EMPOWERING PRACTITIONERS: A CONCEPTUAL FRAMEWORK FOR VALUE CO-CREATION THROUGH SMART SERVICE INNOVATION METHODOLOGIES

Research Paper

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Abstract

Smart services offer great innovation potential by incorporating digital technologies into non-digital value-creation processes. As smart service innovation poses significant challenges to organizations, existing research has contributed to understanding and addressing this phenomenon by developing various methods, tools, and processes. Yet, the academic community often still fails to bridge the "last mile" and help practitioners apply this knowledge in their specific application contexts. This article outlines how research can empower practitioners by systematically providing methodological knowledge for smart service innovation. We review and contrast existing methodologies and present a conceptual framework for value co-creation through smart service innovation methodologies. In addition, we identify six essential resource types required in these methodologies and propose emergent research avenues to guide future contributions to smart service innovation research.

Keywords: Smart service innovation, Methodology, Digital transformation, Conceptual framework.

1 Introduction

Digital technologies, such as cloud computing, mobile devices, big data, and analytics, enable today's companies to extend their offerings beyond physical products by providing digital services to customers and related stakeholders (Ulaga and Reinartz, 2011; Valencia et al., 2015; Hunke, Heinz and Satzger, 2022). For instance, John Deere, traditionally known for its agricultural machinery, is now investing heavily in digital service suites that allow farmers and dealers to manage fleet information online and monitor machines remotely to provide proactive support (Tosato, 2021). Unlike purely digital services such as Google's search engine or Meta's social networks, these smart services are still closely tied to physical products such as John Deere's harvesting machines. These physical products become smart products when integrated with digital technologies and serve as boundary objects between actors within smart service systems (Porter and Heppelmann, 2014; Beverungen et al., 2019).

Despite the recognized technological potential for business innovation, traditional companies often struggle to incorporate smart services into their core portfolios through smart service innovation (SSI) due to factors such as limited digital skills, perceived risks, and increased complexity across business functions (Anke et al., 2020; Wolf et al., 2020; Heinz, Park, et al., 2022). Several research streams, including product and software engineering, service design and management, and information systems development, contribute methodological knowledge for SSI initiatives and aim to help organizations innovate smart products and services. For example, Pöppelbuß and Durst (2019) present a smart service canvas, Anke et al. (2020) identify generic roles in multi-actor SSI projects, while Jussen et al. (2019) and Moser and Faulhaber (2020) integrate business model development and prototyping in ecosystems into a lightweight, agile process.

Despite the availability of numerous SSI methods and tools (Marx et al., 2020), the academic community has struggled to bridge the "last mile" and ensure the widespread adoption of the methodological knowledge gained (Hagen, Jannaber and Thomas, 2018). In particular, existing research often overlooks the heterogeneity of SSI contexts and provides insufficient guidance for deciding when and how to apply the proposed resources (Giray and Tekinerdogan, 2018). Presumably, relevant research often falls short of its potential managerial impact because it lacks a thorough discussion of its applicability in a specific innovation context. In line with recent calls, we argue that information systems (IS) research could become a research platform in the future, i.e., a collective provider of formalized knowledge for managers and other stakeholders to enable innovation and thus value creation using digital technologies (Böhmann, Leimeister and Möslein, 2014; Nambisan et al., 2017; Grisold et al., 2022).

A few recent publications have synthesized existing methodological knowledge into more comprehensive "methodologies" for SSI, such as the DIN SPEC 33453 of the German Standards Institute (2019) and the collection of methods for the digital economy by Robra-Bissantz et al. (2022). However, these existing methodologies take isolated approaches that are difficult to reconcile and often fail to achieve their claimed potential. Therefore, we argue that methodology development should be an ongoing process and discourse rather than a one-time limited research project in order to keep up with the ever-changing phenomena by continuously validating and updating methodological resources (Böhmann, Leimeister and Möslein, 2014; Tiwana and Kim, 2019). To shed more light on this issue, this article explores the following research question: *How can SSI research systematically contribute methodological knowledge that enables practitioners to successfully apply it in their SSI context?*

To address this question, we take a conceptual approach augmented by a review of four instances of "SSI methodologies," which we define as systems of prescribed courses of action for smart service innovation that include innovation methods and guidance on when and how to apply them. After purposive sampling (Bryman, 2016) of SSI methodology instances from different academic fields and sources, we apply qualitative content analysis (Mayring, 2004; Hsieh and Shannon, 2005) to systematically analyze the collected documents. Based on the review and comparison of these SSI methodologies, we propose a conceptual framework for value co-creation through SSI methodologies, identify six types of resources needed in such a methodology, and develop emergent research avenues for SSI research. Our findings contribute to SSI and digital innovation management research and lay the groundwork for IS research to serve as a research platform by mobilizing and orchestrating resources for a continuously evolving SSI methodology and making it applicable to practitioners.

The remainder of this article is structured as follows: The subsequent section provides the background of this study. We then present our research method, followed by a review of exemplary SSI methodologies and our conceptual findings. Finally, we discuss the theoretical and practical implications of our findings, address the limitations of our study, and provide an outlook for future research.

