Customize the service design process:

From the perspective of evaluating stakeholder engagement

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Abstract

Service design principles are an important measure to guide service designers to achieve a favorable service design process. Timely evaluation and improvement of the design process are essential to avoid risks and failures promptly and efficiently. Stakeholders, as a critical element in human-centred and collaborative service design, and their values need to be discussed. Through the recognition of the importance of different stakeholders, proper stakeholder engagement can be planned and implemented. Clarifying the internal relationship between stakeholder participation and the service design process, enables service designers to determine measurement criteria for decision-making during the planning of the service design process, from the perspective of stakeholder participation. Especially in a design context where there are many restrictions, guidance is urgently needed to adjust the service design process properly. This study reflects the interaction between the acknowledgment of the value of stakeholder participation and the customization of the service design process.

Keywords: Service design process, stakeholder engagement, human-centred, collaborative

Further information

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Content

1.0 Introduction

1.1 The topic under investigation and Research background

The topic under investigation

Service design, still described as an 'emerging field' a few years ago (Mager, 2009; Bisset, 2010), has nowadays experienced rapid and notable evolution with developed academic networks. This discipline is now possessing a rising reputation and impacts in the public sector and social services. Driven by changes and demands in economy and marketing (Moritz, 2005; Stickdorn, Hormess, Lawrence & Schneider, 2018), the origin of service design indicates that it is a highly practical discipline. The standard models of the service design process and various tools and methods that reflect the characteristics of service design are introduced in this study, which are useful and productive. Although the standard models of the design process are widely spread and used in academia, many researchers emphasize that the process of service design should be customized according to practical constraints or needs (Best, 2006; Design Council, 2015; Stickdorn et al., 2018). Especially in research-oriented projects or projects related to the public sector with many restrictions, how to correctly and effectively adjust the service design process still lacks common guidance.

Recognizing the value of different stakeholders is the key to realizing human-centred service design, while the participation of stakeholders emphasizes the fundamental principle of service design-collaborative. Therefore, the appropriate plan and implementation of stakeholder engagement seem to be positioned at the core of service design. Based on this view, service designers may be able to establish a reasonable measurement standard of a favorable service design process from the perspective of stakeholders. This research is aiming to figure out a practical service design process model under non-ideal service design context, based on exploring the relationship between appropriate stakeholder participation and structuring the service design process.

Research background (Design project, the design team and selected design tools and approaches)

- *The design project and the design team*

This research is progressing together with the design project inspired by the Critical Communication, Safety and Human-Centered Services of the Future project (2016-2017). Implemented by the Media Pedagogy Center of the University of Lapland and the Service

Innovation Corner SINCO of the Faculty of Arts in cooperation with several foreign universities, the CRICS (2016-2017) project works on developing simulation-based education, critical communication in healthcare, and social services. At the final stages of the CRICS (2016-2017) project, our project team discovered the possibility of extending this research subject.

Under the context of the CRICS (2016-2017) project, Myself, Zhang Yuanyuan, and Hossein Tabandehpour (later withdrew for personal reasons) together formed a project team, aiming for optimizing the emergency ambulance service in Rovaniemi, Finland, with full use of service design knowledge and skills. All three students from our team were studying the major of service design at the University of Lapland. In this design project, our main task is to find out the urgent needs and problems of emergency ambulance service under the arctic context with various service design methods or tools.

- *Selected design tools and approaches*

Our design project team created a new service period for the emergency ambulance service in Rovaniemi by design proposals of a mobile phone application, website, and wearable device through the usage of several service design tools (customer journey map, user personas, brainstorming, stakeholder map, and service blueprint). The design outcomes were then tested and evaluated through experience prototype embedded in a design workshop.

The workshop followed the order: the introduction of our project, a few warm-up games, two service scenarios with the questionnaire embedded, and a focus group discussion. The whole workshop began with a brief slideshow of our project purpose. Buchenau and Suri (2000) define experience prototype as any kind of representation, in any medium, designed to understand, explore or communicate what it might be like to engage with the product, space, or system we are designing. The simulation of the service experience can be realized with some form of mock-up of the service system (Lawrence et al., 2010). In our workshop, we carried out two role plays on specific service scenarios that may happen in medical emergency services with physical mock-ups of the products and environments. One is about a foreigner falling while biking in Ounasvaara, a ski resort located in the center of Rovaniemi city. The other one simulates a Finnish resident fainting in the city center of Rovaniemi. These two scenarios are advanced for covering most functions of the service path and the mobile application while involving all stakeholders.

According to the above process, it can be found that in addition to some props provided by the laboratory, some tools and instructions need to be designed and implemented respectively. We named all the characters in the role plays and used simple sentences to explain the event situation or the task of the character. The participants received character names and the prompt cards (see Appendices 1) to carry and view at any time. Prompt cards were distributed randomly and were not made public to other participants. Because the specific functions of the wearable device are not the focus of our research, we designed a paper bracelet to simply simulate its appearance. The interaction of mobile phone software was realized through the design of high-fidelity prototype which was highly functional and interactive. We used Marvel software to link the clickable buttons on the specific application interface with the target interface to make the software interactive. This high-fidelity prototype allowed us to test the usability in the workflow.

