems and solutions that could not be mapped to existing patterns (*development approach*) served as the input for building completely new ones (***#SP7*** to ***#SP10***). For instance, we did not find patterns in our sample to cover the problem of ensuring accessibility to processes in order to leverage participation (see adaptability and employee performance). Therefore, a novel pattern for social accessibility was crafted. This builds upon real-world insights highlighting the power of individualization of processes and accessibility to working environments which help to ensure a fit between task and person. As another example, we collected best practices concerning the creation of awareness and education to handle possible hazards in the working environment responsibly, which was translated into the pattern for social training.

The *basic patterns* cover approaches that are generally applicable and can be instantiated in different ways (see Figure 3). Compensations and alternatives can be used in cases where it is not possible to change the core structure of the processes. They can be combined with other social patterns, for instance, compensating for negative influence from having poor resources. During the instantiation, social goals need to be considered, such as process variants to establish equity of access to key services (e.g., health and education, McKenzie 2004).

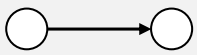
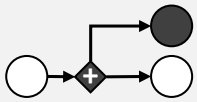
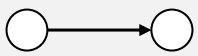
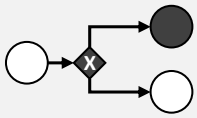
[#SP1] **Social compensation**	Improving internal and external socially sustainable performance by compensating negative effects without changing the (core) process structure.
Problem [P1]: Organizations often have well-established processes that are compliant with regulations and ensure economic success. It is therefore challenging to find a way to increase social goals without adjusting the actual processes. **Solution [S1, S2]**: In case there are no options for adjusting processes, activities for social compensation can be instantiated. They help to (partly) compensate for negative social influences. **Examples**: ▪ Compensate physical work through free access to gyms (internal), preventive health care (internal), additional goodies (e.g., drinks, clothing) (internal) ▪ Compensate negative influences through financial donations to social projects (external), establishment of social projects (external)	Before  After 
[#SP2] **Social alternative**	Improving socially sustainable performance by offering an alternative process path to the employees, partners, and customers without changing the (core) process structure.
Problem [P1, P4]: Organizations often follow strict criteria for optimizing their processes. Changing processes may lead to additional costs. Alternative process paths could be initiated to improve social goals and generate comparable outcomes. **Solution [S3]**: Alternative process paths are implemented to improve social goals. Possible process costs need to be calculated and covered (e.g., customers who choose a social process path). Reasons for increased costs need to be communicated. **Examples**: ▪ Alternative work modes: remote and flexible working hours (internal) ▪ Subsidized mobility variants, such as job bikes (employee decision, internal) ▪ Work variants and job rotation against monotonous tasks (staff decision, internal) ▪ Fair products in addition to the standard assortment (customer decision, external)	Before  After 

Figure 3. Basic Patterns for Socially Sustainable Business Processes

The *resource patterns* shed light on handling, reusing, and communicating social aspects of process materials and resources (see Figure 4). Resources have a significant impact on the

process and the participants for which reason their selection should embody social principles, for instance, inter-generational justice and healthy workplaces (e.g., Breitenbach 2020).

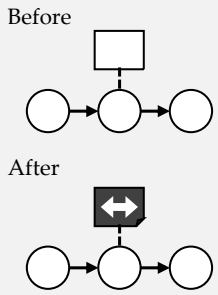
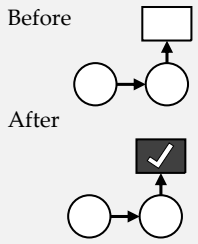
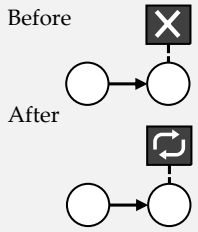
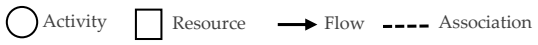
[#SP3] Social resource replacement	Improving socially sustainable performance by replacing resources that have a negative influence on actors without changing the (core) process structure.
Problem [P1-P3]: Organizations often select their resources based on economic and functional criteria, and thereby may neglect social goals. Different ways of labor and new regulations will require organizations to improve their process resources. **Solution [S4]**: Resources have a significant impact on the processes. They should reduce negative influence on employees, suppliers, and the broader society. **Examples**: ▪ Replace resources to support ergonomic work, such as height-adjustable desks ▪ Hire ergonomic teams to ensure healthy working places ▪ Replace resources to support health and well-being, such as through job bikes ▪ Eliminate so-called 'conflict materials'	
[#SP4] Social labeling	Improving the socially sustainable image of an organization by labeling processes and products with social certificates and standards.
Problem [P4]: The redesign of processes towards more social sustainability might be complex and cost-intensive. External people might not be aware of this. **Solution [S5]**: Socially redesigned processes and activities need to be communicated to potential customers to explain their benefits. This can be supported by labels. **Examples**: ▪ Communicate and report socially sustainable product/process features ▪ Adjust the appearance of products/services to highlight social features ▪ Ensure compliance with Fair trade, CmiA-certified cotton, …	
[#SP7] Social resource reuse	Improving socially sustainable performance by reusing resources that have a special value for society without changing the (core) process structure.
Problem [-]: Organizations often select their resources based on economic goals, and thereby may neglect rethinking how the resources can be procured and reused. **Solution [S10]**: Some process resources can be reused. Establishing circular instead of linear thinking helps to handle valuable resources more responsibly. **Examples**: ▪ Establish effective water management if (parts of the) processes are performed in regions with water scarcity	
	

Figure 4. Resource Patterns for Socially Sustainable Business Processes

The *value chain and ecosystem patterns* focus on social sustainability beyond organizational boundaries (see Figure 5). They prompt organizations to rethink which process activities are related to which partner to ensure the best possible execution as well as select and monitor partners along the entire supply chain with social principles, such as fair labor or establishing new infrastructure in rural communities (Kotlarsky et al. 2023).

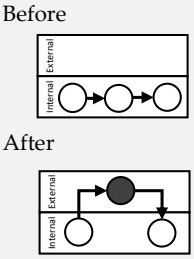
[#SP5] **Social sourcing**	Improving socially sustainable performance by transferring activities to organizations that can carry out an activity in a responsible manner.

Problem [P5]: The production of goods or the offering of services typically consists of numerous different activities. As some activities require high-level expertise, organizations should reflect on their own but also external partner capabilities to ensure activities are best possibly performed.

Solution [S6]: Outsourcing in which activities are transferred to organizations that can perform them in a socially manner; insourcing to transfer external activities into the own organization that is trained in handling certain activities.

Examples:

- Outsource the handling of chemical products to specialized organizations
- Outsource the monitoring of data privacy issues to reduce risks of fails



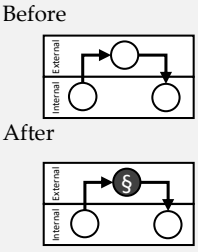
[#SP6] **Social value chain**	Improving socially sustainable performance by defining and monitoring socially sustainable standards that have to be applied by every partner within a value chain.

Problem [P6]: Today's value chains reach beyond national boundaries and are subject to different laws and regulations. This heterogeneity leads to challenges in terms of monitoring and compliance.

Solution [S7, S8]: As process partners have a significant impact, they should be selected and monitored through the lens of social goals.

Examples:

- Perform continuous audits to verify how process partners fulfill social regulations
- Check compliance of process activities that are performed with external partners
- Establish supplier management systems to report on compliance with work safety



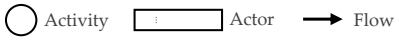


Figure 5. Value Chain and Ecosystem Patterns for Socially Sustainable Business Processes

Lastly, the *human-centric patterns* provide insights into how to design processes so that many different people can participate and develop a culture of cohesion (see Figure 6). Particularly in times of skilled labor shortage in which it is important to identify and recruit appropriate talent, it becomes more relevant to train employees to be able to execute (other) process activities as well as to establish processes that can be performed by diverse people regardless of their backgrounds (e.g., language, gender, handicaps; see also inclusive approaches as proposed by Waas et al. 2023). Organizations that have redesigned their processes accordingly can attract more potential talents.

6 Demonstration and Evaluation

6.1 Applying the Patterns to Real-World Use Cases

Sustainability reports from companies across industries (e.g., manufacturing, energy, finance, and telecommunication) were analyzed to demonstrate that the patterns can be used in practice. This allows us to verify, refine, and extend the initial set of patterns. Following our sampling strategy that makes use of the most important industrial sectors[3], 24 sustainability reports from large companies were collected (see Appendix B). This type of report has been critiqued in the past to be overwhelming and sometimes overselling (e.g., Pucker 2021). We

[3] To ensure a representative sample of reports, we draw from 'sales of the most important industrial sectors in Germany' (statista 2019).

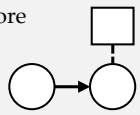
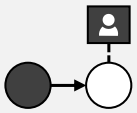
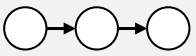
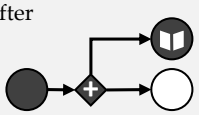
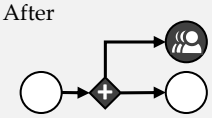
[#SP8] **Social accessibility**	Improving socially sustainable performance by adjusting processes to allow participations regardless of employee's, partner's, customer's background.
Problem [P1, P2, P7]: Organizations often design their processes based on economic and functional goals. Aspects of designing processes in an accessible way to incorporate diverse people might be less focused. **Solution [S9, S11]**: Adjusting processes in terms of human-specific needs to allow everyone regardless of their background (e.g., gender, religion, physical health) to participate in activities. Individualization and flexibility need to be considered. **Examples**: ▪ Provide flexible process structures, such as remote (internal) ▪ Monitor human fatigue, such as tiredness during physical labor (internal) ▪ Use inclusive/multiple languages to reduce barriers (internal, external) ▪ Add subtitles to activities/resources that can be read aloud (internal, external)	Before  After 
[#SP9] **Social training**	Improving socially sustainable performance by educating internal and external actors to enable them to participate in processes appropriately.
Problem [P2, P7]: Organizations often design their process activities based on economic goals. The use of internal competencies and talent might be neglected. **Solution [S12]**: Extending processes to train and promote internal talent. This enables employees to perform certain activities in a socially responsible manner. **Examples**: ▪ Implement competence management (employees have the required knowledge) ▪ Add process activities to train how to handle hazardous material, resources ▪ Allow employees to try (new) process activities by themselves (sandbox)	Before  After 
[#SP10] **Social togetherness**	Improving socially sustainable performance by creating a strong team-cohesion within an organization and doing something good together.
Problem [P-]: Organizations often focus on economic issues and thereby neglect 'soft activities' that are capable of enhancing the organizational culture. **Solution [S13]**: Additional activities should be offered to allow people to jointly stand up for social issues/goals. This improves internal and external performance. **Examples**: ▪ Offer events that can be joined by all employees, such as joint breakfasts ▪ Establish 'walkathon challenges' or donation initiatives to support scholarships ▪ Establish carpools to bring together different employees (reduce emissions)	Before  After 

Figure 6. Human-centric Patterns for Socially Sustainable Business Processes

anticipate possible issues concerning the results but find sustainability reports to be an adequate source to extract generic insights because at worst, they represent an idealized state of activities. Also, they have served as useful input for investigating sustainability (e.g., Wulfert et al. 2023).