2 Background

We define SSI as the reconfiguration of diverse resources, including smart technologies, to create new or recombine existing market offerings as resources that are beneficial to some actor(s) in a given context (Yoo, Henfridsson and Lyytinen, 2010; Barrett et al., 2015; Lusch and Nambisan, 2015; Heinz, Breidbach, et al., 2022), where smart technologies are digital technologies embedded in a cyber-physical context (Beverungen et al., 2019; Tuunanen et al., 2019). While the outcomes of SSI processes typically involve the use of digital technologies, recent studies emphasize that SSI can also involve changes in organizational routines or business models by (re)interpreting the affordances of smart products (Heinz, Benz, et al., 2022; Heinz, Breidbach, et al., 2022). The intelligence of products can be described by their increased awareness and connectivity (Allmendinger and Lombreglia, 2005), which enables value creation by, for example, monitoring, diagnosing, or optimizing the product or increasing its autonomy (Porter and Heppelmann, 2014). While the availability of modular technological resources in the form of protocols, digital platforms, and IoT suites today facilitates technical implementation (Naik et al., 2020; Herterich et al., 2022), economic and organizational uncertainties continue to pose major challenges for companies (Heinz, Park, et al., 2022; Pöppelbuß, Ebel and Anke, 2022). A particular reason for the difficulty of managing and orchestrating SSI is that it typically requires the involvement of a network of actors within and across organizations who bring different resources to bear during the innovation or operational phase (Anke, Pöppelbuß and Alt, 2020; Pöppelbuß, Ebel and Anke, 2022).

To systematically develop such complex systems from the initial idea of a value proposition to a production-ready system, collaborative work should be guided by methodological knowledge. With the discipline of method engineering, IS research has a long tradition of dealing with the systematic design, construction, and adaptation of such knowledge to develop information systems (Brinkkemper, 1996, p. 276). It has also been recognized that there is no "one-size-fits-all" approach to development and innovation processes, as the specifics of projects and organizations are never fully considered in standardized methods. Situational method engineering (Henderson-Sellers and Ralyté, 2010) suggests that the method for a specific initiative should be created from existing more or less formalized parts which we call methodological building blocks (Jacobson, Ng and Spence, 2007; Henderson-Sellers and Ralyté, 2010). The selection and composition are driven by the actual context, described by "situational factors," such as team and application size, organizational culture, business risks, and legal aspects (Clarke and O'Connor, 2012). Also, organizations require different sets of methods and techniques depending on their level of digital transformation (Alt, 2019).

With the focus on value in digital transformation, techniques such as the Business Model Canvas (Osterwalder and Pigneur, 2010) and methods such as business model innovation are applied to guide transformation projects (Alt, 2019). Since smart service systems consist of a technical software-intensive system, a service process, and often an innovative business model, these perspectives need to be covered by appropriate development approaches (Pakkala and Spohrer, 2019). Therefore, methodological knowledge from different disciplines could support SSI, including service engineering, PSS engineering, software engineering, business model innovation, systems engineering, user-centered design, innovation management, and general management (Bullinger, Fähnrich and Meiren, 2003; Abramovici, Göbel and Neges, 2015; Kuhlenkötter et al., 2017; Hagen, Kammler and Thomas, 2018). Furthermore, to address the specific characteristics and potentials of smart services, methods need to consider the role of data as a resource and the use of digital technologies in service systems (Demirkan et al., 2015; Herterich and Mikusz, 2016). This has led to a call to develop new service engineering methods (Peters et al., 2016). Although improving and adapting existing methods for the digital age are ongoing, they do not adequately address SSI's increased complexity and agility (Marx et al., 2020).

To adopt a more systemic perspective on service innovation, *service systems engineering* (SSE) has emerged as a discipline that takes service systems as the basic unit of analysis and recognizes the capabilities of smart products as enablers of service innovation (Böhmann, Leimeister and Möslein, 2014). Recently, several approaches to SSE have been proposed in the academic literature, such as recombinant service engineering (Beverungen, Lüttenberg and Wolf, 2018), a multilevel design framework for service systems (Grotherr, Semmann and Böhmann, 2018), smart service engineering (Jussen et al., 2019; Moser and Faulhaber, 2020), or the DIN SPEC 33453 "Development of Digital Service Systems" (German Standards Institute, 2019). Despite this diversity, most methods and process models emphasize the importance of agility, i.e., they follow the principles of the "Agile Manifesto" (Beck et al., 2001), which calls for a highly iterative research and development organization with intensive customer involvement. Furthermore, adopting agile practices helps to adapt to the dynamics of the environment (Paluch and Grube, 2020; Kuhrmann et al., 2022) and thus to cope with the complexity and uncertainty inherent in SSI (Ramirez Hernandez and Kreye, 2020; Sjödin et al., 2020).

In general, it can be stated that the need for better guidance for SSI is widely recognized. As a result, agile process models and a variety of methods have been proposed that directly address the specifics of smart services. However, as many methods have been developed without a specific process model in mind, mapping activities to appropriate methods and techniques is poorly understood. In addition, the proposed process models and methods provide little information on how to apply them in multi-actor settings such as service ecosystems. This mainly refers to the question of how to organize work among multiple actors depending on their capabilities and the activities to be performed.

3 Research Method

To augment our conceptual study approach, we analyze and compare four recent academia-related approaches to developing an SSI methodology. Akin to a discovery process, our exploratory approach provides SSI researchers with a better understanding of SSI methodology development and allows them to systematize and situate their research efforts.

Data Collection. We used a purposive criteria-based sampling strategy (Bryman, 2016) to develop a protocol with four criteria for screening potentially eligible SSI methodologies and selecting them for our review to ensure that the selected methodologies (1) focus on the specifics of SSI projects, (2) have a sufficiently broad coverage of SSI activities from idea development to market launch, (3) employ a scientific approach to methodology development as evidenced by embedding in the existing body of knowledge and a reproducible approach to methodology development, and (4) have the maturity of a completed project at the time of this study. In addition, we ensured that our final set of methodologies was diverse in terms of constituent characteristics such as publication form and the primary audience, SSI activities covered, types of methodological building blocks, and discipline of origin. Descriptions of the four instances considered are provided later in this article (see Table 1 and Table 2).