1.2 Research questions and methodology

This research aims to reveal the inner connection with stakeholder engagement and the service design process. Furthermore, a customized model of the service design process is provided from the perspective of the evaluation of stakeholder participation. Thus, the main research question is “How to customize the service design process from the perspective of the assessment of stakeholder engagement?”. This question is elaborated on by three sub-questions:

- How to improve a service from a human-centred perspective?
- How does stakeholder engagement reflect service design principles and how can such insights contribute to new knowledge and learning of service design processes?

I conducted a mixed-method approach in this research and used action research as my research strategy. The data collection methods applied are the key informant interview, questionnaires, in-depth interviews, observation, and focus group discussion. The data are analyzed through statistics and content analysis.

1.3 Thesis structure

Here, in the first chapter, I introduce the research topics and research background (the design project process and design project team). Along with this, there are specific explanations for the research questions and the significance and limitations of the research. In the second chapter, I first reviewed the literature about the theoretical content of the service design field. I then narrowed the

topic down to stakeholder engagement, reflecting the collaborative and human-centred principles of service design. With further discussion of the importance of stakeholders and tools to realize it, I then figured out the existing research gaps. The third chapter introduces the methodology in detail, following the order of methodical choice, strategy, data collection techniques, and analysis procedures. The fourth chapter displays the results and discussions of the key findings, illustrating a customized service design process by acknowledging the value of various stakeholder participation. In the fifth chapter, I summarized the research outcomes and, in the sixth chapter, listed the possibilities for further research through analysis of the limitations of the research findings.

1.4 Value of the research

In some specific circumstances, when the implementation of the design proposals is not reachable or required, or when some key stakeholders are inaccessible, the model of service design process provided by this study would be very practical or valuable. Examples for possible design context can be: when some service design projects are research-led, when the design team is not hired and participate on a voluntary basis, or when the resources needed for the project are lacking.

1.4 Limitations of the research

The outcome of the research only forms part of the standard service design process, lacking discussion about the implementation stage. The new model of the service design process is applicable in the absence of key stakeholders, but it does not fundamentally improve such limitations. Secondly, because the research is carried out in synchronization with the practical design project, the research data collected are under a limited context of the scope of the design project. In other words, whether the results of the research are applicable in different design environments has not been confirmed. Besides, the sample sizes in this study are relatively small; thus, the reliability of the data collected has, in response, decreased.

2.0 Literature Review

For the first part of the literature review chapter, I would like to comprehensively introduce theoretical content of service design: evolution, definition, principle, and its process. Through a gradual transition from abstract concepts to practical initiatives, a full understanding of service design is formed. And then narrow down to stakeholder engagement in the second part. I emphasize the collaborative and human-centred feature of service design, which, to some extent, reveals the driver to stakeholder engagement. Then I further discuss the importance of stakeholder engagement and tools to realize it. The reviewed literature is mainly books (or certain chapters), short papers, thesis, or articles in service design field, along with few reports of design conferences or online materials. Since service design is an interdisciplinary approach, it is inevitable that a small amount of knowledge from related fields such as human-centred design and marketing. will be involved.

- *Terminology*

In order to ensure the smooth and fluent reading, first of all, I will briefly introduce the meaning of several commonly used terms. Stakeholder represents anyone (a person, group, or organization) that "is somehow connected to or has an interest in a project, organization, or product." (Stickdorn et al., 2018, p.62). Service period means the current period of a service, which includes the pre-service/ service/post-service stages (Stickdorn, 2010a). Touch-points (or touchpoints) are contact points between a service provider and customers (Clatworthy, 2010; Stickdorn, 2010a). Clatworthy (2010) further explains that an experience is formed with interactions between a person, touch-points, and related service-encounters. And combining all concerning experiences allow a person to provide an evaluation of the service or even the service provider.

2.1.0 Evolution of service design

In the discussion of the origin of service design, the industrial age is a fundamental background described as the arguably time point of when design becomes a profession by Stickdorn & Frischhut (2012). The authors trace the origin of service design from the perspective of changes of designer's focus as a shift from ornamentation to artifacts and then to users. In response to such a shift, a variety of fields (product/industrial design, ergonomics, user-centred design, and interaction design) come to people's vision.

Polaine, Løvlie, & Reason (2013) states that industrial designers at the time aimed to use new industrial technology to improve the material standard of living that people desperately needed to restore and improve after the World War. The first generation of industrial designers strove to humanize the technology by efficiently producing useful, high quality, and low-price products and meet the fundamental material needs of their generation. With the contribution of industrial design to the improvement of the standard living in the developed world, in the 20th century, people are now situated with material wealth. As a result, fundamental human needs have changed. The transformation of focus from efficient production and standard living to lean consumption and quality of life is detected.

Also identifying such change, Moritz (2005) puts forward the concept of service revolution to point out that people should shift their focus from product innovation to service innovation due to the rapid growth of the service sector's influence on the economy. The author elaborates on the opportunities for service design by analyzing four major drivers: the booming service economy, the saturated product market, possibilities provided by developing technology, and the necessity of valuing the individual needs of humans. Stickdorn et al. (2018) also discuss similar topics, I think there is some overlap between the views:

1. Moritz (2005) considers that technological changes offer new possibilities to create new service systems by weakening the negative impact of physical boundaries. Thus, relationships between clients and service providers are changing. Stickdorn et al. (2018) proposes that the digital revolution provides customers more channels for information or purchase. People nowadays are keen to share experiences on social media, which leads to easy reach to price comparisons, alternative sources, trusted reviews, and a wealth of other data. Users trust more their peers than advertising campaigns, which makes word of mouth a high status ever had in product selling.