In terms of the analysis, one researcher (the first author) coded the reports to extract paragraphs that refer to social issues and initiatives. Afterward, two additional researchers analyzed the paragraphs and mapped them to the initial set of patterns by indicating which pattern is supported, and which pattern can be refined or extended (see Table 6). The coding results were consolidated in follow up-workshops. Especially aspects concerning the abstraction level were discussed in-depth, including: Should we split 'social compensation'

Category	Pattern	Observation/examples
Verification	#***SP1***. Social alternative	Flexible working (Lufthansa, p. 68)
	#***SP4***. Social labeling	CmiA-certified cotton (Otto, p. 83)
	#***SP6***. Social value chain	Suppliers need to implement a social/ environmental management system (IBM, p. 18)
Refinement	#***SP2***. Social compensation	Added external views to the description to reflect aspects beyond internal compensation
	#***SP3***. Social resource replacement	Split from general 'resource handling' into more concrete patterns for replacement and reuse
	#***SP7***. Social resource reuse	
	#***SP8***. Social accessibility	Broadened the scope from 'individualization' to a more inclusive pattern for general accessibility
Extension	#***SP9***. Social training	Competence management to train and inform employees (Robert Bosch, p. 60)
	#***SP10***. Social togetherness	'Walkathon Challenge'(IBM, p. 36)

Table 6. Insights from the Demonstration (Evaluation Episode 1)

into more specific ones, such as health for employees and social projects? We decided to stick to the initial patterns and subordinate details to the existing patterns (e.g., health as part of social compensation). While the demonstration reveals examples and support for nine out of ten patterns, there were no examples of 'social sourcing' in our sample of reports. Nonetheless, we decided to keep it because of its relevance in other fields of sustainability.

6.2 Applying the Patterns to Improve Social Sustainability in Business Processes

In the second evaluation, we explored if the patterns are assumed to be important, accessible, and suitable, i.e., provide sufficient guidance (Iivari et al. 2020; Rosemann and Vessey 2008). As part of a voluntary exercise, we introduced the patterns and a task to the evaluation participants, let them generate ideas to improve a given scenario and model their most promising ideas with BPMN, as well as asked them to fill out a questionnaire. 18 students participated voluntarily of which 15 filled out the questionnaire (see Table 7).

The results point to the overall *importance* of the pattern to advance social aspects in organizations (accumulated mean 3.77) and that the patterns are *accessible* (e.g., easy to understand, mean 3.53). While the students demonstrate the patterns are *suitable* and, thus, able to guide them in their analysis and redesign activities (e.g., accumulated mean 3.2), additional comments reflect the need for more guidance. For instance: "I think it is difficult to apply the rather abstract patterns to concrete processes." (Participant 9) Therefore, we decided to split the initial pattern on resource handling into concrete ones for resource replacement (#SP3) and resource reuse (#SP7), and extended the description of examples for each pattern.

As the accumulated values for importance and accessibility indicate positive tendencies, we are confident that the patterns provide a useful tool for the business process (re-)design. Moreover, seven participants assessed the overall rating of the patterns with 4/5. While the participants have a BPM background (i.e., attended a university course on BPM and had at least basic experience in modeling, analyzing, and redesigning processes), the generalizability of the findings is limited because they are at student level. They may become future process managers or consultants, which is why we believe their assessment of the pattern usage is still worthwhile to examine.

Question item	Mean	Median	SD
Importance			
In my view, the set of patterns addresses a real problem.	3.6	4	0.63
In my view, the set of patterns addresses an important, acute problem.	3.93	4	0.45
Accessibility			
The set of patterns is easy for me to understand.	3.53	4	0.91
The set of patterns is intelligible to me.	3.27	3	0.79
Suitability (actability and guidance)			
I find that the set of patterns provides sufficient direction.	3.13	3	0.74
I find that the set of patterns provides concrete recommendations.	3.27	3	0.70

Table 7. Results from the Evaluation Episode 2

6.3 Investigating the Pattern's Practical Usefulness through Expert Interviews

In the third part, we collect additional data on the usefulness of our pattern set to support BPM in practice. We selected experts with convenient experience in process management and process consulting; in contrast to sustainability experts during the grounding. Seven interviews with 252 minutes were conducted with experts from different domains and roles (see Section 3.3).

Based on the analysis, the *overall usefulness* of the patterns was confirmed by the experts. This is evident, for instance, by: "Definitely useful. Especially if one aims at implementing social sustainability. It gives companies an orientation [..] processes can be assessed, blind spots can be discussed and mechanisms can be planned. Like a completeness check." (I1) Other statements point to the ability to give impulses for redesign and improvement (e.g., "can be used for inspiration", I7; "for people without BPMN background", I2). We asked them to rate the usefulness on a five-point Likert scale from 1 (not useful) to 5 (highly useful) and achieved an average of 4.07 (min 2, max 5). During the interviews, experts elaborated on actual ways of using the patterns in practice. They suggest using them in collaboration with other employees to explore how those patterns are or should be considered and then jointly determine an action plan. In addition, the patterns can serve as guiding questions for workshops to analyze an organization's current state in terms of social sustainability. Some experts also point to other forms of representing and complementing the pattern content, such as through canvasses.

We further extracted additional *practical examples* to extend our pattern set and explored the *potential for refinements*. New practical cases cover compensation of physical work through additional goodies, alternatives through subsidizing mobility variants, resource replacement by supporting ergonomic work with height-adjustable desks, and sourcing in which chemical products are outsourced to specialized organizations. As improvements, experts particularly emphasized the role of examples for advanced guidance. For instance: "I would prefer more examples and sub-points for inspiration" (I1) or "Digital examples would be helpful in addition to the physical ones that are currently provided" (I7). Several additional (digital) examples were added[4]; also from the expert interviews during the evaluation.

Lastly, we observed some *tensions* (Wang et al. 2023): First, *inspiration through examples versus perceptions as checklists*. While examples are a source of inspiration, they may be perceived as a

[4] Please note: The refinements are already a part of the presented, final pattern set (Section 5).

checklist and limit the exploration of new ideas. Users may try to follow the provided examples as they recognize them as a full list in a category. Second, *generalization versus contextualization*. While the patterns are intended to be abstract to provide impulses for numerous situations and users without extensive modeling expertise, they require effort in contextualizing them to individual purposes. Experts pointed to contextual factors, including organization domain and size (e.g., "[..] dependent on the organization. SMEs – our target customer group – are less concerned with patterns for job rotation.", I6). Third, *sustainability knowledge versus process knowledge*. While more process-oriented users may benefit from the list of social patterns and their underpinning ideas, more sustainability-experienced users may find them less helpful because of their existing knowledge. For instance, a sustainability expert argued: "I think that I am working with them anyway [..] Probably I use those patterns implicitly and not systematically. This helps to get a more complete procedure", I5).

Addressing these observed tensions not just as issues but as opportunities is crucial; especially in situations where tensions drive process redesign and transform challenges into innovation. Wimelius et al. (2021) emphasize that embracing contradictions can lead to more adaptive systems during digital transformation. Embracing these tensions makes the process design more adaptive to diverse perspectives required by phenomena such as those faced when taking into account the concept of social sustainability (Van der Byl and Slawinski 2015).

7 Discussion

Given the auspicious ability of BPM to implement sustainable ideas into organizations, we present ten process patterns to inspire improvements in the realm of social sustainability. The patterns are grounded in literature and expert interviews and iteratively refined through several evaluation episodes. However, we do not claim completeness as the understanding of the social dimension is still evolving and characterized as a multifaceted concept.

7.1 Implications Related to Patterns for Sustainable Business Process Management

Patterns have been around for several years and bear potential for research on business processes and beyond (e.g., Dickhaut et al. 2022; Rosemann et al. 2023). Referring to this paper's context of BPM, particularly from a practice viewpoint, the proposed process patterns can be adapted by organizations to improve their social performance. They support process designers in analyzing and (re-)designing business processes and getting impulses for alternative solutions (as known from explorative BPM techniques, Groß et al. 2024). This is important given that the improvement phase is considered to be the most creative one (Falk et al. 2013; Zellner 2013) and the concept of social sustainability has various nuances. Our solution and functional views on organizations enable reflection on the possible design space. Patterns are proven to increase awareness of this space but also require careful selection and contextualization for the situation at hand (Reijers and Mansa 2005; Rosemann 2020).

This work is an additional step towards a broader view of sustainable development and responds to the fact that "[a] vast majority of authors agree on the term 'Green' BPM (instead of 'Sustainable' BPM)" (Couckuyt and Van Looy 2019, p. 19). With an emphasis on the social dimension, we complement existing research in the context of business process patterns and provide knowledge for improving processes – DSR knowledge contribution to level 2 in which knowledge as operational principles or architecture is presented (Gregor and Hevner 2013). Existing collections of patterns can be extended through social perspectives, such as the

'business process model patterns classification' (bpmpatterns.org, Schoknecht et al., 2020) and the 'business process model pattern taxonomy' (Fellmann et al. 2017), as well as overviews of design heuristics (e.g., Frank et al. 2020) and best practices (e.g., Mansar and Reijers 2007). As an example, the pattern classification dimension for 'quality, compliance and risk' already comprises environmental impacts and can be complemented through social sustainability.