To gather rich data, we used the detailed description of the methodologies (German Standards Institute, 2019; Retrosmart, 2021; IMPRESS, 2022; Robra-Bissantz et al., 2022) as the primary material and searched for secondary material that provided insight into the academic context in which the methodology was created. For both data types, we relied primarily on publicly available documents (i.e., academic articles, white papers, project reports, etc.) but also gathered additional material by contacting key contacts for the initiatives and downloading information from the websites of related institutions and projects. Our final dataset included 47 documents, with 1064 pages to review.

Data Analysis. After familiarizing ourselves with the collected material, we applied qualitative content analysis (Mayring, 2004; Hsieh and Shannon, 2005) using MAXQDA software to analyze the data in three steps. In the first step ("conventional content analysis"), we conducted an inductive open coding approach to capture the key attributes that constitute an SSI methodology, focusing on the unique characteristics of the methodologies studied. We ensured the validity and robustness of the analysis conducted by a single researcher by critically reviewing and discussing the coding progress and the conclusions drawn from the analysis with a second researcher. As a result of this iteration, we defined a coding scheme with the following seven coding categories along with guiding questions for our further analysis: Publication form, stated purpose, target audience, development procedure, methodology components, application instructions, and situational guidance.

In a second deductive step ("directed content analysis"), we applied the coding scheme to re-code the collected material for each of the four SSI methodologies and derive consistent individual descriptions. The results of this analysis for each methodology are presented in Table 1 and Table 2. Finally, in a third analytical step ("comparative analysis"), we looked for patterns among the different SSI methodologies based on the initial findings regarding the areas of interest. In this step, we systematically compared the themes, concepts, and relationships that emerged from the previous two steps. In particular, we derived categories from the initial codes for each guiding question and looked for similarities and differences across the instances. We also conducted a pairwise comparison of the methodologies to look for more subtle similarities and differences and find categories and concepts we did not expect beforehand. The results of the comparative analysis are presented in Section 4.1.

Synthesis and Integration. The continuous comparison of theory and data allowed us to gain new insights throughout the research process to answer our research question. In this final research stage, we use the theoretical lenses identified as being appropriate (Gregor and Hevner, 2013; Grönroos and Voima, 2013; Gottschalk et al., 2022) to synthesize our data analysis findings and derive more abstract knowledge about the development and application of SSI methodologies. As a result, we have arranged our findings into a conceptual framework that represents how methodological knowledge for SSI can be co-created (Section 4.2). Based on this framework, we propose a typology of resources required for an SSI methodology and derive emergent research gaps that can guide future SSI research (Section 4.3).

4 Toward Systematizing Methodological Knowledge for SSI

In this section, we present the results of our review and comparison of four different SSI methodologies. In the following, we describe the results of the individual analysis of Retrosmart in more detail to provide an illustrative excerpt from our sample (cf. Table 1). While the detailed individual description of the other methodologies can be found in the Appendix (Table 2), the remainder of this section presents the more general results of our exploratory review of SSI methodologies in the form of a comparative analysis, a conceptual framework, and a typology.

Retrosmart's structure is based on an existing tool, the Smart Service Canvas (Pöppelbuß and Durst, 2019), which in turn is an adaptation of the widely used Value Proposition Canvas (Osterwalder et al., 2015). As the methodology specifically aims at the technical retrofitting of existing machines and equipment to develop smart service business models, the basic framework is slightly adapted to this context. Aligned with this canvas, the methodology presents an overarching process model with six phases, which draws on design thinking practices to address the different areas of the canvas sequentially. In the main body, Retrosmart presents a detailed description of each process phase and the activities within it, along with (a) supporting methods described with step-by-step instructions, (b) solution patterns as design recommendations to facilitate development, (c) tools and workshop materials to support the implementation of each method, and (d) canvases and similar templates for structuring, aggregating, and documenting results at critical stages.

Throughout the document, the methodology's resources are applied to real-world problems that are easy to understand in order to put methodological knowledge into action. In addition to activity-related information, Retrosmart also includes guidance on organizational implementation (e.g., team composition, role allocation, partner company involvement) and concludes by applying the proposed overall approach to five different use cases. The material is further enriched with "Practical Tips," e.g., to clarify issues of approach and application, to assist in decision-making, or to provide cross-references within the document or to external resources. It also contains dedicated workshop materials (e.g., cut-out pattern cards) to facilitate the implementation. While the methodology contains extensive design recommendations (e.g., forms of displaying information in user interfaces and applicable communication protocols), concrete situation-specific methodological guidance is scarce. Rather, the practitioners are expected to apply the knowledge presented to their own context, occasionally supported by guiding questions or several alternative methodological suggestions.

4.1 Comparative Analysis

As intended by our sampling approach, all methodologies use different *forms of publication*, i.e., a stand-alone practitioner guideline (Retrosmart, 2021), a standard specification (German Standards Institute, 2019), a scientific article in a practitioner journal (Robra-Bissantz et al., 2022), and an interactive web application (IMPRESS, 2022). Each of these forms has specific strengths and weaknesses, particularly concerning their target group reach, externally assured rigor, flexibility of presentation, long-term availability, and updateability. Notably, all methodologies are "self-contained," which makes it difficult to reuse the respective methodological components in other contexts. While DigitalDesign's scientific article comes closest to the presentation of scientific knowledge that researchers are accustomed to, it offers fewer options to guide practitioners in applying the content than IMPRESS's web application. On the other hand, designing an appropriate web application is a complex, deliberate task that cannot be expected of every scientist in today's dispersed SSI landscape. Since no clear dominant design can be derived from our comparison, future research should further explore different ways of communication, e.g., by taking inspiration from other fields that have a more direct relation to practical applications (e.g., medicine or computer science).