2. The service economy becomes a dominant part of the economy second only to agriculture and manufacturing (Moritz, 2005). As reactions, product companies are transforming into solutions companies by adding service as an enrichment while pure service companies are also emerging. Stickdorn et al. (2018) further propose that new methods to measure customer satisfaction and innovate experiences strategically across departments are badly needed due to these two flaws:

- Customer experience is highly ignored as factors "outside the basic offering and the processes necessary to deliver the core value" are usually streamline or cut away as an overhead cost.

- While creating new value together, each department values only their own achievements. The cross-functional cooperation is difficult due to different worldview and terminologies of each department.

3. Organizations start to prioritize innovation due to the saturated product market (Stickdorn et al. , 2018). Especially focus on service due to its importance in business. New ways to understand customers, create ideas, and work on those ideas into the new product, operation, or even business models are urgently needed. Redesign of service in strategy, branding, and marketing supports increasing competitiveness and advertising value for products (Moritz, 2005).

Stickdorn et al. (2018) believe that service design was born in the 1990s and 2000s as an approach to working on services, developed by designers based on design methodology. Service design emerged in the intersection between interaction design and product design, taking its inspiration from the user-centric practices of the two fields (Stickdorn & Frischhut, 2012). Service designers were at first driven by a sense of applying design thinking to promote customers' value. In the early stages of development, service designers only take responsibility for one part of many during the process of design service. Schauer (2011) presented some of his calculations at the SDN conference. He estimated the portions of dollars spent in the U.S. on each profession involved in the planning and design of services (see Table 1). Although the authors claimed that this is complete unscientific guessing, still these figures are not unfounded.

Departments	System Engineers	Operations Management	Branding & Marketing	Customer Service	"The Organization"	Straight-up Service Designers
Estimated portion	21.7%	15.3%	10.3%	8.0%	40.0%	4.7%

Table. 1 Estimated portion of dollars spent in the U.S. on each profession involved in the planning and design of services adapted from Schauer (2011)

Mager (2009) praises the successful application of service design in basically all fields of service industries and in the field of public and social services. The development of service design is inseparable from the appearance of academic networks as great platforms, a growing body of research literature and methodological books of service design, and academic courses focusing on specific aspects of service design offering by significant amounts of universities (Miettinen, 2012).

Stickdorn et al. (2018) state that service design nowadays enters the public's vision like never before thanks to the overwhelmingly increasing status of customer experience and design (or design thinking). Service design now in the sight of many people with a design background develops rapidly into the term covering all activities in planning and designing services (Stickdorn & Frischhut, 2012, Stickdorn et al.,2018). Stickdorn et al. (2018) affirm the reputation of service design in these fields: incremental and radical service development, innovation, improvement of services, customer experience work, education, empowerment, government, the strategy of organizations.

2.1.1 Define service design

A certain group of design thinkers started to perceive and describe service design (a new discipline) as a new design agenda (Meroni & Sangiorgi, 2016). As an entry point for learning a new term, many people like to start by reading the definition to gain a brief understanding. The term "definition" means an exact statement or description of the nature, scope, or meaning of something (Stevenson, 2010). In another word, what is service design?

Moritz (2005) introduces service design in a quite comprehensive manner: "Service design helps to innovate (create new) or improve (existing) services to make them more useful, usable, desirable for clients and efficient as well as effective for organizations. It is a new holistic, multi-disciplinary, integrative eld." (p. 6). Also, a simple and easy definition using example comes from Fonteijn (2008) : "When you have 2 coffee shops right next to each other, selling the exact same coffee at the exact same price, service design is what makes you walk into the one and not the other, come back often and tell your friends about it." (para.4). A condensed definition also stood out in the vote: "Service design is all about making the services we use usable, easy and desirable." (United Kingdom Design Council, 2015, p. 4). Birgit Mager (Service Design Network, 2015) introduced her definition in an interview as "Service design choreographs processes, technologies and interactions within complex systems in order to co-create value for relevant stakeholders.".

Stickdorn et al. (2018) asked 150 service designers to share and vote on their favorite definition in mid-2016. Miller (2015) crowdsourced her definition with eight versions collected from a virtual, lately launched community of practice for services designers. And this became the most popular definition among 150 designers:

> "Service design helps organizations see their services from a customer perspective. It is an approach to designing services that balances the needs of the customer with the needs of the business, aiming to create seamless and quality service experiences. Service design is rooted in design thinking, and brings a creative, human-centered process to service improvement and designing new services. Through collaborative methods that engage both customers and service delivery teams, service design helps organizations gain true, end-to-end understanding of their services, enabling holistic and meaningful improvements." (para. 15)

Stickdorn (2010b) describes service design as an interdisciplinary approach that combines different methods and tools from various disciplines, which leads a new way of thinking rather than forms a new stand-alone academic discipline. However, he questions the rationality of a common definition because service design is an evolving approach whose development is not consummate enough to form a unified definition. He also worries that a single definition might constrain such an emerging field.

