A Proposition for a Service Systems Design Method*

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1 State of research

Service science studies complex socio-technical service systems. To understand them, service science requires a multidisciplinary approach and a combination of methods and logic from fields, such as computer science, psychology, design, marketing, and more [1]. We are interested in advancing service science by combining three research areas, namely: opportunity recognition, business modeling, and software engineering.

The desired outcome of the project is a service system design method (**Error! Reference source not found.**) that links together three levels – an individual intuition of business, an organization of business, and an IT implementation. On the first design level, an individual, inspired by its environment, gets business ideas that they believe to be valuable to a customer segment. The individual designs the second (organizational) level with other people as a service system. The organizational level feeds the third (IT implementation) level with fuzzy business needs. The IT implementation phase yields a concrete artifact.

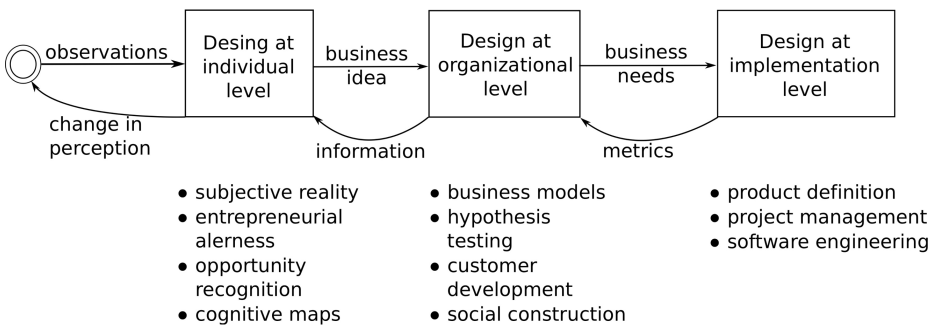

Fig. 1. Provisional service systems design method

On each level, there is:

1. input – information received from the previous step;
2. output – processed data provided to the next level;
3. feedback / guidelines – meta information that we provide to the service designer to support their work;

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4. actions that transform the input into output and process the feedback.

1.1 Individual Level

The literature describes opportunity recognition (identification) as a cognitive process that consists of active or passive search, alertness, and prior knowledge [2]. Tang et al. [3] argue that the most prominent traits for opportunity identification is entrepreneurial alertness. The framework on pattern recognition [2] describes the opportunity recognition phenomenon as entrepreneurs being able to draw parallels and find similarities (i.e., patterns) in various contexts with alertness surpassing active search for information. Individuals use cognitive maps (or frameworks) to represent internally the perceived information, and these maps link together seemingly unrelated notation into opportunities (Weick, 1990). The last step in opportunity recognition is reconfiguration of elements [4], leading to an individual's proposal for a new reality to the society, hence, social construction.

Issues: The individual's intuition of a business opportunity does not translate flawlessly to the next level, where a group of people should achieve a shared understanding.

- Input: identification of observations that leads to a business idea;
- Output: conceptualization of the observations of the individual, first level of structuring;
- Feedback: definition of the information the individual should seek to evaluate their perception regarding the business idea.

1.2 Organizational Level

This new reality goes beyond an individual's cognitive map into an explicit shared understanding of what the envisioned reality would be. Entrepreneurs often use business models to communicate their business proposition with others. A business model captures the most important parts of a business – the way it creates and captures value for a particular set of customers [5]. From a broad perspective, a business model is a story that explains how the enterprise works [6]. Since a business model is an abstraction (it hides the complexity of implementation), the outcome of the implementation may differ from this abstract description. The hypotheses require feedback to adjust the current situation and to be able to achieve the to-be state for the organization.

Issues: At the organization level, the transition between an individual's idea (an imagined service to deliver value) to a structured definition of the service system (conceptual shared service system design) is non-trivial.

- Input: individual's cognitive maps;
- Output: a structured definition of a service system that considers / integrates all individual cognitive maps.
- Feedback: definition of heuristics and of metrics to be monitored from the implementation phase.

1.3 Implementation Level

The implementation level calls for alignment between business and IT. Zachman [9] introduces an information systems architecture that is foundational to the field of enterprise and service-oriented architecture. Weigand et al. [10] argue that to achieve alignment in enterprise architecture, we need to adopt a service perspective. IT-business alignment can be based on value exchange. For example, value-based software engineering recognizes the need for market justification for software and Information and Communication Technology (ICT) infrastructure [11]. This value-based view over software engineering serves as grounds for service-oriented modeling methods such as SEAM (Systemic enterprise architecture methodology). SEAM is a family of methods for strategic thinking, business / IT alignment, and requirements engineering. SEAM is based on software engineering and on Systems Thinking philosophical principles [12].

Issues: At the implementation level, we need to define a desired input which corresponds to concrete business needs and is implementable (i.e., minimizing uncertainty). By tracing the business value, we need to be able to justify the software requirements. In addition, we need to be able to supply relevant metrics to the organization level to test business hypotheses.

- Input: mapping between the business needs and service requirements.
- Output: service that delivers a concrete IT artifact to service adopters.
- Feedback: data from the interaction to feed the feedback loops in the previous level.

1.4 Current Research

One existing research project in our area is on alignment of human-centered service systems with corresponding business models [13]. The project focuses on design principles to facilitate the alignment. It is an early stage research project; it has been presented as a research-in-progress. The primary focus of the project is to implement service innovations that have underlying business models. The design principles guide service designers what actions to take. So far two principles have been stated – define scenarios, and define scale and scope of the service innovation. The validation of the principles is ongoing. The project does not consider IT implementation. In addition, it features few details on the individual's cognition and the possible implications.

