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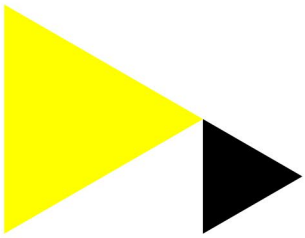

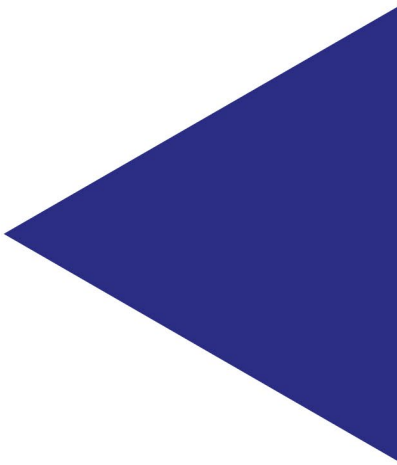

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Innovating digitally for services: A review of innovation process literature focused on digital innovation and service innovation

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Abstract

While literature and practice acknowledge the potential of service innovation as well as digitally enabled innovation processes, the diverse innovation process literature lacks a process model which combines these two aspects. This systematic literature review aims at filling this gap by analysing innovation process theories and approaches with a specific focus on service and digital innovation. 25 conceptualisations of innovation processes were distilled and analysed in detail to present a 'digital innovation process for services' model which includes steps on three levels. Consequently, this literature review expands the current state-of-research and acts as the groundwork for further innovation research projects.

Keywords: innovation process; digital innovation; service innovation; process mapping;

1. Introduction

In the light of new trends such as digitalization and servitization, staying competitive proves to be a difficult task for many companies. Due to the challenges arising from changes in technology and customer behaviour,

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companies are asked to constantly innovate [1]. In this regard, servitization or service innovation has appeared as a successful way for many companies to overcome the dead-end road of competition [2]. As companies focus more and more on developing services, service innovation has started to gain increasing attention also in research causing the traditional product innovation view to shift towards a multidimensional service innovation view, see e.g. [3, 4]. However, the development and designing of new services is still little researched and not a lot is known about the process behind the development [5]. The knowledge and understanding about how digital technologies are being strategically used during the process of service innovation is even more limited [6]. Therefore, to fill this knowledge gap, this literature review shall shine light on the digital innovation process for services. By reviewing current and well-established theories and approaches on innovation processes and mapping the identified innovation processes against each other, a new digital innovation process for service development can be created.

While extant literature acknowledges the potential of the combination of servitization and digitalization [7], most studies rather focus on the outcome than the process of innovation [8, 9]. Thus, they consider the potential of digital technologies as part of the service innovation, but not as facilitating the innovation process. Instead, this study contributes to the process-centred literature on innovation which takes digital tools as facilitating and enabling element for service innovation development. Seeing the missing literature to this regard and the forced digitalization due to the pandemic situation also influencing companies' innovation process application, this study not only adds to the innovation process literature, but also to enabling businesses to better adapt to the new digital situation. As such, we are addressing the call for future research of [10] asking for more extensive research on the process perspective of digital innovation.

Based on this identified research gap, the aim of the literature review is to study existing scientific and practice-oriented theories and approaches on innovation management and innovation processes to develop a new understanding and a new model of service innovation processes in a digital format. In this context, it shall be explored (1) how innovation processes are specifically shaped in different theories and approaches, (2) which specific characteristics need to be added, changed, or removed to construct a service innovation process, and (3) how the influence of digital technologies is described in innovation – especially service innovation – process literature.

In the course of this literature review, we will answer these questions including insights such as the generally broad life cycle of sequence depending on the specific focus of innovation and context of occurrence, service innovation focusing on the front end and customer-centricity of the process, and digital innovation thereby facilitating service innovation for example in the opportunity identification steps.