When defining service design, there are opposing camps from different perspectives. Stickdorn (2010b) enumerates various examples to define service design and classifies them into academic approaches and agency approaches, thus highlighting the differences between the contributors' role of service design. Focus on the disagreement on the terminology, Stickdorn et al. (2018) bring out the concept of the "splitters" and the "lumpers.". The splitters emphasize on differentiating service design with related field as experience design, design thinking, holistic UX, user-centered design, human-centered design, new marketing, and etc. Going the other way, the lumpers value the principles these practices all share because the similarities between them are far greater than the differences. Polaine et al. (2013) describe service design as an activity when talking about the multidisciplinary group of people involved in it. This group includes Web designers, interaction designers, user experience designers, product designers, business strategists, psychologists, ethnographers, information architects, graphic designers, and project managers, as they list. Such a complex background of multiple disciplines can be one of the reasons why service design concepts are difficult to be unified.

Stickdorn et al. (2018) claim that terminology is far less critical than accurately implementing service design in action. The authors warn that one single definition of service design can be useful or misleading considering usage in different situations. Various ways to explain can be seen as a puzzle piece to form a full picture of service design.

2.1.2 Principles of service design

"Principles are guidelines for creating good solutions under specific circumstances" (Goodwin & Cooper, 2011, p.9). Due to the uncertainty in the definition of the term service design, Stickdorn (2010a) seeks another way to help understand service design. He outlines the way of thinking required to design services by establishing 5 principles of service design thinking, which have been widely quoted. Different emphases bring different versions of principles. Mager (2009) pushes forward few principles: 'A holistic view, interdisciplinarity, co-creative work, visual thinking and a radical approach' to emphasis the importance of providing inspiration, energy, and motivation to make changes of machines, production processes or materials and even changes of structures, processes, culture, and people. Schauer (2011) concludes five fundamentals of service design from business aspect: 'Value, systems, people, journeys, proposition'.

By expanding the four main characteristics of the service, Meroni & Sangiorgi (2016) introduces the essential design considerations for approaching the service field (compared to products). These tactics are the production of focusing both on interaction and function for services (representing two main distinct service research streams of design research and practice). The 'interaction paradigm' applies design methods and skills to improve the user experience, focusing mainly on how services are implemented or say as the interactive nature of services. On the other hand, the 'functional paradigm' considers what services represent and provide, originated from studies about strategies for sustainable consumption and production. I think that the relatively uncommon wording of Meroni & Sangiorgi (2016) "Intangibility, Inseparability, Heterogeneity, &Perishability" is not conducive to the reader's understanding. However, the summarizing text of these principles can be used as auxiliary material in understanding service design:

> "This overview has summarized some of the approaches and focuses design has been considering when approaching the service realm: making the intangible service intangibility; engaging users in co-creating services when valuing the inseparability of service production and consumption; understanding and designing the factors influencing the quality of service

interactions and facilitating service customization when considering service heterogeneity; and defining replication strategy or radically new collaborative service models when dealing with service perishability." (Meroni & Sangiorgi, 2016, p. 62-63)

As the discipline develops, Stickdorn et al. (2018) revisit the early version of principles and make self-argument. By correcting the confusing wording and adding the missing concepts, the authors give the new version (see Table 2), which I think is the most comprehensive one. Thus, under such principles, I would like to understand service design approach as "a human-centered, collaborative, interdisciplinary, iterative approach which uses research, prototyping, and a set of easily understood activities and visualization tools to create and orchestrate experiences that meet the needs of the business, the user, and other stakeholders" (Stickdorn et al., 2018, p.27).

Principles 2010	Major breakthrough	Principles 2017
1. User-centred "Services should be experience through the customer's eyes."	Using better wording of 'Human' to include all the people involved and related to the service system.	**1. Human-centred** "Consider the experience of all the people affected by the service."
2. Co-creative "All stakeholders should be included in the service design process"	Using better wording of 'Collaborative' to include two concepts: Co-creation and Co-design.	**2. Collaborative** "Stakeholders of various backgrounds and functions should be actively engaged in the service design process."
	Adding the missing characteristic — iteration, which is essential for a design-led approach to get rid of the 'decide-plan-do' model.	**3. Iterative** "Service design is an exploratory, adaptive,and experimental approach, iterating toward implementation."
3. Sequencing "The service should be visualized as a sequence of interrelated actions."	Using better wording.	**4. Sequential** "The service should be visualized and orchestrated as a sequence of interrelated actions."
4. Evidencing "Intangible services should be visualized in terms of physical artifacts."	Adding the missing pragmatic foundation of research and prototyping.	**5. Real** "Needs should be researched in reality, ideas prototyped in reality, and intangible values evidenced as physical or digital reality."
5. Holistic "The entire environment of service should be considered."	Combining several concepts in one word.	**5. Holistic** "Services should sustainably address the needs of all stakeholders through the entire service and across the business."