Hypothesis-testing entrepreneurship is based on the Lean Startup [8]. It is a practice-oriented approach towards entrepreneurship. The presented work is a case, which summarizes [14]. The approach describes steps to achieve a product-market fit. Yet, the details on information and value exchange are minimal. The method is well-recognized in the industry but could be extended by data collection, analysis, and validation.

The current state of SEAM, the method for enterprise and service-oriented architecture, developed in the lab, includes models to analyze and design service adopter motivation and value-based alignment of hierarchical service systems. The present project uses it to design service systems that connect the organizational and implementation levels, with focus on value transformation between the levels. Potentially, we could extend SEAM to the individual designer's level and add explicit feedback mechanisms between levels.

2 State of research work performed by student

The current state of the performed work involves three contexts in which we execute the research. First, on an individual level within a business design class for computer science students. Second, within the context of a collaborating startup, where we observe the transition from an individual to an organizational level and initial implementation. Third, within the context of an established company and implementation in a structured context. We have an industry lab partner who uses a service approach to develop customer-relation management systems for larger companies such as financial institution. As the project develops, we might choose different industry partners.

1. Teaching (individual)

The project describes our teaching approach based on experiential learning, systems thinking and service-dominant logic. We present how by repetition we teach students to recognize principles/ patterns that exist in the practice and to understand how the same principles and patterns can be used in different contexts. We have collected data with two questionnaires during the semester. The project was presented a research-in-progress at ISPIM 2017. We test our hypotheses on how individuals perceive business opportunities, how they structure their business ideas and begin to model businesses.

2. Startups (from individual to organization)

The project investigates how a startup structures business hypotheses, makes decision-making process explicit, and evolves from fluid organization into a structured one. Our primary focus is to inspect how we can trace value exchange between elements in a business model, and hence, design service systems based on value transformation with the help of business models. We collect data during our collaborations with a startup. The relevance for the project to collect data on how multiple individuals start sharing their own perceptions and form a shared view of the business idea, how they shape the business needs into service requirements.

3. Industry (organization and implementation)

The project investigates the opportunity recognition process within established companies. Industry collaboration on requirements engineering, project definition, and software development. We have collected data from a field project (4 days of participation in requirements specifications workshops for a customer-relationship management system). We observe how a structured organization formalizes their business needs for the implementation of a new service.

3 Research Methodology: Design science research

The research methodology is based on design science research. “Design science […] creates and evaluates IT artifacts intended to solve identified organizational problems” [15]. By designing an artifact, we solve a practical problem and contribute to the knowledge base. “Artifacts are defined as constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems)” [15].

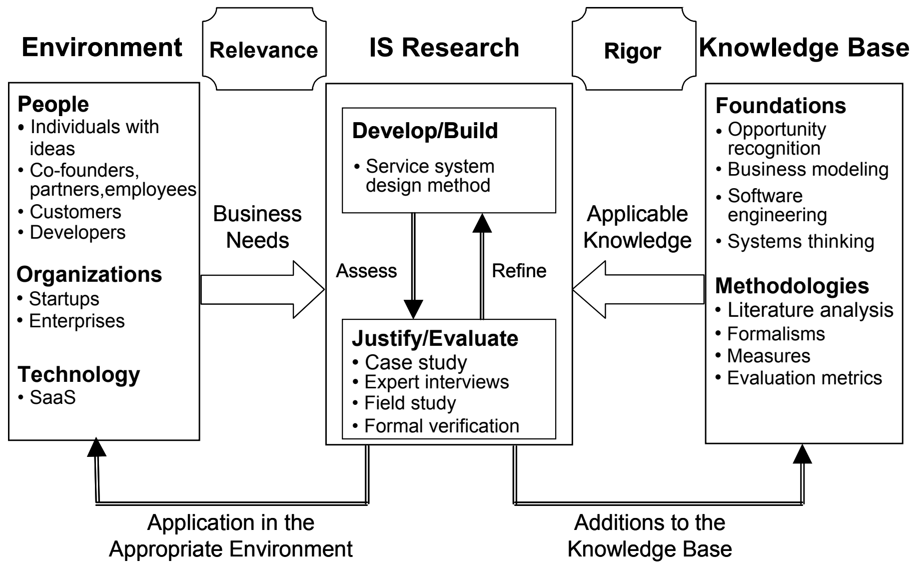

Fig. 2. Research design based on [15]

In our case, the practical problem is that startups struggle to design businesses and corresponding software solutions. Our artifact is a method to design service systems. To build a method, we first need to identify and combine constructs and models, which are going to correspond to inputs, outputs, and feedbacks between the levels (individual, organization, implementation) and evaluate their relevance. Then, we need to design the artifact (a method) based on these constructs and models. To obtain constructs and models, we perform literature analysis to identify what exists already and we conduct field studies to understand what is in use. We evaluate them with expert interviews and case studies. Second, we design the artifact (a service design method) by using the previously identified set. The build phase again is based on literature analysis and field studies. We evaluate to what extent the proposed method solves the practical problem with expert interviews, case studies, and formal verification of models. This concludes the application in the appropriate environment. Third, we contribute to the knowledge base. The evaluation criteria on the theoretical contribution come from the knowledge base methodologies.

4 Doctoral project timeline

The execution of the research project will follow an iterative approach. There will be three iterations, for each academic year, and a final thesis writing period after the last iteration.

Table 1. Doctoral project timeline

Objective	Iteration 1	Iteration 2	Iteration 3
Constructs and models design	Sep - Nov 2017	Sep - Oct 2018	Sep 2019
Constructs and models evaluation	Dec 2017 - Feb 2018	Nov 2018–Feb 2019	Oct – Dec 2019
Method design	Mar – May 2018	Mar – Apr 2019	Jan – Feb 2020
Method evaluation	Jun – Aug 2018	May – Aug 2019	Feb – Apr 2020

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