Retrosmart – Smart-Service-Retrofits *(Retrosmart)*
Publication Form: Stand-alone practitioner guideline
Stated Purpose: Establish a basic understanding and provide an approach for executing innovation initiatives that address the technical retrofit of existing machines and equipment and the development of smart service business models
Target Audience: Companies in the mechanical and plant engineering sector that are undertaking an innovation project in the smart service context
Development Procedure: Development in a heterogeneous project team from research and practice as part of a funded consortium project. Scientific elaboration and integration, as well as practical testing and illustration based on five real use cases
Methodology Components: • Description of basic phenomena, concepts, and schemes based on widely known successful use cases • Overarching process with phases that can be iterated through, presented in a central framework • Detailed description of the individual process phases and the activities they contain • Recurring recommendations for the use of basic practices (e.g., prototyping) • Supporting methods described with step-by-step instructions • Solution patterns as design recommendations to facilitate the development • Tools and workshop materials to support the implementation of each method • Canvases and similar templates for structuring, aggregating, and documenting results at critical stages • Ongoing application of the artifacts to real-world problems that are easy to understand • Guidance on organizational implementation, e.g., team composition, deciding on the inclusion of partner companies, role allocation in the team and the overall initiative • Holistic illustration of an innovation project through diverse use cases • Reference to more detailed external resources
Application Instructions: • “Practical tips” as a recurring element, e.g., to clarify questions in the approach and application, support for decision-making, or cross-references within the methodology or to external resources • Workshop material (e.g., cut-out pattern cards) to facilitate the execution • Application of abstract content to real-world examples, holistic illustration based on use cases addressed
Situational Guidance: • Guiding questions to clarify the initial situation of the innovation project; based on this, however, only content-related recommendations follow, no methodological recommendations • Guiding questions for determining the subsequent activity based on the progress of the project • Individual situational recommendations, e.g., different procedures if customer can be included or not

Table 1. Individual analysis of SSI methodology “Retrosmart”

In terms of their *stated purpose* and *intended audience*, the methodologies tend to differ from one another only in nuances. They all aim to guide companies, especially product-oriented manufacturers, that want to benefit from digital transformation (DigitalDesign) and develop digital, smart services (DIN SPEC) through innovation initiatives (Retrosmart). While Retrosmart explicitly formulates the goal of first establishing a basic understanding of the phenomenon, DigitalDesign focuses primarily on methods the innovation team can apply. Another differentiating aspect is the scope of the methodologies. While DIN SPEC explicitly limits its content to downstream processes (service management), IMPRESS chooses the broader scope of digital transformation by also addressing topics such as generally required competencies and organizational change. Another boundary condition may be certain aspects of the innovation initiative itself: Retrosmart, for example, is specifically aimed at companies that want to offer new business models by retrofitting existing machines.

The *development procedure* of the four methodologies studied was also very similar. Retrosmart and IMPRESS are each the result of a three-year funded research project in which academic and business partners worked together to develop new methodological knowledge and combine it with existing knowledge while continuously applying it to real use cases for testing and reflection. DIN SPEC and DigitalDesign, in contrast, can be more accurately described as “ensemble methodologies” as they bring together individual results from such collaborations between research and practice. While the development of DIN SPEC was closely linked to the original individual projects, DigitalDesign emerged from an open call to the scientific community to assemble methodological knowledge in a practice-oriented manner. Overall, the approaches chosen reflect the paradigm of design science (Hevner et al., 2004), where knowledge is generated and evaluated in a real-world environment and then, in turn, integrated into the existing academic knowledge base.

In all four methodologies, similar types of *methodology components* can be found. Except for DigitalDesign, which aims to provide a collection of methods rather than a comprehensive methodology, all initially "prepare the ground" by describing and defining basic concepts referencing established scientific knowledge. They also use both methodological and design-oriented recurring elements, such as basic innovation practices (e.g., design thinking techniques) or design dimensions (e.g., technology, revenue model, ecosystem partnerships). Another common feature is that methodological resources are assigned to specific activities in the innovation process. These activities, in turn, are usually grouped into phases and arranged in a higher-level reference process and are thus interlinked. The core of the methodologies is a set of proposed methods that represent prescriptive knowledge for carrying out innovation activities. In most instances, these methods are consistently described with step-by-step instructions, including visual representations or other supporting elements, and provide examples based on real-world use cases. Application is also often facilitated by "solution patterns" or commonly chosen strategies intended to serve users as "building blocks" for their innovation activities. In addition, Retrosmart and DIN SPEC try to make the application even more tangible by describing different exemplary innovation initiatives in detail and outlining where and how the content can support them. Finally, a common element of all methodologies is the interspersing of "practical tips" at various points and advice on the general management and organizational implementation of the innovation project.

Even though a few of the methodological components discussed already contain some *application instructions* and *situational guidance*, we would still conclude that many decisions about the content's application and "enactment" are still left to the addressee. However, several elements support situational adaptation: Retrosmart often asks "guiding questions" to clarify the specific situation of the initiative and, thus, to make methodological or design-related decisions. DIN SPEC makes it possible to compare methods for the same activity in terms of difficulty of application and depth of content and briefly covers different entries and starting points in the overall process, depending on the individual situation. DigitalDesign provides specific recommendations for applying the methods in workshop formats, e.g., explaining the role of a distinct facilitator, recommending introductory keynote speeches, and suggesting specific analog and digital collaboration tools. IMPRESS has the most comprehensive options due to its presentation in a web application but currently uses these options only for some methodological components. For example, for developing an innovation strategy and a business model, interactive components recommend specific complementary building blocks or prevent the selection of incompatible elements. In addition, the suggested patterns can be supplemented with the users' content, and the compiled results can be saved via an import/export function. This example shows that this form can have a very different character than traditional document publishing and that the interactivity of a web application offers the possibility of greater customization.