Table. 2 The evolution of the principles of service design adapted from Stickdorn et al. (2018)

2.1.3 Service design process

“Designing the process and choosing the right methods and tools are core skills in service design.”(Stickdorn et al. , 2018, p.83). Although the design process (or more subdivided into the service design process) is considered nonlinear in reality (Stickdorn, 2010c; Stickdorn & Frischhut, 2012), it is still possible to outline a structure or say a framework for service design processes. (Moritz, 2005) illustrates the process by dividing the holistic view of Service design into a list of different, easy-to-understand tasks in different stages. Comparing the different versions of service design process published in recent decades, although the wording and the number of stages, steps or phases are different, they mostly follow similar service design principles and mindset (Stickdorn et al. , 2018). I will list some examples of service design process or design process：

1. SD Understanding, SD Thinking, SD Filtering, SD Generating, SD Explaining, SD Realising (Moritz, 2005)
2. Preparation, Incubation, Insight, Evaluation, Elaboration (Best, 2006)
3. Discover, Define, Develop, Deliver (Design Council, 2007)
4. Discovering, Concepting, Designing, Building, Implementing (DesignThinkers Academy, 2009)
5. Exploration, Creation, Reflection, Implementation (Stickdorn, 2010c)
6. Discovery, Definition, Development, Deliver (Design Council, 2015)
7. Research, Ideation, Prototyping, Implementation (Stickdorn et al. , 2018)

Base on a study of the design processes used in leading global companies, the 'double diamond' design process model developed in 2005 maps the divergent and convergent stages of design processes (Design Council, 2007) . Stickdorn et al. (2018) apply appropriate usage of such “interplay between divergent phases (seeking opportunities) and convergent phases (making decisions)” (p. 85) in the service design field, recognizing its recurring pattern of creating and reducing options (see Figure 1). To start a service design process, research activities help to generate knowledge which then extracted to key insights. Ideation activities follow up to gain promising ideas by filtering design opportunities. In prototyping, potential solutions are explored and built, and then in implementation, you focused on final solutions through evaluation and decision making.

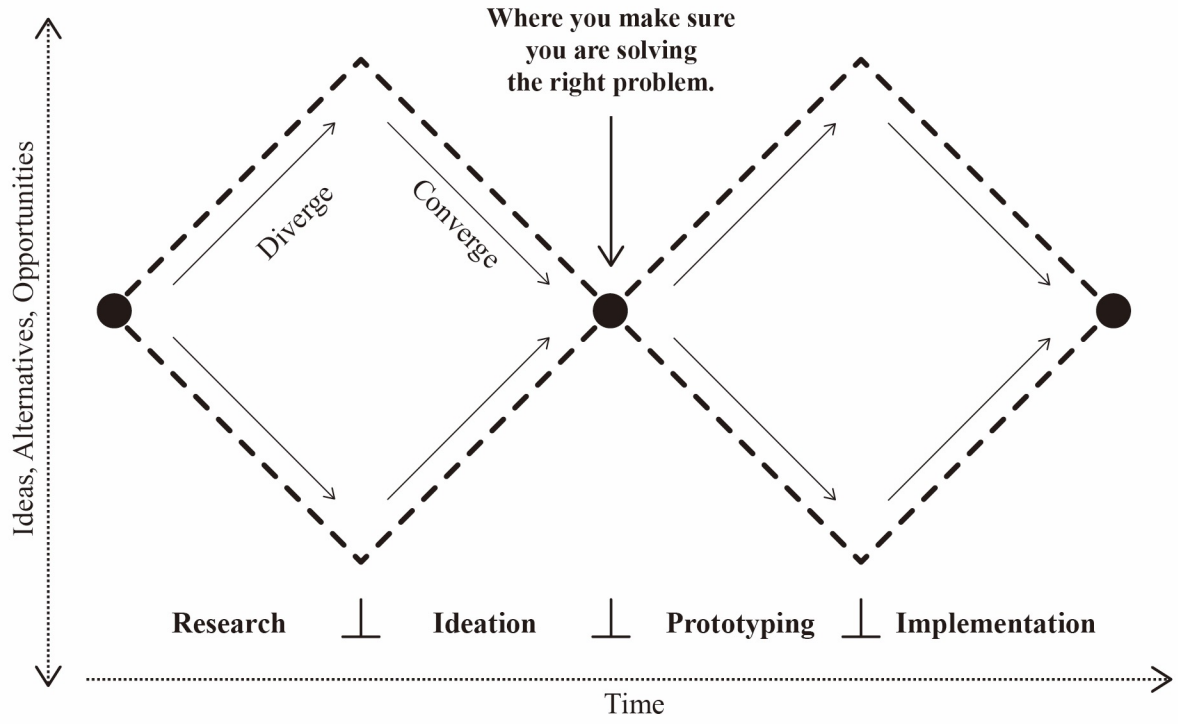


Figure. 1 Service design process under 'double diamond' model
adapted from Stickdorn et al. (2018)

A standardized process model can effectively improve efficiency in the way of helping familiarize collaborators with design ways of working (Design Council, 2015) or to say helping understand and improve working procedures, and optimize communicating performance(Best, 2006). It clarifies the inner relationship between the underlying mindsets and activities, results in the easier application of tools and methods (Moritz, 2005), and contributes to an easy understanding of service design with a generic framework (Moritz, 2005; Stickdorn et al. , 2018). And it allows designers a greater impact upon the design outcomes (Stickdorn, 2010c).