But before going into more detail of the literature review findings, firstly, a conceptual framework with agreed definitions of key terms is presented. This is followed by a detailed description of the methodological approach with its analytical steps to clarify the literature search, analysis, and processing procedure. Based on the methodological approach, the identified relevant innovation process literature is presented according to a before formulated categorisation. Preceding the main mapping of innovation processes, it shall give a first impression of the available literature and its specific focus. Finally, this paper results in the mapping of an up-to-date digital innovation process for services. Although a wide range of literature on innovation processes – renowned and well-established as well as recent and up to date – is portrayed, service- and digital-specific aspects will be highlighted. Following the mapping procedure, a three-level model is constructed which will not only contribute to the ongoing discussion in innovation process literature, but also provide a detailed while structured model for implementation in businesses.

2. Conceptual overview – Definitions of relevant terms

Before starting the detailed review of relevant literature, certain definitions of terms need to be clarified to frame the context of the review. Starting with the key topic and focus of this study – digital innovation process for services – certain related terms shall be defined. Therefore, this term shall be broken down into its relevant sub-concepts to define the framing of the study. Based on scientific literature different definitions were identified, analysed, and compared to select those specifically fitting to the context of the study. Based on a commonly agreed understanding of the term innovation [11, 12, 13], the general concept of innovation process was defined [11, 14]. Next, the specifications digitalization [13, 7] and servitization [16] as well as its relation to innovation [13, 15, 10, 8, 9] was analysed. The final definitions used for this paper are specified in the following table 1.

Table 1. Final definitions of relevant terms.

Term to be defined	Final definition
Innovation	Innovation is the production or adoption, assimilation, and exploitation of value-added novelty in outputs – such as products, services, and markets – which are implemented. It is both a process and an outcome [11, 12, 13].
Innovation process	Innovation process is a nonlinear cycle of divergent and convergent activities that may repeat in unpredictable ways over time. It is highly iterative, and organisations may enter the process at different stages and backtrack to earlier points but engaging in innovation follows a broadly agreed life cycle [11, 14].
Digitization and Digitalization	Digitization is the transformation from analogue to digital data while digitalization is the application of digital technologies to society [13, 7].
Digital innovation	Digital innovation is the use of digital technology during the process of innovating [13, 15, 10].
Servitization	Servitization is the transformational process of shifting from a product-centric business model and logic to a service-centric approach [16].
Service innovation	Service innovation is the rebundling of diverse resources and change of roles and composition of the actor network involved in the value creation processes [8, 9].

While these definitions shall form a precise framing, it shall be specifically highlighted that the combined term ‘digital service innovation’ does not refer to the development of a digitally based service such as an online platform for customers or an app-based solution, but rather focuses on the digitalisation of the service innovation process itself. Consequently, we will refer to ‘digital innovation for services’ to avoid misunderstandings.

Before taking a detailed look into the methodology of the literature review, the 25 theories considered as relevant were categorised according to certain criteria to give a first overview of the chosen literature foci. Following the idea of an outcome and process perspective as depicted by [11, 12, 13], the following criteria were chosen. While an innovation process is considered to follow an overall agreed lifecycle, specific attention shall be placed on *iterative* elements [11, 14]. Furthermore, as this paper considers the specification of digital innovation [13, 15, 10], the existing or non-existing *digital focus* of the reviewed innovation process theories is presented. To also account for the specification of service innovation, the outcome focus is chosen as a second perspective. In this context, it will be presented in how far the considered theory of approaches is focused on either *products* or *services* or both.

3. Methodology of literature review

Prior to the literature review, the methodological approach shall be outlined. Starting with the literature search in the first step, a set of criteria was decided on regarding the selection and inclusion of papers. To remain within the scope of a process view, only papers were included which specifically focused on innovation models describing the sequences of activities and innovation phases. Furthermore, the contribution of the papers to the theoretical background behind service innovation and to relevant definitions was another criterion of inclusion. In order to provide a state-of-the-art review on new digital innovation processes for services, the literature review will specifically focus on service and digital innovation literature. As such, we consider scientific literature which was published since the emergence of the service focus in innovation literature as first mentioned in [19], starting to theorise innovation in services for the first time. Thus, papers from 1986 until 2021 were considered including well-established as well as current theories and approaches. For an extensive literature research, databases such as Science Direct and Google Scholar were conducted. In addition, a structured search on the Web of Science was carried out including the time period as well as specific search terms. The search terms used during the creation of the relevant literature database consisted of different combinations of the following terms:

- Innovation, innovation management, innovation process
- Digital innovation, digitalization, digital tools
- Servitization, service innovation, services, service sector

The literature search yielded 242 results according to the databases used. After a first round of screening, only 80 articles were perceived to be specifically relevant for the literature review. After a more detailed analysis of these

articles, 55 articles remained which provided the theoretical base and contributed to development of the new service development model for this literature review. Specifically, 25 of these scientific articles were found to include innovation process theories and approach which were used for the mapping of innovation processes.