In comparison to adjacent patterns, we can observe both overlaps and peculiarities. Rosemann et al.'s (2023) benevolent process design guidelines, for instance, also point to the relevance of reaching beyond traditional economic values and the well-being of stakeholders. These guidelines share some similarities with our patterns, such as considering customers' well-being (e.g., guidelines for 'be fair') or compensating for negative effects (e.g., guidelines for 'do right'). In contrast, our work contextualizes abstract ideas from existing literature. For example, Rosemann's (2020) explorative design pattern 'process expansion' creates value through additional activities and is similar to our 'social compensation', and 'process differentiation' is comparable to 'social alternative'. Lastly, adjacent work contains ideas that are not covered by the current version of our pattern set due to their focus on rather related aspects or specific viewpoints, such as allowing employee suggestions (Sohns et al. 2023) or authentication to check beforehand if tasks can be performed by certain persons (Stoiber and Schönig 2024). Table 8 provides an overview of this paper's pattern set and maps it with existing work on patterns, practices, and guidelines to highlight similarities and potential for combining different approaches in the future.

This paper	Examples of related BPM redesign approaches
#*SP1*. Social compensation	Reverse, compensate for a mistake (Rosemann et al. 2023) Green compensation for environmental processes (Nowak 2014)
#*SP2*. Social alternative	Acceptance, such as offering a variety of currencies (Rosemann et al. 2023) Green variant for environmental processes (Nowak 2014) Triage best practice: alternative tasks (Mansar and Reijers 2007)
#*SP3*. Social resource replacement	Resource change for environmental processes (Nowak 2014) Substitution of materials (Betz and Carporale 2014) Less energy-intensive resources (Lübbecke et al. 2016)
#*SP4*. Social labeling	Eco-labels for Green IT (Loeser 2013)
#*SP5*. Social sourcing	External advice (Sohns et al. 2023) Outsourcing, use trusted parties (Mansar and Reijers 2007)
#*SP6*. Social value chain	---
#*SP7*. Social resource reuse	Resource reduction (Lübbecke et al. 2016)
#*SP8*. Social accessibility	Employ disabled people (Dewan et al. 2012) Empathy to demonstrate care (Rosemann et al. 2023) Empower: give workers authority (Mansar and Reijers 2007)
#*SP9*. Social training	Education, skills training (Dewan et al. 2012) Prevention to avoid regret/harm by new activities (Rosemann et al. 2023) Tasks and skills (Haleem et al. 2023) Deviation detection (Stoiber and Schönig 2024)
#*SP10*. Social togetherness	Sponsoring social events, and awareness programs (Dewan et al. 2012) Attentiveness to feel seen (Rosemann et al. 2023)

Table 8. Comparison of this Pattern Set to Examples of BPM Redesign Approaches

7.2 Implications Related to Social Sustainability

Emerging streams in IS research shed particular light on social sustainability (e.g., Kranz et al. 2022; Lobschat et al. 2021; Tim et al. 2021) and thereby follow recent shifts in customer

demands and ensure compliance with new regulations. Our work gives imperatives on how to transform organizational processes into more socially sustainable entities. It complements IS and BPM research on social sustainability, such as social process redesign (e.g., Senderovich et al. 2020) and social responsibility (e.g., Haleem et al. 2024). By obtaining real-world problems from experts who have to deal with socially driven changes, we disclose both barriers and insights on how to manage social sustainability. This can support research and practice in making more informed decisions concerning future efforts, such as planning change projects and integrating socially sustainable goals into existing standards and certifications. Also, it covers empirical findings and, thus, responds to recent calls for more empirical studies in sustainable IS (Tan and Nielsen 2024). Once the patterns presented in this paper have been applied to specific problems, experiential knowledge can be accumulated which in turn may enhance our collective understanding of social sustainability.

The comparison of our results with the first conceptualizations of social sustainability in the IS discipline (Kotlarsky et al. 2023; Schoormann and Kutzner 2020) indicates that the pattern set addresses most of the identified themes. As an example, *diversity* and *inclusion* can be promoted through accessible working environments (social accessibility, #SP8) and *cohesion* through togetherness (social togetherness, #SP10). Also, social characteristics are fulfilled, such as *education* by training employees (social training, #SP9), *health* by eliminating conflict materials (social resource replacement, #SP3), as well as *welfare* by compensating for the negative effects on the broader society (social compensation, #SP2).

From a legal viewpoint, we see growing pressure to reflect on social factors as evidenced by new regulations like the Australian Sustainability Reporting Standards (AASB 2023) or the EU taxonomy (European Commission 2023). Our patterns pave the ground for improving social issues. Take, for instance, key criteria of the social factor from the ESG framework (CPA Australia 2024): *Employee health and safety* can be addressed by social compensation and alternatives (#SP1-#SP2) or social resources (#SP3); *training and development* by social training (#SP9); *diversity, equity, and inclusion* by social accessibility (#SP8); *community support* by social togetherness (#SP10); *human rights* and *labor* by social value chain (#SP6).

7.3 Implications Related to Designing Process Patterns

From a methodical view, the development of process patterns should make use of existing domain knowledge (Nowak 2014). Therefore, this paper presents an approach that extracts empirical data, such as from expert interviews and secondary data (here in the form of sustainability reports). This allows us to consider both grounding in existing knowledge and ensuring practical relevance. Moreover, Fellmann et al. (2018) argued that the prevailing type of publications in the context of patterns is the *proposal of solution* (i.e., presenting a solution for a given problem) and only 13% of their sample of publications fall into the category *evaluation research*. To address this deficit, we draw on established steps from DSR to perform both activities of developing and evaluating artifacts, which can serve as a blueprint.

7.4 Limitations and Future Directions

This paper is not free of limitations which – in turn – open avenues for future research. First, during the analysis, we extracted possible dependencies between the patterns, which are not the focus of this paper. For instance, healthy working conditions can be achieved through 'compensation' (e.g., offering additional activities that compensate for unhealthful activities) or 'training' (e.g., offering education so that employees can handle dangerous working

materials appropriately). More research is required to investigate whether certain patterns can be combined or not. Second, the patterns shed light on the 'bright side' (positive) of social sustainability and thereby aim to represent good examples. To provide a tool that is capable of identifying the 'dark side' in particular, so-called anti-patterns could be explored. These patterns pose solutions that are known to have weaknesses and help to avoid these in the first place (Koschmider et al. 2019). Third, we present rather generic patterns that can be applied to different units including the process model, approaches to be implemented by organizations to improve social sustainability, as well as the continuum from more operative to more strategic decisions. They create awareness of process designers for the existence of such opportunities and provide ideas to treat a particular problem class but still need "to be adapted in skilfull ways in response to prevailing conditions" (Reijers and Mansar 2005, p. 294). The feasibility assessment and actual deployment of one of the patterns is highly context-specific (Rosemann 2020) and beyond the scope of this paper. Fourth, our demonstration and evaluation are restricted to the participants (e.g., students from a BPM course in episode 2 lead to limited generalizability). Future efforts should be made in terms of proof of use in naturalistic settings, such as through case studies in organizations. Lastly, general methodical limitations apply: the literature review is restricted to its search phrases and sources; the coding of the data is based on our own decisions; the number of experts and their location (country-specific regulations); sustainability reports tend to be more positively and could be subject to 'social washing'.

8 Conclusion

Transforming businesses towards sustainability is among the urgent pressures. A successful transformation requires considering numerous viewpoints, such as customers who increasingly spend their money on fair products, employees who demand inclusive working conditions, and lawmakers who are passing new regulations. While BPM can help organizations become more sustainable, we can observe that the supporting toolset overemphasizes the economic paradigm. We present a set of ten business process patterns to advance our understanding of how to employ BPM for social aspects. They allow for reflecting on important social issues, including accessibility of working environments, training of employees, responsible usage of resources, and monitoring supply chains. The patterns provide orientation about the analysis and (re-)design of processes, as well as support generating and implementing novel ideas in existing organizations. Our work complements existing tools and methods from BPM, advances the current body of knowledge in this stream, and sparks future research on this important perspective to achieve a more holistic consideration of sustainability in business processes.

References

AASB (2023). Exposure Draft ED SR1 Australian Sustainability Reporting Standards. https://aasb.gov.au/news/exposure-draft-ed-sr1-australian-sustainability-reporting-standards-disclosure-of-climate-related-financial-information/

Ahmed, M. D., and Sundaram, D. (2012). Sustainability modeling and reporting: From roadmap to implementation. *Decision Support Systems*, *53*(3), 611–624. doi.org/10.1016/j.dss.2012.02.004

Ahlers, D., Krogstie, J., Driscoll, P., Lundli, H. E., Loveland, S. J., Rothballer, C., and Wyckmans, A. (2017). Supporting municipal greenhouse gas (GHG) emission inventories using business process modeling: a case study of Trondheim Municipality. *Business Process Management Workshops* (pp. 416–427). Springer.

Alexander, C. (1977). *A pattern language: Towns, buildings, construction*. Oxford University Press.

Anjaria, K. (2024). Enhancing sustainability integration in sustainable enterprise resource planning (S-ERP) system: Application of transaction cost theory and case study analysis. *International Journal of Information Management Data Insights*, *4*(2), 100243. doi.org/10.1016/j.jjimei.2024.100243

Betz, S., and Caporale, T. (2014). Sustainable software system engineering. *Proceedings of International Conference on Big Data and Cloud Computing*.

Bögel, S., Stieglitz, S., and Meske, C. (2014). A role model-based approach for modeling collaborative processes. *Business Process Management Journal*, *20*(4), 598–614. doi.org/10.1108/BPMJ-07-2013-0094

Brambilla, M., Fraternali, P., and Vaca, C. (2012). BPMN and design patterns for engineering social BPM solutions. In F. Daniel, K. Barkaoui, and S. Dustdar (Eds.), *Business Process Management Workshops* (pp. 219–230). Springer. doi.org/10.1007/978-3-642-28108-2_22

Breitenbach, F. J. (2020). Application of business process management for corporate sustainability [Doctoral dissertation, University of Plymouth]. doi.org/10.24382/1199

Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S., Chidzero, B., Fadika, L., Hauff, V., Lang, I., Shijun, M., Morino de Botero, M., Singh, M., Okita, S., and Others, A. (1987). *Our Common Future ('Brundtland report')*. Oxford University Press, USA.