Diverting the attention to the limitations of standardizing the process model, the adaptive nature and iterative nature are worth noting. First, the process model is a rough framework rather than "a prescriptive, linear how-to guide"(Stickdorn, 2010c, p.126). It is challenging to visualize iterations as a process as it is inevitable to describe a linear process no matter with circles or other graphic forms by Inadvertently sequence the stages (Stickdorn et al., 2018). The service design process is explorative and iterative, standing opposite to the results expected and steps planned-in-advance. Stickdorn & Frischhut (2012) suggests to identify the existing mistakes and take quick reaction in the form of iterations, corresponding to the motto "fail early, fail cheap, fail safe.". Next, Frameworks should be adapted and customized to suit the task or project (Best, 2006; Design

Council, 2015; Stickdorn et al., 2018), client and user requirements(Best, 2006), the people, culture, the challenges(consider its' complexity), the available budget, time and other resources (Stickdorn et al. , 2018).

2.2.0 Stakeholder

Stakeholder represents anyone (a person, group, or organization) that "is somehow connected to or has an interest in a project, organization, or product." (Stickdorn et al., 2018, p.62). This terminology used in service design field differs for organizations and cultures upon various players involved(Stickdorn et al., 2018). To cite a few examples, different authors mentions people with different roles to expand the term stakeholder: users, employees and more (Stickdorn & Frischhut, 2012); customers, staff , and management people who use and provide services from the managing director to the end user, and from frontline staff to third-party suppliers (Polaine et al., 2013); people in your or your client's organization who produce the product or influence the product's direction (Goodwin & Cooper, 2011).

Stickdorn et al.(2018) provide a detailed classification, under service design context, that helps designers better understand or deal with stakeholders (see Table 3):

User: Who uses a service or product. **Customer:** Who buys services or products. **Client:** Who orders and purchases (service design) services.	**Service delivery team:** A person, group, or department within an organization that is responsible for providing services to users or customers. - **Employee** Employed by an organization. - **Frontline staff** Providing services in direct interaction with users and customers. - **Support staff** Supporting frontline staff without direct interaction with users and customers.	**Design team:** A group of people that is involved in the service design process. - **Core (service) design team** A (small) group of people that manage a service design project, typically experts on service design. - **Extended (service) design team** A (larger) group of people that are involved in different activities of a service design project, typically cross-functional and multidisciplinary experts with specific competences related to the subject matter of a service design project.

Table. 3 The classification of stakeholders adapted from Stickdorn et al. (2018)

2.2.1 Collaborative nature of service design

In the previous discussion of the principles of service design, it was mentioned that Stickdorn et al. (2018) replaced the word 'co-creative' with the term 'collaborative'. The reason is the wording of

'co-creative' may confuse the involving concepts of co-create and co-design, and thus conceals the emphasis on co-design in service design field nowadays for the collaborative and cross-disciplinary nature of service design. Co-creation refers to that value is generated by services which only exist with the participation of a customer, while Co-design is the process of creation by people from muti-disciplinary.

Co-creation

Vargo & Lusch (2014) establishes the service-centered dominant logic as the potential replacement of the traditional goods-centered paradigm, base on the shifting focus from tangible toward intangible, from producer to consumer, from the thing exchanged to the process of exchange, and from mechanics to systems. Service-dominant logic (SDL) clarifies that the service experience is the basis of all business (Stickdorn & Frischhut, 2012); services are the basis of all economic activity (Stickdorn et al. , 2018); and “all existing products were created by a service design process, whether intentional or unintentional.” (Stickdorn et al. , 2018, p.29). SDL defines services as a process of value co-creation, therefore, emphasizes stakeholder participation (Ksenija Kuzmina, Tracy Bhamra, & Rhoda Trimingham, 2012).

That, products and services should no longer be distinct because tangible products and intangible service(assisted by products) both benefit stakeholders, is influenced by the shift in the interpretation of value (Daniela Sangiorgi, 2012). Value is initially considered to be embedded in physical products, and thus services (not proven in the tangible outcomes) are not contributing to value creation. While now value is understood as co-created through interactions among various economic and social actors through the customer usage of offering that companies proposed. Service design emerged and was initially described as designing a service interaction platform between the user and the provider, following the heated discussions about value co-creation.

Moritz (2005) summarizes 6 characteristics of services to underline the major shift in thinking “needed for and delivered by service design”(p.29):

1. Services are not tangible, without any physical form.
2. Services are not separable from consumption.
3. Service cannot be stored that it is only valuable when clients access to it.
4. Services are used rather than owned due to the impossibility to transport or export it.
5. Services are complex experiences (over time and across serval touchpoints).