4.2 Value Co-Creation through SSI Methodologies

Building on the comparison of four SSI methodologies, we synthesized our descriptive findings into more abstract knowledge about the development and application of SSI methodologies by integrating them with existing theories. In doing so, we not only used the methodologies themselves but also considered the actual use of methodological knowledge ("enactment") by taking into account the described practical applications in the methodologies as well as our own experience with practice-oriented studies (Schön, 1983). In particular, we draw from Grönroos and Voima's (2013) notion of "value creation spheres" to distinguish between (a) the *global research sphere,* which aims to formalize descriptive and prescriptive knowledge about the overall phenomenon of SSI (Mokyr, 2002; Gregor and Hevner, 2013), (b) a *local practitioner sphere*, where formalized and tacit knowledge is enacted in a specific innovation context (Gottschalk et al., 2022), and (c) a *joint sphere* in which SSI methodologies can facilitate value co-creation through the application of methodological knowledge in a local context. This distinction allowed us to develop a conceptual framework for value co-creation through SSI methodologies, which is shown in Figure 1 and discussed in more detail in the following subsection.

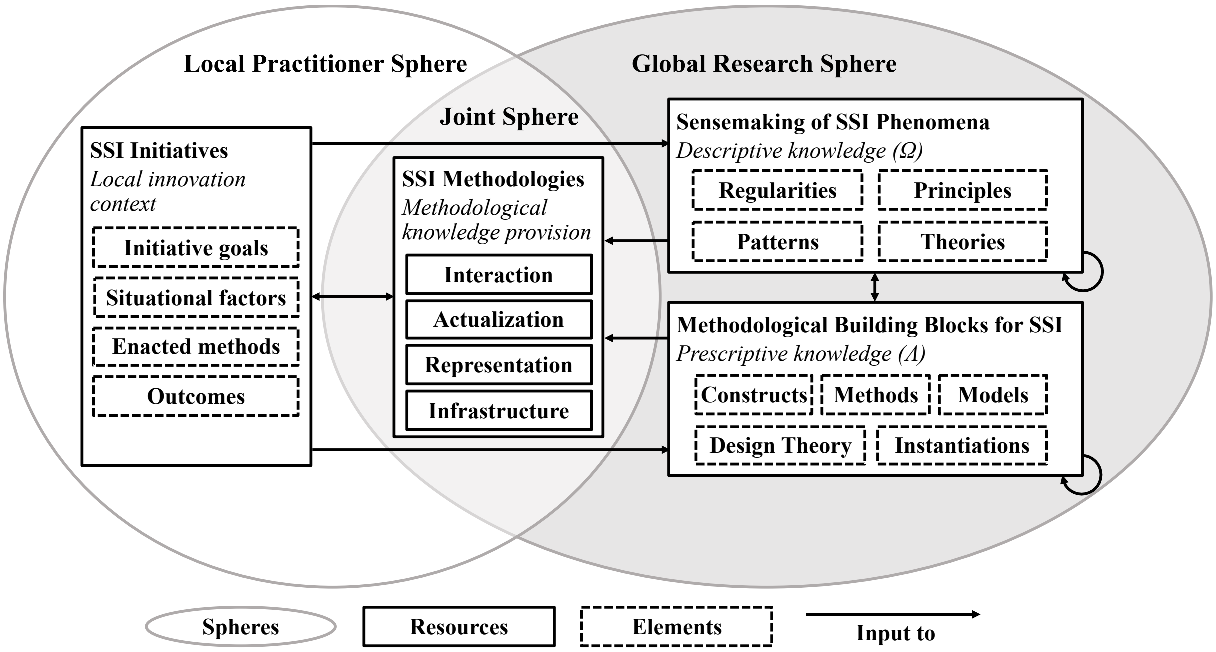

Figure 1. A conceptual framework for value co-creation through SSI methodologies

In developing and applying methodological knowledge for SSI, we identify activities forming a "hermeneutic cycle," which is an iterative path to understanding (Gadamer, 2008; Boell and Cecez-Kecmanovic, 2014). On the one hand, the general scientific understanding of a phenomenon such as SSI ("the whole") develops from the understanding of individual instances such as a specific SSI initiative ("a part"). On the other hand, the local practical understanding in the initiative ("a part") draws on the actors' prior understanding of the overall phenomenon ("the whole"), which may be informed by descriptive and prescriptive knowledge from science (Gregor and Hevner, 2013). Given the growing body of knowledge and the ever-changing problem space in the face of technological and organizational evolution, the proposed framework should be interpreted more as a "flat" static representation of what is actually a dynamic "hermeneutic spiral" along the time dimension (Paterson and Higgs, 2005).

First, as discussed in Section 2, scholars from different disciplines contribute knowledge that enables other actors to avoid making the same mistakes (Chandra Kruse and Nickerson, 2018). This knowledge is often represented as methodological building blocks (i.e., constructs, methods, models, design theory, instantiations) to be applied in SSI activities. This prescriptive knowledge typically builds on and reflects descriptive, "sensemaking" knowledge (i.e., regularities, principles, patterns, theories) as justificatory kernel theories (Gregor and Hevner, 2013). For example, both Retrosmart and DIN SPEC suggest that practitioners should consider a smart product as a "boundary object" (Star and Griesemer, 1989; Beverungen et al., 2019; Ebel, Jaspert and Pöppelbuß, 2022). As discussed in the previous subsection, these methodological building blocks can be included as resources with different functions in a practitioner-oriented SSI methodology but can take different forms.