Following the initial categorisation of the literature, a detailed process mapping procedure is carried out to lead to the process framework in the end. The process mapping was broken down into six different steps (see figure 1). Firstly, one basic innovation process, which appeared as most relevant for the topic, was decided on. Secondly, further processes in the field of innovation management, innovation processes, digital innovation, service innovation and similar fields were identified. Thirdly, the actual mapping process was structured into three different rounds. In the first round of process mapping, the different innovation process theories were simply broken down into their general phases that described the innovation process and mapped to the identified basic model in step 1. In a second round of mapping, the roughly mapped processes were reviewed in detail by identifying and distinguishing the specific activities and tasks within each process step to verify their fit to the chosen phase. In a last round of process mapping, the highlighted similarities and service-specific activities were simplified by combining the process steps.

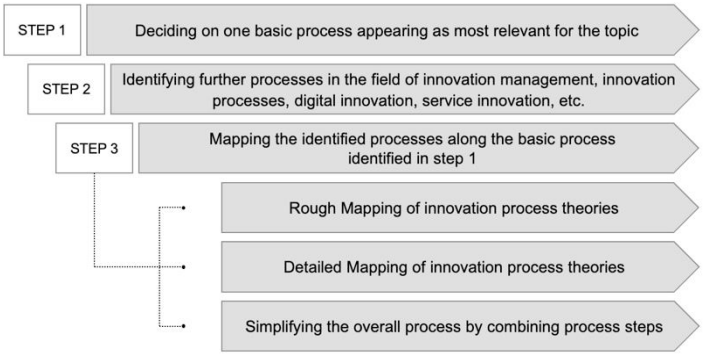

Fig. 1. Conceptual model of literature review (own depiction).

The detailed process mapping resulted in a three-level digital innovation process model for services which can be universally applied within the range of service innovation processes.

4. Literature review

4.1. Categorisation of innovation process literature

Based on academic literature, 25 approaches on innovation processes were identified for this literature review. The focus during the research was on specific theories about the different stages and phases of an innovation process to identify a general digital innovation process applicable to the creation of service offerings. In table 2, an overview is given on the various identified innovation processes and their specific theoretical focus.

The 25 identified innovation processes revealed that many innovation process phases are considered to be similar, and some stages were found repeatedly in various theories, i.e., some sort of ‘ideation’ steps and different variations of ‘development’ steps. Often, the theories differed in terms of their specific focus on different phases. Innovation theories such as Design Thinking [23] or The Fuzzy Front-End theories [28, 29], among others, put more emphasis on the early stages of an innovation process while other theories disclosed more insights on how service innovation can develop from existing solutions e.g. [19], focusing more on the later stages. Most of the identified theories on innovation processes took a general approach or a product approach whereas only a few specialised on service innovation. Some approaches showcasing innovation were very detailed and included specific tasks in each step e.g. [18], while some theories merely described the general directions in which the innovation process could move e.g. [11]. Moreover, another key insight is the fact that innovation processes are required to be differentiated depending on the context in which they proceed and the need to include these differences in the innovation digitalisation process.

As some companies struggle to manage innovation based on universal models, this is an important aspect to be highlighted [37].