Christmann, A. S., Crome, C., Graf-Drasch, V., Oberländer, A. M., and Schmidt, L. (2024). The twin transformation butterfly: Capabilities for an integrated digital and sustainability transformation. *Business & Information Systems Engineering*, doi.org/10.1007/s12599-023-00847-2

Cleven, A., Winter, R., and Wortmann, F. (2012). Managing process performance to enable corporate sustainability: A Capability maturity model. In J. vom Brocke, S. Seidel, and J. Recker (Eds.), *Green Business Process Management* (pp. 111–129). Springer. doi.org/10.1007/978-3-642-27488-6_7

Corbett, J., Dennehy, D., and Carter, L. (2023). Introduction to the special section: Digital innovation for social development and environmental action. *Communications of the Association for Information Systems*, *53*(1), 22-41. doi.org/10.17705/1CAIS.05302

Couckuyt, D., and Van Looy, A. (2019). A systematic review of Green Business Process Management. *Business Process Management Journal*, *26*(2), 421–446. doi.org/10.1108/BPMJ-03-2019-0106

Couckuyt, D., and Van Looy, A. (2021). An exploration of green business process maturity based on ecolabels. *Business Process Management Journal*, *27*(7), 1999-2020. doi.org/10.1108/BPMJ-05-2021-0293

Dewan, N. A., Chowdhury, M. H., and A Quaddus, M. (2012). The elements for sustainable e-business modelling: A 3D approach. *Proceedings of the Pacific Asia Conference on Information System*, Hochiminh City, Vietnam.

Dickhaut, E., Li, M. M., Janson, A., and Leimeister, J. M. (2022). The role of design patterns in the development and legal assessment of lawful technologies. *Electronic Markets*, *32*(4), 2311–2331. doi.org/10.1007/s12525-022-00597-1

Dumas, M., La Rosa, M., Mendling, J., and Reijers, H. A. (2018). *Fundamentals of Business Process Management*. Springer. doi.org/10.1007/978-3-662-56509-4

European Commission. (2023). *EU taxonomy for sustainable activities*. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

Falk, T., Griesberger, P., and Leist, S. (2013). Patterns as an artifact for business process improvement-insights from a case study. *Proceedings of Design Science Research in Information Systems and Technology*, Helsinki, Finland.

Fellmann, M., Koschmider, A., Laue, R., Schoknecht, A., and Vetter, A. (2017). A taxonomy and catalog of business process model patterns. *Proceedings of the 22nd European Conference on Pattern Languages of Programs*, Irsee, Germany. doi.org/10.1145/3147704.3147725

Fellmann, M., Koschmider, A., Laue, R., Schoknecht, A., and Vetter, A. (2018). Business process model patterns: State-of-the-art, research classification and taxonomy. *Business Process Management Journal*, *25*(5), 972–994. doi.org/10.1108/BPMJ-01-2018-0021

Frank, L., Poll, R., Röglinger, M., and Rupprecht, L. (2020). Design heuristics for customer-centric business processes. *Business Process Management Journal*, *26*(6), 1283–1305. doi.org/10.1108/BPMJ-06-2019-0257

Gamma, E. (1995). *Design patterns: Elements of reusable object-oriented software*. Addison-Wesley Longman Publishing.

Gohar, S. R., and Indulska, M. (2020). Environmental Sustainability through Green Business Process Management. *Australasian Journal of Information Systems*, *24*. doi.org/10.3127/ajis.v24i0.2057

Gohar, S. R., and Indulska, M. (2016). Business process management: saving the planet? Preprint arXiv:1606.02459.

Ghose, A., Hoesch-Klohe, K., Hinsche, L., and Le, L. S. (2010). Green business process management: A research agenda. *Australasian Journal of Information Systems*, *16*(2). doi.org/10.3127/ajis.v16i2.597

Goldkuhl, G., and Sjöström, J. (2018). Design science in the field: Practice design research. In S. Chatterjee, K. Dutta, and R. P. Sundarraj (Eds.), *Designing for a Digital and Globalized World* (pp. 67–81). Springer Publishing. doi.org/10.1007/978-3-319-91800-6_5

Goni, J. I. C., and Van Looy, A. (2022). Process innovation capability in less-structured business processes: A systematic literature review. *Business Process Management Journal*, *28*(3), 557–584. doi.org/10.1108/BPMJ-07-2021-0487

Graves, N., Koren, I., and Van Der Aalst, W. M. P. (2023). ReThink Your Processes! A review of process mining for sustainability. *Proceedings of International Conference on ICT for Sustainability*. doi.org/10.1109/ICT4S58814.2023.00025

Gregor, S., and Hevner, A. (2013). Positioning and presenting design science research for maximum impact. *MIS Quarterly*, *37*(2), 337–355. doi.org/10.25300/MISQ/2013/37.2.01

Groß, S., Grisold, T., Mendling, J., and Hasse, J. (2024). Idea generation in exploitative and explorative business process redesign techniques. *Information Systems and e-Business Management* (forthcoming). Doi.org/10.1007/s10257-024-00684-0

Haleem, F., Ilyas, M., and Jehangir, M. (2024). Driving organizational value through sustainable business processes and green information technology. *Business Process Management Journal*. doi.org/10.1108/BPMJ-01-2024-0011

Hu, P. J. H., Hu, H. F., Wei, C. P., and Hsu, P. F. (2016). Examining firms' green information technology practices: A hierarchical view of key drivers and their effects. *Journal of Management Information Systems*, *33*(4), 1149-1179. ddoi.org/10.1080/07421222.2016.1267532

Iivari, J., Hansen, M. R. P., and Haj-Bolouri, A. (2020). A proposal for minimum reusability evaluation of design principles. *European Journal of Information Systems*, 1–18. doi.org/10.1080/0960085X.2020.1793697

Ketter, W., Padmanabhan, B., Pant, G., and Raghu, T. S. (2020). Special issue editorial: addressing societal challenges through analytics: an ESG ICE framework and research agenda. *Journal of the Association for Information Systems*, *21*(5). Doi.org/10.17705/1jais.00631

Klessascheck, F., Fahrenkrog-Petersen, S. A., Mendling, J., and Pufahl, L. (2024). Unlocking sustainability compliance: Characterizing the EU Taxonomy for business process management. doi.org/10.48550/ARXIV.2408.11386

Koschmider, A., Laue, R., and Fellmann, M. (2019). Business process model anti-patterns: A bibliography and taxonomy of published work. *Proceedings of the European Conference in Information Systems*, Uppsala-Stockholm, Sweden.

Kotlarsky, J., Oshri, I., and Sekulic, N. (2023). Digital sustainability in information systems research: Conceptual foundations and future directions. *Journal of the Association for Information Systems*, *24*(4), 936-952. Doi.org/10.17705/1jais.00825

Kranz, J., Zeiss, R., Beck, R., Gholami, R., Sarker, S., Watson, R. T., and Whitley, E. A. (2022). Practicing what we preach? Reflections on more sustainable and responsible IS research and teaching practices. *Communications of the Association for Information Systems*, *51*(1), 557-580. doi.org/10.17705/1CAIS.05138

Lobschat, L., Mueller, B., Eggers, F., Brandimarte, L., Diefenbach, S., Kroschke, M., and Wirtz, J. (2021). Corporate digital responsibility. *Journal of Business Research*, *122*, 875–888. doi.org/10.1016/j.jbusres.2019.10.006

Loeser, F. (2013). Green IT and Green IS: Definition of constructs and overview of current practices. *Proceedings of the Americas Conference on Information Systems*, Chicago, Illinois, USA.

Lübbecke, P., Fettke, P., and Loos, P. (2017). Sustainability patterns for the improvement of IT-related business processes about ecological goals. In M. Dumas and M. Fantinato (Eds.), *Business Process Management Workshops* (Vol. 281, pp. 428–439). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_31

Magdaleno, A. M., Duboc, L., and Betz, S. (2017). How to Incorporate Sustainability into Business Process Management Lifecycle? In M. Dumas and M. Fantinato (Eds.), *Business Process Management Workshops* (Vol. 281, pp. 440–443). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_32

Mansar, S. L., and Reijers, H. A. (2007). Best practices in business process redesign: Use and impact. *Business Process Management Journal*, *13*(2), 193-213. doi.org/10.1108/14637150710740455

McKenzie, S. (2004). *Social sustainability: Towards some definitions* [Working Paper Series].

Medicke, J., and McDavid, D. (2004). Patterns for business process modeling. *Business Integration Journal*, *1*, 32–35.

Meuser, M., and Nagel, U. (1991). Expertlnneninterviews—Vielfach erprobt, wenig bedacht. In D. Garz and K. Kraimer (Eds.), *Qualitativ-empirische Sozialforschung: Konzepte, Methoden, Analysen* (pp. 441–471). VS Verlag für Sozialwissenschaften. doi.org/10.1007/978-3-322-97024-4_14

Missimer, M., Robèrt, K.-H., and Broman, G. (2017). A strategic approach to social sustainability – Part 2: A principle-based definition. *Journal of Cleaner Production*, *140*, 42–52. doi.org/10.1016/j.jclepro.2016.04.059

Nastjuk, I., Hanelt, A., and Kolbe, L. (2016). Too much of a good thing? An experimental investigation of the impact of digital technology-enabled business models on individual stress and future adoption of sustainable services. *Proceedings of the International Conference on Information Systems*, Dublin, Ireland.

Nowak, A. (2014). *Green Business Process Management: Methode und Realisierung* [Doctoral Thesis, University of Stuttgart]. http://elib.uni-stuttgart.de/handle/11682/3423

Nowak, A., Binz, T., Fehling, C., Kopp, O., Leymann, F., and Wagner, S. (2012). Pattern-driven green adaptation of process-based applications and their runtime infrastructure. *Computing*, *94*(6), 463–487. doi.org/10.1007/s00607-012-0188-x

Nowak, A., Breitenbücher, U., and Leymann, F. (2014). Automating green patterns to compensate CO2 emissions of cloud-based business processes. *Proceedings of the 8th International Conference on Advance Engineering Computing and Applications in Sciences (ADVCOMP)*, Rome, Italy, 132–139.