6. Service quality is difficult to measure with wider variability and difficulties in controlling the quality.

Humans unintentionally or deliberately shape the world around to suit ourselves which referred to as design (Goodwin & Cooper, 2011). With various related philosophies and assumptions, “design” becomes an incredibly broad term to define. Goodwin & Cooper (2011) present their definition of design as “Design is the craft of visualizing concrete solutions that serve human needs and goals within certain constraints.” (p.4). In reaction to revolution of service, design experiences the shift from observing users from a design-centric perspective to involving users in the design process from a user-centered perspective (Moritz, 2005). Interest for active approaches involving customers in the development process of a new service is increasing (Katarina Wetter-Edman, 2012).This participatory process of design nowadays endows service design in a collaborative nature. Service designers committed to motivating user-participation in value co-creation through effective design and development of the interaction platform where the value propositions are materialized (Sangiorgi, 2012). Service design from the beginning looks at value in its experiential dimension, starts from observation and insights of users where value is co-created.

Co-design: Design with stakeholders not for them

In the previous classification of stakeholders, it is clear that the user is one of the stakeholders. The user and all stakeholders are emphasized in the development and realization of a service, thus service design is described as user-centered, emphasizing the human perspective (Wetter-Edman, 2012). Here, the authors obviously weakened the role and influence of stakeholders other than users. Different from this view, Kuzmina, Bhamra, & Trimingham (2012) claims that service design is human-centered (Augsten, Geuy, Hollowgrass, Jylkäs, & Klippi, 2018), as its core. User-centered design (UCD) covers a broad range of approaches used for interacting with users, and human-centered design (HCD) proposes a broader perspective than the user, emphasizes the stakeholders as a whole (Wetter-Edman, 2012). There is an overlapping of UCD and HCD for their shared goal to meet user needs through approaches with data collection and analysis. The very essence of co-design is to shift the focus from a specific actor to action and attitude that can be transversally applied to all related stakeholders, and this has been recognized for the transition from user-centred to human-centred (Deserti, Meroni, & Raijmakers, 2018). Service design shows the characteristics of user-centred or human-centred derived from its basic approach of gathering insights including experiences, desires, motivations, and needs of stakeholders (Polaine et al., 2013). Some other

disciplines, for example, marketing, seeking business advantage through customer insights, while service design expands research across all stakeholders. Marketing emphasizes reaching understandings of markets through price, promotion, product, and place, in contrast, service design focuses on people and how to collaborate in the design of a service.

Cooperative design, co-design, participatory design are entangled concepts with ambiguous interpretations, representing active inclusion of the user, and other stakeholders in the design process(Wetter-Edman, 2012). In that situation of 'design for people', designer use design expertise to develop the outcome, and the co-creational activities just gather insights of the user as the start point of inspiration rather than actual design solutions. Service design advocates similar terms of “co-production” or methods engaging multiple stakeholders, in another word “designing with people and not just for them” (Polaine et al., 2013, p.vii). The designer acts as a facilitator by guide the process, rather than focusing on creating solutions (Kronqvist & Satu-Mari, 2012). To clearly articulate how to benefit from such an idea, it is essential to turn the insights gathered from all stakeholders into a service proposition and test it through prototypes (Polaine et al., 2013). Personalized services regarded as possible to realize notably benefits organizations, and this suggests that diverting attention from the mass to the individual are providing new opportunities. Uniqueness, diversity, and sustainable improvement might contribute to enhance adaptability as well as agility to meet changing market needs(Augsten et al., 2018).

It hardly differs in the tools or methods service designers adopt in whether innovation work (introduce a new service) or improvement work (improve an existing service); what differs is the purpose of insights (Polaine et al., 2013). During innovation work, the primary concern is to reduce risk by ensuring the feasible value proposition. Both ideal fantasies of a service or insights gathered into actual lives, to some extend, reveal underlying needs. The research and usage of insights advance in building a solid foundation for creating productive ideas confirmed later by early prototyping. Realizing innovation work relies much on producing radical ideas (beyond current norms) and thus risks deviating from people ’s real needs and problems. When it comes to improvement work, people are assumed to know how to use and value of the existing service. Thus, designers focus on seeking enhancement through opportunities from discovering of fail points in the service, rather than unmet needs. Besides, the front-line staff (facing customers) attract attention due to the operational data they can offer (Kronqvist & Satu-Mari, 2012; Polaine et al., 2013), especially in those cases with a tight schedule or limited budget. Designers can expect from

staff identifying most of the problems customers face with a service and providing enough detail (Polaine et al., 2013). However, these two areas obviously overlap and both focus always on people.

People with different roles are involved in the delivery of services, all require specific service elements designed for them (Polaine et al., 2013). This is the part that enables differentiation of service design (with a human-centred characteristic) from user-centered design. The shared experience in terms of knowledge and engagement of all stakeholders, not only customers or users, is critical to producing a successful service.“Good service requires logical thinking with the right people at the right time” (Oosterom &Schuurman, 2012, p.132). Frontline staff, as well as customers, are experts besides managers or marketing employees that can provide other brand-new perspectives and valuable insights into potential improvements base on everyday experiences (Polaine et al., 2013). Through engagement in service innovation or improvement, staff can earn a sense of accomplishment as well as learn “complex ecology of service” and innovation tools and methods which empower them to sustainably improve the service after the cooperation with the service designer is over. Thus, nowadays service designers increasingly act as an educators with organizations explicitly or implicitly to transform not only services but also people's working mode and motivation(Deserti et al., 2018).The difference between service design and other disciplines that use human-centered design methods (e.g. product or UX design) is that service design involves a wider range of interacting-over-time stakeholders and touchpoints (Polaine et al., 2013).