Second, the local innovation context is described in terms of the situational factors and the goals of the initiative, enacted methods, and derived outcomes over time (Gottschalk et al., 2022). These situational factors determine the suitability and enactment of methodological knowledge. They can be both internal (e.g., strategy, culture, established routines, team size, or individual skills) and external (e.g., regulatory requirements in health care or market demand for retrofit solutions for existing products in the field) (Henderson-Sellers and Ralyté, 2010). Practitioners enact the methods within their local innovation context, resulting in an SSI outcome continuously assessed against the initiative's goals (Klünder et al., 2019). The methodological resources an SSI methodology provides can be used in this step to facilitate value creation (e.g., filling out a canvas). However, when enacting parts of the methodology, the practitioner acts more as an independent value creator outside of direct interaction.

Finally, like the service providers in Grönroos and Voima's (2013) study, we argue that an SSI methodology can only be relevant if it directly or indirectly facilitates innovation in a local practitioner domain. This facilitation occurs in a *joint sphere* between research and practice, where the two interact to "co-create" value, ultimately leading to better SSI outcomes. However, our review suggests that existing SSI methodologies primarily take a "production" perspective, facilitating value creation by producing resources to be used in the practitioner sphere, sometimes involving some practitioners as "co-producers." In contrast, we propose to consider an SSI methodology from a value creation perspective, identifying means of indirect or direct interaction to co-create value by integrating resources with different functions (infrastructure, representation, interaction, actualization) in the local innovation context while allowing researchers to formalize knowledge to continuously evolve the methodology.

An SSI methodology combines and links these resources to guide practitioners in a consistent and accessible way. While "infrastructure" and "representation" are resources that facilitate the delivery of methodological knowledge, resources of "interaction" and "actualization" serve to enable and optimize the application of knowledge in the local innovation context. Practitioners interpret the provided resources in their situational context to construct a method, i.e., to choose a course of action, by dynamically adapting the methodological suggestions to their needs. We argue that a comprehensive SSI methodology can and should guide practitioners through this process. As exemplary guidance, DigitalDesign suggests that a knowledgeable facilitator should join the workshops for most methods to dynamically adjust the methodological procedure. Retrosmart, on the other hand, provides only boundary conditions (e.g., "developed primarily for retrofit applications") and prompting questions (e.g., "is a customer available to be involved in this activity?") to guide practitioners through the construction process. An interactive web application such as IMPRESS can provide more technology-enabled means of tailoring methods to a situational context.

Moreover, applying methodological knowledge in local contexts also provides an opportunity to build new knowledge and thus make sense of the phenomenon as a whole. Generalizing across different situational contexts allows these insights to be formalized by building both new descriptive knowledge (e.g., by identifying patterns of innovation processes in a particular context) and prescriptive knowledge (e.g., by improving tools and templates, adapting a method to a situational context, or designing a new process model). Given the complexity of the ever-changing phenomenon of SSI, this continuous adaptation of knowledge is necessary to provide meaningful resources in the long run. The framework presented can help to understand the development of an SSI methodology as an ongoing process and discourse and make it easier for researchers to position their contributions within this process (Grisold et al., 2022).

4.3 A Typology of Resources and Emergent Research Avenues

To make this call for collective contributions to an SSI methodology more explicit, we derive six types of resources needed in an SSI methodology. We provide examples of each type from our sample and present emergent research avenues for each resource type.

Type A) Sensemaking resources. The methodologies reviewed show that descriptive knowledge is often closely intertwined with prescriptive knowledge in SSI methodologies. IMPRESS, for example, presents previously identified patterns as solution constituents for various aspects such as the business model, value creation processes, or organizational processes. This descriptive knowledge is conveyed through a system of pattern cards and is given prescriptive meaning through a method description and how it applies to the practitioner's context. Another kind of useful sensemaking resource in the methodologies is excerpts from real-world use cases where the methodological knowledge was helpful. In addition, rich narratives such as case studies can help put abstract knowledge into action through storytelling and make the methodology more accessible to practitioners (Andrews, Hull and Donahue, 2009; Boldosova, 2019). Finally, future SSI research would benefit from empirical studies that systematically determine the relevant situational factors of SSI initiatives and identify patterns therein to allow for more nuanced statements about the applicability of knowledge to individual situational contexts (Giray and Tekinerdogan, 2018; Gottschalk et al., 2022).

RA1: Identify patterns and theories to better understand the phenomenon of SSI and inform method engineering (Gregor and Hevner, 2013).

RA2: Provide resources for repeatable storytelling with rich narratives to translate abstract concepts into action (Andrews, Hull and Donahue, 2009; Boldosova, 2019).

RA3: Systematize the situational factors of SSI initiatives to distinguish between contexts (Bekkers et al., 2008; Giray and Tekinerdogan, 2018; Gottschalk et al., 2022).

Type B) Methodological resources. The number of methodological resources in the methodologies studied and those identified in other reviews (Marx et al., 2020), indicates that many such resources have already been proposed to guide SSI initiatives. However, the overlap in content and lack of connections between the methodologies reviewed highlight that SSI research lacks systematization, comparability, and, most importantly, a cumulative research approach (vom Brocke et al., 2020). Appropriate approaches to systematization could use a common set of life cycle stages, design dimensions, and system types to which suitable methods can be assigned. In addition, the current prevailing mode of research – short-term funded research projects and individual publication efforts – does not provide the incentive for ongoing validation of methodological resources that would be required to keep them up to date (Tiwana and Kim, 2019). The methodologies presented provide an overview of typical methodological resources such as reference processes, method descriptions, or recommendations for an organizational redesign that can be subject to further development and review.

RA4: Review and synthesize existing interdisciplinary methodological knowledge for SSI using a systematic meta-model (Engels and Sauer, 2010; Marx et al., 2020).