Table 2. Overview of different innovation processes and their specific focus

Studies and approaches on innovation processes	Iterative element	Digital focus	Product focus	Service focus
1. Digital Service Innovation Process [13]		x		x
2. Process Theory of Innovation [12]			x	x
3. Disruptive Innovation Process [17]			x	x
4. New Service Development Process [18]	x			x
5. Reverse Product Cycle [19]				x
6. Stage-Gate-Model [20]			x	
7. Product Development Funnel [21]			x	
8. Service Innovation Process [22]				x
9. Design Thinking [23]	x		x	x
10. Design Thinking-Based Innovation [24]	x		x	x
11. Innovation Journey [11]	x		x	x
12. Service Logic Value Generation Process [25]	x			x
13. Innovation Management Process [26]			x	
14. Iterative Stage-Gate-Model [27]	x		x	
15. The Fuzzy Front End of Innovation [28]			x	
16. The Fuzzy Front End [29]			x	
17. D4 Roadmap [30]			x	x
18. Outcome-Driven Innovation (Jobs-to-be-done theory) [31]			x	
19. Innovation Life-Cycle [14]	x			
20. Digital Service Innovation Sprints [14]	x	x		x
21. Innovation Process for Services [32]				x
22. Revised Theoretical Model for Service Innovation [33]				x
23. Public sector innovation process [34]	x		x	x
24. Overlapping Stage-Model [35]	x	x	x	
25. Search Model [36]			x	x

Further differences were found with regard to the sequence of innovation steps. Many theories mentioned an iterative approach and a non-linear life cycle e.g. [11, 18, 23, 27] contrasting linear innovation processes e.g. [20]. Moreover, focusing specifically on service innovation, it was stated that service innovation occurred differently from firm to firm – some followed a rather strict structure of innovation steps while other companies innovated more flexibly and unstructured [18]. Especially Van de Ven [11] claimed that innovations cannot be reduced to a fixed sequence of steps and stages which is why a usual stage gate model [20] cannot truly depict the innovation life cycle which rather consists of a "nonlinear cycle of divergent and convergent activities that may repeat in unpredictable ways over time" [11, p.40]. In this context, according to a case study on 17 companies [18], a rough summary of innovation activities revealed that - despite the structural differences in the innovation steps - all companies put explicit focus on the front end of the process, 'gathering customer insights' being the most important key activity. This insight is kept in mind during mapping the innovation processes.

4.2. Mapping of digital innovation process for services

To account for the specifics of service and digital innovation, these specific elements were highlighted throughout the process mapping. The result of the process mapping consists of a digital innovation process model for services. In total, six overall digital service innovation process steps were summarised on the first level (see figure 2) which, in

turn, contain 19 different detailed process steps on the second level. Various exemplary concrete activities complete the third level to account for company context elements, especially the context of small and medium-sized enterprises. A full overview of the three-level process can be seen in the Appendix. The first level of the digital innovation process for services goes as follows:

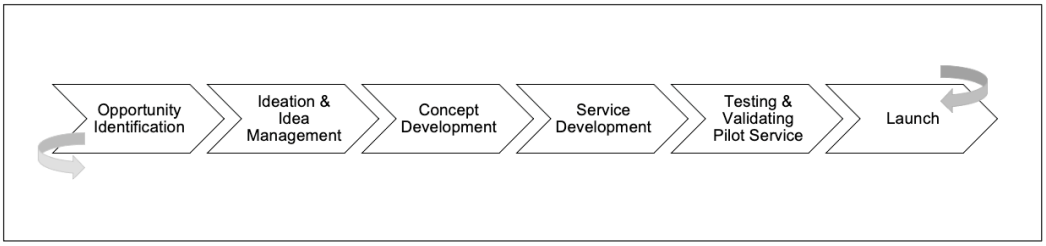

Fig. 2. First level stages of the Digital Innovation Process for Services (own depiction).

The first process step is *Opportunity Identification*. It consists of firstly gathering customer insights, then identifying areas of opportunities from these insights and lastly, identifying customer needs for digital services. Concrete activities, for instance, would involve conducting market research and customer interviews, study new trends and technology and observing customer and target groups. This step is necessary to understand and scope a problem based on the needs of customers and/or users.

The second process step is *Ideation and Idea Management*. During process mapping, it became clear that the 'Ideation Phase' not only involved the creation of ideas, but the complete decision-making process involved. Therefore, the second process step entails, in detail, idea generation, idea scoping, idea assessment and idea prioritising and selection. These steps comprise concrete activities from brainstorming, sketching out service blueprints over risk evaluation to ranking the ideas. The focus is not only on idea generation but puts equal emphasis on selecting the right idea that is based on the problem identified.