Nowak, A., and Leymann, F. (2013). *An overview on implicit Green Business Process Patterns* (CR: H.4.1; p. 35). Universität Stuttgart, Institute of Architecture of Application Systems (IAAS).

Nowak, A., Leymann, F., Schleicher, D., Schumm, D., and Wagner, S. (2011). Green Business Process Patterns. *Proceedings of the 18th Conference on Pattern Languages of Programs*, 6:1-6:10. doi.org/10.1145/2578903.2579144

Nowak, A., Leymann, F., Schumm, D., and Wetzstein, B. (2011). An architecture and methodology for a four-phased approach to Green Business Process Reengineering. In D. Kranzlmüller and A. M. Toja (Eds.), *Information and Communication on Technology for the Fight against Global Warming* (Vol. 6868, pp. 150–164). Springer. doi.org/10.1007/978-3-642-23447-7_14

Opitz, N., Krüp, H., and Kolbe, L. M. (2014). Green Business Process Management – A Definition and Research Framework. *Proceedings of the 47th Hawaii International Conference on System Science*, Hawaii, USA, 3808–3817. doi.org/10.1109/HICSS.2014.473

Pan, S. L., Carter, L., Tim, Y., and Sandeep, M. S. (2022). Digital sustainability, climate change, and information systems solutions: Opportunities for future research. *International Journal of Information Management*, *63*, 102444. doi.org/10.1016/j.ijinfomgt.2021.102444

Peffers, K., Tuunanen, T., Rothenberger, M. A., and Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, *24*(3), 45–77. doi.org/10.2753/MIS0742-1222240302

Petter, S., Khazanchi, D., and Murphy, J. D. (2010). A design science based evaluation framework for patterns. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, *41*(3), 9–26. doi.org/10.1145/1851175.1851177

Pucker, K. P. (2021). Overselling sustainability reporting. *Harvard Business Review*. https://hbr.org/2021/05/overselling-sustainability-reporting

Recker, J., and Mendling, J. (2016). The state of the art of business process management research as published in the BPM conference. *Business & Information Systems Engineering*, *58*(1), 55–72. doi.org/10.1007/s12599-015-0411-3

Recker, J., Rosemann, M., Hjalmarsson, A., and Lind, M. (2012). Modeling and analyzing the carbon footprint of business ürocesses. In J. vom Brocke, S. Seidel, and J. Recker (Eds.), *Green Business Process Management* (pp. 93–109). Springer. doi.org/10.1007/978-3-642-27488-6_6

Reijers, H. A., and Mansar, S. L. (2005). Best practices in business process redesign: an overview and qualitative evaluation of successful redesign heuristics. *Omega*, *33*(4), 283–306. doi.org/10.1016/j.omega.2004.04.012

Rosemann, M. (2020). Explorative process design patterns. *Proceedings of the International Conference*, Seville, Spain. doi.org/10.1007/978-3-030-58666-9_20

Rosemann, M., and Vessey, I. (2008). Toward improving the relevance of Information Systems Research to practice: The Role of Applicability Checks. *MIS Quarterly*, *32*(1), 1–22. doi.org/10.2307/25148826

Rosemann, M., Ostern, N., Voss, M., and Bandara, W. (2023). Benevolent business processes-design guidelines beyond transactional value. *Proceedings of the International Conference on Business Process Management,* Utrecht, Netherlands, pp. 447-464. doi.org/10.1007/978-3-031-41620-0_26

Rozman, T., Draghici, A., and Riel, A. (2015). Achieving sustainable development by integrating it into the business process management system. In R. V. O'Connor, M. Umay Akkaya, K. Kemaneci, M. Yilmaz, A. Poth, and R. Messnarz (Eds.), *Systems,*

Software and Services Process Improvement (pp. 247–259). Springer International Publishing. doi.org/10.1007/978-3-319-24647-5_20

Russell, N., van der Aalst, W. M. P., and ter Hofstede, A. H. M. (2016). *Workflow patterns: The definitive guide*. MIT Press.

Sarker, S., Chatterjee, S., Xiao, X., and Elbanna, A. (2019). The sociotechnical axis of cohesion for the IS discipline: Its historical legacy and its continued relevance. *MIS Quarterly*, *43*(3), 695–720. doi.org/10.25300/MISQ/2019/13747

Schoknecht, A., Vetter, A., Koschmider, A., Fellmann, M., and Laue, R. (2020). *Process Model Pattern Classification*. Business Process Model Patterns Classification. http://bpmpatterns.org/

Schoormann, T., Behrens, D., and Knackstedt, R. (2017). Sustainability in business process models: A taxonomy-driven approach to synthesize knowledge and structure the field. *Proceedings of the International Conference on Information Systems*, Seoul, South Korea.

Schoormann, T., and Kutzner, K. (2020). Towards understanding social sustainability: An information systems research-perspective. *Proceedings of the International Conference on Information Systems*, virtual.

Schoormann, T. and Kutzner, K. (2021). Socially business process patterns – A sustainability report-driven demonstration and refinement. *Proceedings of the INFORMATIK*. doi.org/10.18420/inf2020_53

Schoormann, T., Kutzner, K., Pape, S., and Knackstedt, R. (2019). Elevating social sustainability in business processes: A pattern-based approach. *Proceedings of the International Conference on Information Systems*, Munich, Germany.

Schreiber, C. (2020). Automated sustainability compliance checking using process mining and formal logic. *Proceedings of the 7th International Conference on ICT for Sustainability*. doi.org/10.1145/3401335.3401355

Schryen, G. (2013). Revisiting IS business value research: What we already know, what we still need to know, and how we can get there. *European Journal of Information Systems*, *22*(2), 139–169. doi.org/10.1057/ejis.2012.45

Schweizer, A., Schlatt, V., Urbach, N., and Fridgen, G. (2017). Unchaining social businesses-blockchain as the basic technology of a crowdlending platform. *Proceedings of the International Conference on Information Systems*, Seoul, South Korea.

Seid, E., Popov, O., and Blix, F. (2024). Evaluation of asfalia, a security attack event monitoring framework. *Procedia Computer Science*, 237, 793–802. doi.org/10.1016/j.procs.2024.05.167

Senderovich, A., Schippers, J. J., and Reijers, H. A. (2020). Socially-aware business process redesign. In D. Fahland, C. Ghidini, J. Becker, and M. Dumas (Eds.), *Business Process Management* (Vol. 12168, pp. 75–92). Springer International Publishing. doi.org/10.1007/978-3-030-58666-9_5

Seidel, S., Bharati, P., Fridgen, G., Watson, R., Albizri, A., Boudreau, M.-C., Butler, T., Kruse, L., Guzman, I., Karsten, H., Lee, H., Melville, N., Rush, D., Toland, J., and Watts, S. (2017). The Sustainability Imperative in Information Systems Research. *Communications of the Association for Information Systems*, *40*(1). doi.org/10.17705/1CAIS.04003

Seidel, S., Brocke, J. vom, and Recker, J. (2011). Call for Action: Investigating the Role of Business Process Management in Green IS. *All Sprouts Content*, *11*(4).

Seidel, S. and Recker, J. (2012), Implementing Green Business Processes: The Importance of Functional Affordances of Information Systems. *Proceedings of the Australasian Conference on Information Systems*, Geelong, Australia.

Smith, C. U., and Williams, L. G. (2000). Software performance antipatterns. *Proceedings of the 2nd International Workshop on Software and Performance*, 127–136. doi.org/10.1145/350391.350420

Sohns, T. M., Aysolmaz, B., Figge, L., and Joshi, A. (2023). Green business process management for business sustainability: A case study of manufacturing small and medium-sized enterprises (SMEs) from Germany. *Journal of Cleaner Production*, 401, 136667. doi.org/10.1016/j.jclepro.2023.136667

Stadtländer, M., Schoormann, T., and Knackstedt, R. (2019). How software promotes the integration of sustainability in business process management. *Proceedings of the 14th Wirtschaftsinformatik*, Siegen, Germany, 1942–1953.

Stoiber, C., and Schönig, S. (2024). Leveraging the industrial internet of things for business process improvement: A metamodel and patterns. *Information Systems and E-Business Management*. doi.org/10.1007/s10257-024-00676-0

statista (2019). *Umsätze der wichtigsten Industriebranchen in Deutschland bis 2018*. Statista. https://de.statista.com/statistik/daten/studie/241480/umfrage/umsaetze-der-wichtigsten-industriebranchen-in-deutschland/

Tan, B., and Nielsen, P. (2024). Information systems and sustainable development: From conceptual underpinnings to empirical insights. *Information Systems Journal*. doi.org/10.1111/isj.12543

Tim, Y., Cui, L., and Sheng, Z. (2021). Digital resilience: How rural communities leapfrogged into sustainable development. *Information Systems Journal*, *31*(2), 323-345. doi.org/10.1111/isj.12312

Troshani, I., Doolin, B., Fradley, K., and Rampersad, G. (2022). Information systems, sociomaterial practices and the emergence of environmental management infrastructures. *Australasian Journal of Information Systems*, *26*. doi.org/10.3127/ajis.v26i0.3829

UN (2015). *A/RES/70/1—Transforming our world: The 2030 Agenda for Sustainable Development*. https://sustainabledevelopment.un.org/index.php?page=view&type=111&nr=8496&menu=35

UN (2021). *United Nations Global Compact,. Social sustainability.* https://www.unglobalcompact.org/ what-is-gc/our-work/social

Vallance, S., Perkins, H. C., and Dixon, J. E. (2011). What is social sustainability? A clarification of concepts. *Geoforum*, *42*(3), 342-348. doi.org/10.1016/j.geoforum.2011.01.002

Van der Byl, C. A., and Slawinski, N. (2015). Embracing tensions in corporate sustainability: A review of research from win-wins and trade-offs to paradoxes and beyond. *Organization & Environment*, *28*(1), 54-79. doi.org/10.1177/1086026615575047

Veit, D. J., & Thatcher, J. B. (2023). Digitalization as a problem or solution? Charting the path for research on sustainable information systems. *Journal of Business Economics*, *93*(6), 1231-1253. doi.org/10.1007/s11573-023-01143-x

Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D., Tegmark, M., and Fuso Nerini, F. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications*, *11*(1), Article 1. doi.org/10.1038/s41467-019-14108-y

vom Brocke, J., Loos, P., Seidel, S., and Watson, R. T. (2013). Green IS: Information Systems for Environmental Sustainability. *Business & Information Systems Engineering*, *5*(5), 295–297. doi.org/10.1007/s12599-013-0288-y

vom Brocke, J., Watson, R. T., Dwyer, C., Elliot, S., and Melville, N. (2013). Green information systems: Directives for the IS discipline. *Communications of the Association for Information Systems*, *33*(1), 30. doi.org/10.17705/1CAIS.03330

vom Brocke, J., Seidel, S., and Recker, J. (Eds.). (2012). *Green Business Process Management*. Springer Berlin Heidelberg. doi.org/10.1007/978-3-642-27488-6

vom Brocke, J., and Sinnl, T. (2011). Culture in business process management: A literature review. *Business Process Management Journal*, *17*(2), 357–378. doi.org/10.1108/14637151111122383

Watson, R. T., Boudreau, M.-C., and Chen, A. J. (2010). Information systems and environmentally sustainable development: Energy informatics and new directions for the IS community. *MIS Quarterly*, *34*(1), 23–38.