RA5: Expand the existing body of resources through forward and backward loops for cumulative development and ongoing validation (Tiwana and Kim, 2019; vom Brocke et al., 2020).

Type C) Representation resources. Although closely related to methodological resources, an SSI methodology requires not only methodological building blocks but also a carefully designed form of representation. Unlike academic publications, where the rigor of the development and its theoretical embedding can seem as important as the artifact itself (Baskerville et al., 2018), practice-oriented forms of presentation need to strike a balance between providing comprehensive information and reducing the complexity of the methodological knowledge provided (Täuscher and Abdelkafi, 2017). Also, visualizing the content in a meaningful way should be a deliberate design task in its own right, especially in more complex forms of presentation, such as web applications, where inspiration from the field of human-computer interaction might be useful.

RA6: Determine the right balance between providing comprehensive information and reducing the complexity of the methodological knowledge provided (Täuscher and Abdelkafi, 2017).

RA7: Create templates and visual representations to present and link different types of methodological building blocks clearly and concisely (Täuscher and Abdelkafi, 2017).

Type D) Infrastructure resources. The heterogeneous landscape of SSI methodologies indicates a vulnerability in today's academic discourse. In contrast to fields such as computer science or medicine, IS, and indeed management research in general, has historically not been very successful in establishing a "hot line" to its intended audience of managers (Lilien, 2011; Baskerville et al., 2018). Similar to Grisold et al.'s (2022) recent call for IS research to become a research platform and provide the methodological infrastructure to leverage digital trace data, our discipline should aspire to the same role within the digital innovation management discourse (Nambisan et al., 2017) – that of a collective provider of formalized knowledge for managers and other stakeholders to enable innovation and thus value creation using digital technologies. Fruitful starting points for contributing to such an infrastructure could be to apply socio-technical systems design (Bostrom and Heinen, 1977) to potential representations of an SSI methodology or to rethink governance mechanisms for a research platform for

SSI methodologies to allow for generativity and openness while ensuring stability and control (Wareham, Fox and Giner, 2014; Mindel, Mathiassen and Rai, 2018).

RA8: Apply socio-technical systems design to ensure the accessibility of the infrastructure to practitioners (Bostrom and Heinen, 1977).

RA9: Design governance mechanisms to balance generativity and control in the ecosystem (Wareham, Fox and Giner, 2014; Mindel, Mathiassen and Rai, 2018).

Type E) Actualization resources. Future research should also address the actualization of knowledge by practitioners. While it is necessary to direct managers and innovation teams to appropriate methods for their innovation context, it is not sufficient if team members are unfamiliar with them (Richter and Anke, 2021). Hence, an applicable SSI methodology should either limit the method base to those known to the team or include additional (interactive) tools and training materials to understand the proposed methodological resources before applying them in a real project. In this context, resources that allow situational construction of a method and further potential means to facilitate their enactment, such as (semi-)automated instructions, should be included in an SSI methodology.

RA10: Support the situational method construction allowing for different degrees of controlled flexibility (Harmsen, Brinkkemper and Oei, 1994; Alt, 2019; Gottschalk et al., 2022).

RA11: Investigate the role of a facilitator in the method actualization process and whether and how this role can be automated (Giray and Tekinerdogan, 2018; Gottschalk et al., 2022).

Type F) Interaction resources. Finally, in line with our call for ongoing validation of methodological knowledge once created, SSI research should find ways to collect and process feedback from the practitioners' interaction with the methodology in order to reflect, learn, and improve the methodology, thus incorporating reinforcing feedback loops (Anderson, 1999). The conceptual framework presented could be further interwoven with existing research procedures, such as action design research (Sein et al., 2011; Mullarkey and Hevner, 2019), to provide both researchers and practitioners with actionable guidance for value co-creation in real-world projects. Also, today's technology provides the ability to introduce (partially) automated mechanisms for data collection and analysis to improve the infrastructure and knowledge delivery of the methodology, for example, by analyzing tracking data on a website.

RA12: Outline how action design research projects can be set up so that practitioners can enact the methods in their innovation context while researchers formalize the lessons learned (Sein et al., 2011; Mullarkey and Hevner, 2019).

RA13: Develop (partially) automated data collection and analysis mechanisms to improve infrastructure and knowledge delivery in reinforcing feedback loops (Anderson, 1999).

5 Discussion and Conclusion

This article compares four SSI methodologies to answer how SSI research can systematically contribute methodological knowledge that enables practitioners to successfully apply it in their context. Based on a comparative analysis, we present a conceptual framework for value co-creation through SSI methodologies. We derive six types of resources needed in an SSI methodology to lay the foundation for IS research to become a research platform that systematically provides methodological knowledge for SSI and makes it applicable to practitioners. In this section, we conclude our study by identifying its implications for research, policy and practice, as well as its limitations and potential for future research.

5.1 Implications for Research

Our findings contribute to the discourse on SSI and digital innovation management and have three main implications for IS research. First, we discuss the nature and status quo of methodological knowledge for SSI and digital innovation in general. The analysis of existing methodologies highlights the current strengths and weaknesses of practice-oriented research. Using the derived framework and typology as theoretical artifacts, we aim to encourage future research to continue to engage with practitioners and contribute relevant knowledge that helps to guide innovation initiatives. However, today's dispersed SSI landscape may require some initial "housekeeping" before SSI research can add to the knowledge base in a cumulative tradition. We also note the need for ongoing validation of resources in the face of ever-changing phenomena and contexts.

Second, we explore how our research can have more impact in practice. With the results presented, we aim to mobilize and orchestrate resources to present of field's valuable contributions in a more accessible form to practitioners. Compared to disciplines such as computer science and medicine, which are more successful in their real-world impact, we must acknowledge that our target audience may have a different relationship to scientific outlets. Therefore, we should also engage in a discourse with disciplines such as marketing and scientific communication to find ways to bridge the "last mile" and enable practitioners to use scientific knowledge in their respective application contexts.