The next step that follows is *Concept Development* which includes detailed process steps such as concept generation, concept description, concept selection and concept testing. This process phase focuses on, among other activities, very detailed and advanced ideation with concepting activities, describing practical use cases, and creating first prototypes and first drafts of the idea that are tested with customers. During this phase, the idea is enhanced with more details and brought to life. Important aspects are concretised such as the value proposition.

As the fourth process step, the *(Service) Development* phase takes place. Explicitly process steps that are relevant for service innovation have been established which are the implementation of changes after having tested the concept, experimentation and/or simulation of the implemented ideas, the development of different service elements as well as the preparation for validation of the service innovation. In this process stage, implementation and integration activities such as software development would be a focus, design activities, many rounds of prototyping and developing a pilot service. Validation activities are prepared for the next stage such as planning usability tests.

The fifth stage is *Testing and Validating the Pilot Service*. This includes the instalment and deployment of developed services, setting up the pilot service and testing and validating the pilot service. Overall, this phase is characterised with preparational activities for the pilot service, setting up a way to showcase the pilot service such as setting up a pilot store and doing many different customer tests such as field tests, beta tests or in-home use tests. All these tests will be focused on acquiring direct feedback from first-time users or customers or gaining insights into their behaviour.

The last stage is the *Launch* of the service innovation which mainly focuses on commercialisation. Commercialisation would entail concrete activities such as implementing a market launch plan, generating first sales and continuous verification of the solution.

All these six phases are meant to follow an *iterative approach* which allows to iterate within each phase but also between different phases. Therefore, during the many testing activities, it is possible to gain significant insights which lead to having to backtrack in the process phases to redefine certain implications or make necessary changes to the

idea or development. Therefore, this digital service innovation process model is not to be understood as a fixed sequential model but allows for some stages to be skipped and for some to go in parallel to each other.

A full overview of the three-level process with all synthesised insights from the 25 identified innovation processes can be seen in table 3. While the first level refers to the overall steps as briefly described above, the second level presents a more detailed procedure of steps. Finally, the third level refers to specific tasks which are considered to be part of the respective process step.

Table 3. Three-level Digital Innovation Process for Services.

First Level	Second Level	Third level
Opportunity Identification	1. Gathering customer insights	Market research; customer interviews; identifying nuggets and stories; identifying dimensions of user behaviour; creating timelines, e.g., day-in-the-life timelines; gathering information about customer's preferences
	2. Identify areas of opportunity	Studying new trends, approaches, and technology; defining innovation challenge; identifying jobs-to-be-done and outcomes for each job; desktop research; problem scoping
	3. Identify needs for digital services	Fundamental research; observational or ethnographic research; participant observation; non-participant observation; separation of user experience into phases; testing initial assumptions; preparing preliminary roadmap for observation and interviewing
Ideation & Idea Management	4. Idea Generation	Generating ideas for products, services, and environments; generating ideas with different perspectives, e.g. customer-oriented, technology-oriented, cost-oriented; generating ideas using different methods, e.g. brainstorming, customer journey, touchpoint approach, storytelling, and lead user method; questioning and challenging existing assumptions; exploring solutions through various combinations and substitution; identifying new paradigms for potential solution generation; seeking solutions from outside knowledge databases; applying solutions from nature's problem solving; including customers by letting them provide ideas; interaction with service ecosystem actors
	5. Idea Scoping	Visualising and detailed descriptions of ideas using sketches, service blueprints, or customer journeys; stakeholder analysis; problem scoping and definition; determining customer demands using skills workshops, life cycle analyses, or trend analyses; focusing ideation efforts on specific performance metrics
	6. Idea assessment	Determining implications of ideas (people, time, or costs); finding practical uses for ideas; assessment according to solving problems and needs of users/customers; assessment according to attractiveness, risk, and alignment with existing projects; evaluating ideas against the same specific performance metrics to determine which ideas will get the job done
	7. Idea prioritising & selection	Sorting and prioritising ideas; evaluating against outcome expectations; strengthening and shaping ideas
Concept Development	8. Concept generation	Very detailed ideation with concepting activities; more detailed research activities, e.g., about customer behaviour; soliciting feedback from potential users; logical or intuitive concept generation techniques, e.g., morphological analysis, brainstorming, sketching, or word association
	9. Concept description	Creating concept descriptions using use cases, blueprints, or service process description; building use cases; formulating value propositions; discussion of background processes; building rollout plan
	10. Concept selection	Selecting concepts based on decision tools and prioritisation methods
	11. Concept testing	Creating first prototypes (first drafts of e.g., service user interface visualisation); determining learning goals; refining concept designs into many prototypes (products, services, and process concepts); validating prototypes by testing concepts with handful of stakeholders and customers; acquiring feedback from users or customers (iteratively)
Service Development	12. Implementation of changes	Completing detailed design of new service; technical and system-based implementation, or integration activities like software development; developing a test plan (integrated rollout plan)
	13. Experimentation or simulation of implemented ideas	Setting up pilot systems; prototyping; detailed tests; marketing and operations plans; including customers as co-creators and testers