Wang, B., Ciriello, R. F., and Mathiassen, L. (2023). What is paradox in Information Systems research? Towards a narratology. *Proceedings of the Australasian Conference on Information Systems*, Wellington, Australia.

Wass, S., Thygesen, E., and Purao, S. (2023). Principles to facilitate social inclusion for design-oriented research. *Journal of the Association for Information Systems*, *24*(5), 1204-1247. doi.org/10.17705/1jais.00814

Webster, J., and Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2), xiii–xxiii. https://www.jstor.org/stable/4132319

Wesumperuma, A., Ginige, J. A., Ginige, A., and Hol, A. (2011). A framework for multi-dimensional business process optimization for GHG emission mitigation. *Proceedings of Australasian Conference on Information Systems*, Sydney, Australia.

Wimelius, H., Mathiassen, L., Holmström, J., and Keil, M. (2021). A paradoxical perspective on technology renewal in digital transformation. *Information Systems Journal*, *31*(1), 198-225. doi.org/10.1111/isj.12307

Winter, R., Vom Brocke, J., Fettke, P., Loos, P., Junginger, S., Moser, C., Keller, W., Matthes, F., and Ernst, A. (2009). Patterns in business and information systems engineering. *Business & Information Systems Engineering*, *1*(6), 468. doi.org/10.1007/s12599-009-0073-0

Wulfert, T., Woroch, R., Strobel, G., Schoormann, T., and Banh, L. (2023). Unboxing the role of e-commerce ecosystems to address grand challenges. *Proceedings of the European Conference on Information Systems*, Kristiansand, Norway.

Zellner, G. (2011). A structured evaluation of business process improvement approaches. *Business Process Management Journal*, *17*(2), 203–237. doi.org/10.1108/14637151111122329

Appendix A:

ID	Reference
01	Schoormann, T., Behrens, D., & Knackstedt, R. (2017). Sustainability in Business Process Models: A Taxonomy-Driven Approach to Synthesize Knowledge and Structure the Field. In Proceedings of the International Conference on Information Systems.
02	Schoormann, T., Kutzner, K., Pape, S., & Knackstedt, R. (2019). Elevating social sustainability in business processes: A pattern-based approach. Proceedings of the International Conference on Information Systems, Munich, Germany.
03	Stadtländer, M., Schoormann, T., & Knackstedt, R. (2019). How software promotes the integration of sustainability in business process management. In Proceedings of the Wirtschaftsinformatik.
04	Wesumperuma, A., Ginige, J. A., Ginige, A., & Hol, A. (2011). A framework for multi-dimensional business process optimization for GHG emission mitigation. In Proceedings of the Australasian Conference on Information Systems.
05	Couckuyt, D., & Van Looy, A. (2019). A systematic review of green business process management. Business Process Management Journal, 26(2), 421-446. doi.org/10.1108/BPMJ-03-2019-0106
06	Vom Brocke, J., & Sinnl, T. (2011). Culture in business process management: a literature review. Business Process Management Journal, 17(2), 357-378. doi.org/10.1108/14637151111122383
07	Bögel, S., Stieglitz, S., & Meske, C. (2014). A role model-based approach for modelling collaborative processes. Business Process Management Journal, 20(4), 598-614. doi.org/10.1108/BPMJ-07-2013-0094
08	Brambilla, M., Fraternali, P., & Vaca, C. (2011). A notation for supporting social business process modeling. In Business Process Model and Notation, Workshop BPMN, Lucerne, Switzerland (pp. 88-102). Springer Berlin Heidelberg. doi.org/10.1007/978-3-642-25160-3_7
09	Brambilla, M., Fraternali, P., & Vaca, C. (2012). BPMN and design patterns for engineering social BPM solutions. In Business Process Management Workshops: BPM 2011 International Workshops, Clermont-Ferrand, France (pp. 219-230). Springer Berlin Heidelberg. doi.org/10.1007/978-3-642-28108-2_22
10	Lübbecke, P., Fettke, P., & Loos, P. (2016). Towards ecological workflow patterns as an instrument to optimize business processes with respect to ecological goals. In Hawaii International Conference on System Sciences (pp. 1049-1058). IEEE.
11	Lübbecke, P., Fettke, P., & Loos, P. (2017). Sustainability patterns for the improvement of IT-related business processes with regard to ecological goals. In Business Process Management Workshops: BPM 2016 International Workshops, Rio de Janeiro, Brazil (pp. 428-439). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_31
12	Nowak, A. (2014). Green Business Process Management: Methode und Realisierung. doi.org/10.18419/opus-3406
13	Nowak, A., & Leymann, F. (2013). An Overview on Implicit Green Business Process Patterns. Universität Stuttgart, Institut für Architektur von Anwendungssystemen.
14	Nowak, A., & Leymann, F. (2013). Green Business Process Patterns--Part II. In International Conference on Service-Oriented Computing and Applications (pp. 168-173). IEEE. doi.org/10.1145/2578903.2579144
15	Nowak, A., Leymann, F., & Schumm, D. (2011). The differences and commonalities between green and conventional business process management. In International Conference on Dependable, Autonomic and Secure Computing (pp. 569-576). IEEE. doi.org/10.1109/DASC.2011.105
16	Nowak, A., Breitenbücher, U., & Leymann, F. (2014). Automating green patterns to compensate Co2 emissions of cloud-based business processes. In Proceedings of ADVCOMP (pp. 132-139).

17	Nowak, A., Leymann, F., Schleicher, D., Schumm, D., & Wagner, S. (2011). Green business process patterns. In Proceedings of Conference on pattern languages of programs (pp. 1-10). doi.org/10.1145/2578903.2579144
18	Nowak, A., Binz, T., Fehling, C., Kopp, O., Leymann, F., & Wagner, S. (2012). Pattern-driven green adaptation of process-based applications and their runtime infrastructure. Computing, 94, 463-487. doi.org/10.1007/s00607-012-0188-x
19	Schoormann, Thorsten; Kutzner, Kristin (2021).: Socially business process patterns – A sustainability report-driven demonstration and refinement. Proceedings of the INFORMATIK. doi.org/10.18420/inf2020_53
20	Schreiber, C. (2020). Automated sustainability compliance checking using process mining and formal logic. In Proceedings of the 7th international conference on ICT for sustainability (pp. 181-184). doi.org/10.1145/3401335.3401355
21	Larsch, S., Betz, S., Duboc, L., Magdaleno, A. M., & Bomfim, C. (2017). Integrating sustainability aspects in business process management. In Business Process Management Workshops, Rio de Janeiro, Brazil, September 19, 2016, Revised Papers 14 (pp. 403-415). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_29
22	vom Brocke, J., Watson, R. T., Dwyer, C., Elliot, S., & Melville, N. (2013). Green Information Systems: Directives for the IS Discipline. Communications of the Association for Information Systems, 33. doi.org/10.17705/1CAIS.03330
23	Watson, R. T., Boudreau, M. C., & Chen, A. J. (2010). Information systems and environmentally sustainable development: energy informatics and new directions for the IS community. MIS Quarterly. doi.org/10.2307/20721413
24	Schoormann, T., & Kutzner, K. (2020). Towards Understanding Social Sustainability: An Information Systems Research-Perspective. In Proceedings of the ICIS.
25	Dewan, N. A., Chowdhury, M. H., & A Quaddus, M. (2012). The elements for sustainable e-business modelling: A 3D approach. In Proceedings of the PACIS.
26	Schweizer, A., Schlatt, V., Urbach, N., & Fridgen, G. (2017). Unchaining Social Businesses-Blockchain as the Basic Technology of a Crowdlending Platform. In Proceedings of the ICIS.
27	Hu, P. J. H., Hu, H. F., Wei, C. P., & Hsu, P. F. (2016). Examining firms' green information technology practices: A hierarchical view of key drivers and their effects. Journal of Management Information Systems, 33(4), 1149-1179. doi.org/10.1080/07421222.2016.1267532
28	Goni, J. I. C., & Van Looy, A. (2022). Process innovation capability in less-structured business processes: a systematic literature review. Business Process Management Journal, 28(3), 557-584. doi.org/10.1108/BPMJ-07-2021-0487
29	Mansar, S. L., & Reijers, H. A. (2007). Best practices in business process redesign: use and impact. Business Process Management Journal, 13(2), 193. doi.org/10.1108/14637150710740455
30	Haleem, F., Ilyas, M., & Jehangir, M. (2024). Driving organizational value through sustainable business processes and green information technology. Business Process Management Journal. doi.org/10.1108/BPMJ-01-2024-0011
31	Senderovich, A., Schippers, J. J., & Reijers, H. A. (2020). Socially-aware business process redesign. In Business Process Management: 18th International Conference, BPM 2020, Seville, Spain. doi.org/10.1007/978-3-030-58666-9_5
32	Rosemann, M., Ostern, N., Voss, M., & Bandara, W. (2023). Benevolent Business Processes-Design Guidelines Beyond Transactional Value. In International Conference on Business Process Management (pp. 447-464). Cham: Springer Nature Switzerland. doi.org/10.1007/978-3-031-41620-0_26
33	Zellner, G. (2011). A structured evaluation of business process improvement approaches. Business Process Management Journal, 17(2), 203-237. doi.org/10.1108/14637151111122329