Third, our research is closely related to the current debate on rethinking the role of the IS discipline and the importance of theorizing in IS (Burton-Jones et al., 2021; Grisold et al., 2022; Grover and Lyytinen, 2022). Without neglecting the need for theory as a means to make sense of contemporary phenomena, we share the vision of recent calls for IS research to become a research platform in the future, i.e., a collective provider of formalized knowledge for managers and other stakeholders to enable innovation and thus value creation using digital technologies (Böhmann, Leimeister and Möslein, 2014; Nambisan et al., 2017; Grisold et al., 2022). We hope our findings can provide fertile ground for future analysis of the SSI phenomenon and perhaps inspire other discourses on related phenomena within the digital innovation research stream.

5.2 Implications for Policy and Practice

Because the methodologies we compared were all derived from publicly funded research projects, our study also has implications for policymakers. Thus, our call for cumulative development and ongoing validation (Tiwana and Kim, 2019) should guide not only future research efforts but also what and how research is funded. It will greatly benefit if policymakers (continue to) fund collaborative projects between practitioners and researchers that incentivize an expanded joint sphere over an extended period. Such projects can serve three purposes simultaneously: (1) to enact the existing methodological knowledge in a local initiative and thereby make it known to a wider audience, (2) to validate and improve the understanding of knowledge applied in specific contexts through research and publication of results, and (3) to expand the knowledge base through long-term empirical interaction where needed. In addition, future research should provide specific guidance on how approaches such as action design research (Sein et al., 2011; Mullarkey and Hevner, 2019) can be systematically applied to simultaneously address problems in the local practitioner and the global research sphere.

5.3 Limitations and Outlook

Given our study's nature and broad scope, some limitations should guide future research to validate our findings. First, for the reasons discussed above, a full systematic (literature) review of methodological knowledge for SSI was not conducted. Thus, our study cannot pinpoint specific topics to fill the gaps in existing SSI methodologies. For example, other related methodologies (e.g., Moser and Faulhaber, 2020) were not included. For future research, we recommend a nested research approach to compare existing knowledge about different components of an SSI methodology (e.g., processes, activities, methods, general practices, and tools). Second, our study does not currently include the voice of practitioners themselves. In future research, we plan to extend our conceptual findings by triangulating them through a comprehensive action design research project in future research. Third, future research should conduct not only qualitative but also quantitative studies to systematically compare the usefulness of the methodologies and the methods themselves (e.g., effectiveness in terms of quantity or quality) but also their presentation (e.g., using click rates or eye-tracking). Finally, our study focused only on SSI in private companies. Future research should also investigate whether the envisioned SSI methodology can be useful beyond this, for example, in other digital innovation contexts (e.g., FinTech) or to guide public or non-profit innovation in administrations or non-governmental organizations.

Appendix: Overview of SSI Methodologies

Methodology	Individual Coding
Retrosmart – Smart-Service-Retrofits *(Retrosmart)*	see Table 1.
DIN SPEC 33453: Development of Digital Service Systems *(DIN SPEC)*	***Publication Form:*** Standard specification (released in 09/2019) ***Stated Purpose:*** Provide guidance and accelerate the development of new services and the associated organizational transformation process ***Target Audience:*** Companies that want to develop digital service systems in an industrial context ***Development Procedure:*** Content developed in multiple funded research projects, standard specification created through workshops and a Delphi study ***Methodology Components:*** Definition of basic terms and concepts; design dimensions as a frame for innovation; continuous implementation of basic principles; reference process with three phases; activities within the phases; uniformly prepared methods for carrying out the activities; decision points on how to proceed; description of ideal-typical development projects as scenarios ***Application Instructions:*** Flexible entry and exit points in an iterative process ***Situational Guidance:*** Comparability of methods to facilitate method selection; connection between methods via input and output relationships
Methods for Designing Digital Platforms, Business Models and Service Ecosystems *(DigitalDesign)*	***Publication Form:*** Collaborative practitioner article (published in 09/2022) ***Stated Purpose:*** Help companies to position themselves in digital markets ***Target Audience:*** Organizations that want to benefit from digital transformation ***Development Procedure:*** Seven individual research results that were developed and refined with practitioners ***Methodology Components:*** Consistently presented methods: (1) description and goal, (2) process and execution, (3) experiences, tips and tricks (optional). This usually includes: any restrictions on technologies/domains, step-by-step instructions, canvases/templates as inspiration and visualization tools, explanations based on a practical example, hints for moderation and execution ***Application Instructions:*** Recommendations for workshop formats: participants, the role of a separate moderator, agenda (e.g., recommendation of introductory keynote speeches), supporting collaboration tools ***Situational Guidance:*** Description of possible application contexts; “meta-methods” to select appropriate methodological approach depending on the context
IMPRESS – Pattern-based Planning of Smart Services *(IMPRESS)*	***Publication Form:*** Web application (released in 05/2022) ***Stated Purpose:*** Supporting transformation to smart service provider by providing a toolkit of methods and reusable solution patterns ***Target Audience:*** Mid-level management of traditional product manufacturers ***Development Procedure:*** Development in a heterogeneous project team from research and practice as part of a funded consortium project ***Methodology Components:*** Norm strategies, business model patterns, and solution modules using practical examples; reference transformation process incl. work design, organization, processes and roles, required competencies ***Application Instructions:*** Guidance through overall structure and navigation of the web application; import/export functions; moderation plans for workshops ***Situational Guidance:*** Individual process design using presented process patterns; partially automated situational recommendations based on user input

Table 2. Overview of reviewed SSI methodologies

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