Service Development	14. Development of different service elements	Finalising service elements like user interface design; design of systems that allows and sustains new user experience; further rounds of prototyping and testing; pilot service development
	15. Preparation for validation	Planning of customer and user interviews; planning of usability tests; design reviews
Testing & Validating Pilot Service	16. Installation and deployment of services	Preparational activities for pilot service
	17. Setting up pilot service	Setting up a way to showcase pilot service, e.g., a pilot store with service and tangible components of service solution
	18. Testing and validating	Doing customer tests; user or field trials (testing service under actual use conditions); beta tests; in-home tests; trial sell and usability tests; collecting data from customers and users about behaviour or feedback; finalising designs and service components
Launch	19. Commercialisation	Implementation of market launch plan and operations plan; generating sales; continuous solution verification

5. Research contribution and implications

Seeking to develop a new understanding and a new model of service innovation processes in a digital format, through our analysis, this study makes several contributions to theory and practice. Firstly, reviewing existing literature from a process perspective, this paper highlights the divergent discussion on linear and non-linear process models and their inclusion of iterative elements. By focusing on innovation process literature surrounding digital innovation as well as service innovation foci, this study provides a detailed picture of specific elements within the general innovation process and stresses their importance. As such, we contribute to the recent scientific literature by providing a macro-level – first level – as well as meso- and micro-level – second and third level – view on innovation process modelling. By mapping existing innovation process theories and approaches with different level of representation and detail, such as [11] and [18], or different focus, such as on initial steps [23] and [28] or on the later steps [19], relevant innovation process literature is not only synthesised on the specific level, but also set into the relation between the different levels and foci.

Secondly, this paper contributes to practice in teaching future innovation experts and enabling companies to perform digital innovation for services by providing a scientifically grounded while practice-oriented process model. While targeting innovation process educators as well as businesses, it shall serve as a framework for application. In this context, the presented process mapping shows its strength in giving an overview of the process on the first and second level, while also providing detailed, at-hand tasks to follow on the third level. Regarding educators, this model shall provide a first step towards enabling them to teach innovation processes on a state-of-the-art level, thereby, enabling future experts in this field. Next to this, businesses find value in applying the model in their innovation development processes to strengthen their service-oriented perspective and be facilitated by digital applications.

Thirdly, this study presents a new approach to process mapping methodology on multi levels as a basis for future research in order to conceptualise an implementation of digital innovation process for service companies.

6. Conclusion and future research

Having contributed to clarifying the research question on how innovation-as-a-process takes place, this literature review expands the current state-of-research and can act as the groundwork for further innovation research projects. Although the research question was successfully answered, certain limitations shall be mentioned and future research opportunities highlighted. Having aimed for an up-to-date process model, this study falls under the limitation of time, presenting a need for future revision of the model to stay up to date. Furthermore, the dynamics found in innovation literature have asked for a clear definition of certain terms to present the framing of the study. Consequently, specifications outside of the agreed definitions have not been considered in this paper. In this context, the specific consideration of innovation process for ‘digital services’ appears as an interesting field of research for the future.

Additionally, it needs to be mentioned that only a selection of relevant innovation process literature could be considered – following the criteria of theories being well-established and/or recent. As a result, important theories and approaches considered in practice might be missing. To fill this gap, we propose follow-up, empirical studies on innovation processes used in practice.

Based on the presented options for future research, further validation steps shall follow to finalise the proposed model. It is recommended to carry out a qualitative study on innovation process teaching practices with educators in higher education institutions to partly fill this gap.

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