34	Stoiber, C., & Schönig, S. (2024). Leveraging the industrial internet of things for business process improvement: a metamodel and patterns. Information Systems and e-Business Management, 1-29. doi.org/10.1007/s10257-024-00676-0
35	Sohns, T. M., Aysolmaz, B., Figge, L., & Joshi, A. (2023). Green business process management for business sustainability: A case study of manufacturing small and medium-sized enterprises (SMEs) from Germany. Journal of Cleaner Production, 401, 136667. doi.org/10.1016/j.jclepro.2023.136667
36	Baggia, A., Leskovar, R., Delibašić, B., & Petrović, N. (2013). Opportunities of sustainable business practices in SME's. In Proceedings of the 32nd International Conference on Organizational Science Development, Portoroz, Slovenia (pp. 20-22).
37	Rozman, T., Draghici, A., & Riel, A. (2015). Achieving sustainable development by integrating it into the business process management system. In EuroSPI 2015, Ankara, Turkey. doi.org/10.1007/978-3-319-24647-5_20
38	Ahlers, D., Krogstie, J., Driscoll, P., Lundli, H. E., Loveland, S. J., Rothballer, C., & Wyckmans, A. (2017). Supporting Municipal Greenhouse Gas (GHG) emission inventories using business process modeling: a case study of Trondheim Municipality. In Business Process Management Workshops: BPM 2016 International Workshops, Rio de Janeiro, Brazil, September 19, 2016, Revised Papers 14 (pp. 416-427). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_30
39	Anjaria, K. (2024). Enhancing sustainability integration in Sustainable Enterprise Resource Planning (S-ERP) system: Application of Transaction Cost Theory and case study analysis. International Journal of Information Management Data Insights, 4(2), 100243. doi.org/10.1016/j.jjimei.2024.100243
40	Magdaleno, A. M., Duboc, L., & Betz, S. (2017). How to incorporate sustainability into business process management lifecycle?. In Business Process Management Workshops: BPM 2016 International Workshops, Rio de Janeiro, Brazil, September 19, 2016, Revised Papers 14 (pp. 440-443). Springer International Publishing. doi.org/10.1007/978-3-319-58457-7_32
41	Seid, E., Popov, O., & Blix, F. (2024). Evaluation of Asfalia, a Security Attack Event Monitoring Framework. Procedia Computer Science, 237, 793-802. doi.org/10.1016/j.procs.2024.05.167
42	Graves, N., Koren, I., & van der Aalst, W. M. (2023, June). ReThink Your Processes! A Review of Process Mining for Sustainability. In 2023 International Conference on ICT for Sustainability (ICT4S) (pp. 164-175). IEEE. doi.org/10.1109/ICT4S58814.2023.00025
43	Fortunati, S., Morea, D., & Mosconi, E. M. (2020). Circular economy and corporate social responsibility in the agricultural system: Cases study of the Italian agri-food industry. Zemedelska Ekonomika, 66(11), 489-498. doi.org/10.17221/343/2020-AGRICECON
44	Hasan, M. M., Nekmahmud, M., Yajuan, L., & Patwary, M. A. (2019). Green business value chain: A systematic review. Sustainable Production and Consumption, 20, 326-339. doi.org/10.1016/j.spc.2019.08.003
45	Parmiggiani, E., & Monteiro, E. (2018). Shifting baselines? Recommendations for green IS. In Proceedings of ICIS.
46	Betz, S., & Caporale, T. (2014). Sustainable software system engineering. In 2014 IEEE Fourth International Conference on Big Data and Cloud Computing (pp. 612-619). IEEE. doi.org10.1109/BDCloud.2014.113
47	Loeser, F. (2013). Green IT and Green IS: Definition of constructs and overview of current practices. Proceedings of AMCIS.
48	Seidel, S., & Recker, J. (2012). Implementing green business processes: the importance of functional affordances of information systems. In Proceedings of ACIS.

Table A1: Literature Sample (07/2023, updated 08/2024)

Appendix B:

Industry	Publisher of Report	Year of Report
Automotive	BMW Group, https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/responsibility/downloads/de/2019/2019-BMW-Group-SVR-2018-Deutsch.pdf, Access: 2020/05/11.	2018
	Volkswagen AG, https://www.volkswagenag.com/presence/nachhaltigkeit/documents/sustainability-report/2018/Nichtfinanzieller_Bericht_2018_d.pdf, Access: 2020/05/11.	2018
	Continental AG, https://www.continental.com/resource/blob/177190/37853d57eddfa3f46e64425352ebb552/nachhaltigkeitsbericht-2018-data.pdf, Access: 2020/05/11.	2018
Manufacturing	Siemens AG, https://www.siemens.com/investor/pool/de/investor_relations/siemens_nachhaltigkeitsinformationen2018.pdf, Access: 2020/05/11.	2018
	Robert Bosch GmbH, https://assets.bosch.com/media/global/sustainability/reporting_and_data/2018/bosch-nachhaltigkeitsbericht-2018-factbook.pdf, Access: 2020/05/11.	2018
Chemicals	BASF Group, https://bericht.basf.com/2018/de/serviceseiten/downloads/files/BASF_Bericht_2018.pdf, Access: 2020/05/11.	2018
	Bayer AG, https://www.investor.bayer.de/securedl/16789, Access: 2020/05/11.	2018
Electronic	IBM Corporation, https://www.ibm.org/static/responsibility/cr/pdfs/IBM-2018-CRR.pdf, Access: 2020/05/11.	2018
	Cisco Systems Inc., https://www.cisco.com/c/dam/assets/csr/pdf/CSR-Report-2018.pdf, Access: 2020/05/11.	2018
	Canon Inc., https://global.canon/en/csr/report/pdf/canon-sus-2018-e.pdf, Access: 2020/05/11.	2018
Nutrition	Lidl Dienstl. GmbH & Co. KG, https://www.lidl-nachhaltigkeit.de/fileadmin/downloads/Lidl_Nachhaltigkeitsbericht_2016-2017.pdf, Access: 2020/05/11.	2016/2017
	Metro AG, https://reports.metroag.de/corporate-responsibility-report/2017-2018/servicepages/downloads/files/entire_metro_crr1718.pdf, Access: 2020/05/11.	2017/2018
Building	Hochtief AG, https://www.hochtief.de/hochtief/mmdbdownload?id=173421&format=4, Access: 2020/05/11.	2018
	Strabag SE, https://www.strabag.com/databases/internet/_public/files.nsf/SearchView/6C0A043CAC95207FC12583ED0031FAD9/$File/STRABAG_SE_D_GB_2018_web.pdf?OpenElement, Access: 2020/05/11.	2018
Finance	Deutsche Bank AG, https://www.db.com/ir/de/download/Deutsche_Bank_Nichtfinanzieller_Bericht_2018.pdf, Access: 2020/05/11.	2018
	Allianz Group, https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/investor-relations/en/results/2018_q4/en-190411-Sustainability-Report-2018.pdf, Access: 2020/05/	2018
Commerce	Otto (GmbH & Co KG), https://www.ottogroup.com/media/docs/de/geschaeftsbericht/Otto_Group_Geschaeftsbericht_2018_19_DE.pdf, Access: 2020/05/11.	2018/2019
	Bertelsmann SE &-Co. KGaA, https://www.bertelsmann.de/media/verantwortung/downloads/deutsch/bertelsmann-corporate-responsibility-bericht-2017-de.pdf, Access: 2020/05/11.	2017

Industry	Publisher of Report	Year of Report
Energy	Uniper SE, https://ir.uniper.energy/download/companies/uniperag/Sustainability/Uniper_Nachhaltigkeitsbericht_2018.pdf, Access: 2020/05/11.	2018
	E.ON SE, https://www.eon.com/content/dam/eon/eon-com/Documents/en/sustainability-report/EON_Sustainability_Report_2018.pdf, Access: 2020/05/11.	2018
Tourism	TUI Group, https://www.tuigroup.com/damfiles/default/tuigroup-15/de/nachhaltigkeit/berichterstattung-downloads/2019/nachhaltigkeitsbericht-de-en/TUI_CSR18_DE.pdf-91be99e0bc67220ef211280d05702d2a.pdf, Access: 2020/05/11.	2018
	Lufthansa Group, https://www.lufthansagroup.com/media/downloads/en/responsibility/LH-sustainability-report-2018.pdf, Access: 2020/05/11.	2018
Telecommunication	Deutsche Telekom AG, https://bericht.telekom.com/geschaeftsbericht-2018/serviceseiten/downloads/files/entire_dtag_gb18.pdf, Access: 2020/05/11.	2018
	Vodafone Group Plc., https://www.vodafone.com/content/dam/vodcom/sustainability/pdfs/sustainablebusiness2018.pdf, Access: 2020/05/11.	2018

Figure A2: Demonstration Cases

Appendix C: Design Iterations

First Design Iteration (Grounding)

Based on the obtained process patterns from the literature as well as on the problems and best practices from the experts, we inductively derived our preliminary set of process patterns for improving social sustainability (Schoormann et al. 2019).

Pattern title and description	Problem	Solution	Development
Social compensation	**P1**	**S1, S2**	**Implicit**
Improving social performance by compensating negative effects without changing the structure of a process. For example: Compensating internal effects through hiring health consultants or providing free access to gyms; Compensating external effects through establishing foundations, making donations, or offering employees participation in social projects.			
Social alternative	**P1**	**S3**	**Implicit**
Improving social performance by offering an additional alternative process path to the customers without changing the (core) business processes. For example: Integrating a fair-traded product in addition to a basic product and allow customers to select between two variants			
Social resource replacement	**P1, P2, P3**	**S4**	**Implicit**
Improving social performance by replacing resources that have negative influence on employees (internal) and society (external) without changing the structure of a process. For example: Ensuring ergonomic working spaces by replacing typical office furniture with height-adjustable desks.			
Social labeling	**P4**	**S5**	**Implicit**
Improving the social image of an organization by labeling processes, products, and services with corresponding social certificates. For example: Certificating offers with the fairtrade label to disclose characteristics of the production and communicate certain aspects.			
Social sourcing	**P5**	**S6**	**Implicit**

Improving social performance by (a) transferring activities to external organizations that are able to carry out an activity in a socially acceptable manner or by (b) transferring external activities into the own company. For example: Outsourcing processes to a fairtrade label-certified service provide.			
Social value chain	**P6**	**S7, S8**	**Implicit**
Improving social performance by defining social standards that have to be applied by every partner within a value chain. For example: Specifying checklists with socially acceptable criteria that have to be passed by each partner within a value chain—verification of this through audits.			
Social-/human-centered individualization	**P7**	**S9**	**Explicit**
Improving social performance by adjusting processes in terms of human-specific needs in order to allow various people to execute a certain process. For example: Enabling the integration of people with handicaps through individualized working conditions to leverage his/her talents.			

Figure A3: Design Iterations

Second design iteration (Validation Through Demonstration, Evaluation 1)

After applying the initial pattern set to real-world cases, we identified the potential for new patterns (*) as well as for improving and extending existing patterns (**).

(1) Social compensation **
Internal social compensation: Improving internal social performance by compensating negative effects without changing the structure of a process. For example: health—preventive health care [TUI18, p. 70]; nutrition—information for nutrition [DT18, p. 82]; employment protection [Si18, p. 20]. **External social compensation:** Improving external social performance by compensating negative effects without changing the structure of a process. For example: financial donations [BAS18, p. 40]; social projects—scholarships for women [IBM18, p. 36].
(2) Social alternative
Internal social alternative*: Improving social performance by offering an additional alternative process path to the employees/partners without changing the (core) business processes. For example: flexible work—flexible working hours [Lu18, p. 68]; remote work—homeworking policies [Vo18, p. 17]. **External social alternative:** Improving social performance by offering an additional alternative process path to the customers without changing the (core) business processes.
(3) Social resource handling **
Social resource replacement: Improving social performance by replacing resources (i.e., working aids and materials) that have a negative influence on internal and external actors without changing the structure of a process. For example: hiring ergonomic-teams that ensure healthy working places [Co18, p. 33]; materials—avoiding so-called 'conflict materials' [Si18, p. 39]. **Social resource reuse*:** Improving social performance by reusing resources (i.e., circular-principle) that have a special value for society. For example: Effective management of water is important if projects are performed in regions that have water scarcity [Ho18, p. 138].
(4) Social labeling
Improving the social image of an organization by labeling processes, products, and services with corresponding social certificates. For example: Fairtrade [Li16, p. 88]; Global Sustainable Tourism Council [TUI18, p. 11]; Blauer Engel [DT18, p. 83]; CmiA-certified cotton [Ot18, p. 83].
(5) Social sourcing
Improving social performance by (a) transferring activities to external organizations that can carry out an activity in a socially acceptable manner or by (b) transferring external activities into the own company.

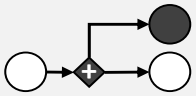
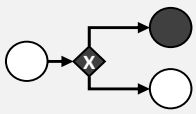
(6) Social value chain
Improving social performance by defining social standards that have to be applied by every partner within a value chain. For example: New supplier needs to develop a social/ecological management system [IBM18, p. 18].
(7) Social-/human-centered accessibility**
Internal social accessibility: Improving social performance by adjusting processes in terms of human-specific needs to allow employees/partners regardless of their background (e.g., gender, religion, physical health) to participate in a certain process. For example: Accessible working environments including lifts or subtitles that can be read aloud when using a computer [Si18, p. 18]. **External social accessibility*:** Improving social performance by adjusting processes in terms of human-specific needs to allow customers/society regardless of their background (e.g., gender, religion, physical health) to participate in a certain process. For example: Accessible stores [Li16, p. 113].
(8) Social training*
Improving social performance by educating internal and external actors to enable them to participate in processes appropriately. For example: Competence management ensures that employees have the required knowledge to execute/participate in their tasks [RB18, p. 60].
(9) Social togetherness*
Improving social performance by creating a strong team-cohesion within an organization or company/department. For example: 'Walkathon Challenge' to support scholarships for women [IBM18, p. 36]; carpools [RB18, p. 58].

* new pattern; ** refined patterns

Figure A4: Second Design Iteration

Third Design Iteration (Applicability Check, Evaluation 2)

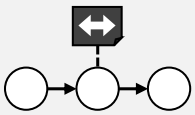
After the collection of data on the importance, accessibility, and applicability (Rosemann & Vessey, 2008) of the patterns. As a consequence, we decided to split the initial pattern on 'resource handling' into more concrete ones for *resource replacement* and *resource reuse*, as well as extend the description of examples provided for each pattern.

Pattern	
[#1] Social compensation	
Improving internal and external socially sustainable performance by compensating negative effects without changing the (core) process structure. For example: ▪ Preventive health care and employment protection/work safety (internal) ▪ Financial donations to social projects (external) ▪ Establishment of social projects/redistribute revenues, such as scholarships (external)	
[#2] Social alternative	
Improving socially sustainable performance by offering an alternative process path to the employees, partners, and customers without changing the (core) process structure. For example: ▪ Remote work and flexible working hours (employee decision, internal) ▪ Job rotation against monotonous tasks (staff decision, internal) ▪ Fair products in addition to the standard assortment (customer decision, external)	

[#3] Social resource replacement

Improving social performance by replacing resources (aids and materials) that have a negative influence on internal and external actors without changing the (core) process structure. For example:

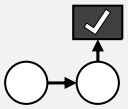
- Hiring of ergonomic-teams to ensure healthy working places
- Elimination of so-called 'conflict materials'



[#4] Social labeling

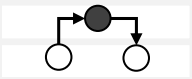
Improving the socially sustainable image of an organization by labeling processes and products with corresponding social certificates and standards. For example:

- Compliance with Fair trade, CmiA-certified cotton
- Compliance with criteria from Global sustainable tourism council



[#5] Social sourcing

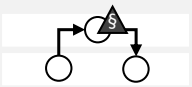
Improving socially sustainable performance by transferring activities to external organizations that can carry out an activity in a socially responsible manner or – vice versa – transferring external activities into the own company that is trained in handling certain activities.



[#6] Social value chain

Improving socially sustainable performance by defining and monitoring socially sustainable standards that have to be applied by every partner within a value chain. For example:

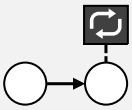
- Supplier needs to have a management system to report on compliance with safety at work



[#7] Social resource reuse

Improving socially sustainable performance by reusing resources (e.g., circularity thinking instead of linearity) that have a special value for society. For example:

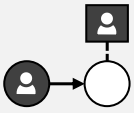
- Effective water management if (parts of the) processes are performed in regions with water scarcity



[#8] Social accessibility

Improving socially sustainable performance by adjusting processes in terms of individual, human-specific needs to allow employees, partners, and customers regardless of their background (e.g., gender, religion, physical health) to participate in a certain process. For example:

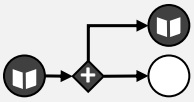
- Subtitles that can be read aloud when using technology (internal, external)
- Accessible stores with lifts so that everyone can participate (external)



[#9] Social training

Improving socially sustainable performance by educating internal and external actors to enable them to participate in processes appropriately. For example:

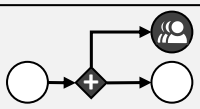
- Competence management to ensure that employees have the required knowledge for their tasks
- Awareness, education, and training to handle hazardous material



[#10] Social togetherness

Improving socially sustainable performance by creating a strong team-cohesion within an organization and doing something good together. For example:

- 'Walkathon Challenge' to support scholarships
- Establishment of carpools



Activity | Resource | Gateway | Actor | Flow | Association

Figure A5:Third Design Iteration

Appendix D: Selected Definitions

Category	Description
Process pattern	"Process patterns are proven solutions to recurring situations and are popular artefacts within Business Process Management."; "are atomic building blocks for business processes and aim to trigger specific considerations among stakeholders dealing with processes […]" (Rosemann et al., 2023) "Ambler (1998) introduced the term process patterns aiming to describe best practices in software engineering processes" (Fellmann et al., 2018)
Process design pattern	"The purpose of explorative design patterns is to increase the awareness of a process designer for the existence of growth opportunities leading to a larger process design space."; "support the identification of options to create new value from existing business processes." (Rosemann, 2020) "[…] such techniques seem more hit or miss than a set of structured heuristics that would guide the redesigner, or at least provide some tools for process transformation" (Zellner, 2013)
Business process design guideline	"[…] design guidelines refer to higher order principles and are motivated by a design intention" (Rosemann et al., 2023) "Patterns as atomic and often (semi) formalised templates can be a part of a design guideline."(Rosemann et al., 2023)
Business process model pattern	"A business process model pattern is the description of a proven solution to a recurring problem that is related to the creation or modification of business process models in a specific context. This description is typically organized in a structured document supporting the reader in understanding under which circumstances the proposed solution will be useful." (Fellmann et al., 2018).
Business process improvement (BPI) pattern	"[…] we refer to process improvement patterns (PIPs) as generic concepts for enhancing particular aspects of business processes."; "PIPs as practices" (Lohrmann & Reichert, 2016) "We define a BPI pattern as a reusable solution for a certain problem in a business process within a certain context. […] The application of a BPI pattern thereby results in some form of change, e.g. on the activities […] or the required resources for its execution." (Falk et al., 2013) "One advantage of patterns is that they provide precise operational guidelines while at the same time being flexible enough for being applied in different contexts." (Falk et al., 2013)
Process redesign heuristics	"[…] common tool used for process improvement and innovation are heuristics. Generally, heuristics are cognitive shortcuts that facilitate the exploration of a solution space […] (re-)design heuristics specifically help create innovative ideas when redesigning existing or designing new business processes (Recker and Rosemann, 2015)." (Frank et al., 2020)
Design practices	"Although an ideal best practice prescribes the best way to treat a particular problem that can be replicated in any situation or setting, it is more fruitful to see it as something that "needs to be adapted in skillful ways in response to prevailing conditions"; "[…] are universal in the sense that they are applicable within the context of any business process, regardless of the product or service delivered." (Reijers & Mansar, 2005)
Process anti-pattern / Weakness pattern	"Process anti-patterns (aka weakness patterns [18, 19]) describe insufficient solutions and are recognized by the appearance of failures." (Rosemann, 2020)

Figure A6:Selected Definitions

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