There is worrying about co-creation in service design that it may cause risks and potential costs of resources, time, and spaces for interaction (Østergaard, 2018). A feasible solution is to define the key stakeholders in the planning of the design process. Also, it can be difficult to build trust and common aims in multiple networks of people, especially in social innovation issues. Deserti et al. (2018) also indicate a raising concept of beyond human-centred design, emphasizing 'non-human agents' from the planet to A.I.s beyond current range of ordered groups of people. This demands a better understanding of the role of non-human agents and their interaction with people.

2.2.2 Stakeholder engagement

Jeffery (2009) presents clearly why stakeholder engagement is indispensable and useful from the perspectives of the organizations. The premise of stakeholder engagement is that stakeholders should be given the opportunity to comment and input into the development of decisions that influence them. Nowadays, what matters is the active timing of engaging stakeholders, rather than

deciding to involve stakeholder engagement or not as eventually stakeholders are asked to consult. As a result of lacking active engagement, under a crisis situation, the organizations have to apply inactive engagement by the demands of society. Organizations are forced to employ crisis-management techniques in the form of defensive dialogues with stakeholders, which leads to a significant and enduring loss of reputation. Stakeholder management enables one to mitigate risk, and proper stakeholder engagement allows identifying and establishing new opportunities.

Mathur, Price, & Austin (2008) believe that stakeholder engagement can be utilized in practices from various perspectives (as a management technique; an ethical requirement; or a forum for dialogue to promote mutual social learning):

1. From a strategic management perspective (most frequently): obtain knowledge; strengthen the user's ownership of the project; reduce conflict; encourage innovation; and facilitating spin-off partnerships.
2. From an ethical perspective (less often): enhance inclusive decision making, equity, local decision making, and build social capital.
3. From the perspective of social learning (rarely): create a shared vision and objectives by learning about other stakeholder's values and reflecting upon one's own values; increase awareness; change attitudes; and affect behaviors.

Designing a service system requires input from all stakeholders, and also the involvement of designers for new skills and approaches that create embodied solutions to meet the balanced requests of different stakeholders(Han, 2012). The best solution is the outcome of the designers' decision base on acknowledgment and input from multiple stakeholders. Shaping a common view shared with different stakeholders (underlining competences, resources, and interests) can benefit to systemization, envision, and communicate (Cantù & Simeone, 2012). Effective systemizing generates synergies of actors and resources through building connections, to share risks and advantages. Envision refers to facilitate the social conversation thus creating consensus and making potential solutions visible. Communicate means to visualize the project and its results to enable understanding to different actors (e.g. research group, stakeholders, and the wider public).

Han, (2012) points out that, in the early stage, supporting a core of customer-centred, service designers put their emphasis on one specific stakeholder group (service users). They apply mostly traditional marketing tools (such as focus groups, interviews, satisfaction surveys, and

benchmarking) to understand customers, and thus only engage in the very last stages dominated by muti managers of organizations. However, designers show their power of creativity in co-design to integrate different stakeholder needs in practices. Inspired by grounded theory, service design process should start with analyzing empirical data during collection, rather than a set-up hypothesis. Despite the great amounts of work designers may accomplish in the beginning, stakeholders are the ones who eventually touch the establishing service. Thus, the designers should promote stakeholders' judgment in the designer-led process. Besides, sustainable design solutions come out relying on perfect absorbing of local context. Now, designers take responsibility to be invisible facilitators in such localization to encourage stakeholders (especially local service providers) to develop and express their ideas. Constantly switching between a leader and a facilitator according to different stakeholder needs, designers generate and diffuse intensive, intangible knowledge. Designers exert organizational competency to integrate the knowledge obtained from stakeholders to create value (Wayne Gould, 2012). How and in what order or structure the knowledge flowed among the different stakeholders, seemed to guide the designers' choice in stakeholder engagement(Han, 2012).

- *Challenge*

Some of the primary stakeholders might interact directly with designers, while some stakeholders can be difficult to identify or reach without assistance(Han, 2012). Therefore, the scope and resources of the research or project should be taken into consideration. In public sector, in reaction to the existing gap between citizen expectation and reality of public services, a booming number of public organizations are seeking new approaches to their relationship with citizens for a better service offering (Giordano, Morelli, De Götzen, & Hunziker, 2018). And designers are presenting new approaches to connect people and public authorities, facilitating conversations between various stakeholders to let those in power hear the bottom-up voices. In this process, two significant difficulties are implied: It can be difficult to access end-users due to public administrations regulations, or in the case where design is not embedded into the organisation; And a bottom-up co-design process is challenging for its need for a shift in the power distribution/positions/structure of public authorities.

Different stakeholders influence the result of a project to various levels, clients (control information and resources) and end-user (evaluate the result) are proven the most primary stakeholders (Han, 2012). Ignoring, misunderstanding, or mismanaging key stakeholders among the complex network

of power relationships may expand the risk of failure (Han, 2012; Wayne Gould, 2012). Besides, Stickdorn & Frischhut (2012) emphasized the necessity to start stakeholder engagement from the very beginning of the design process. Goodwin & Cooper (2011) support this view as well that when designers advocate end-users, they are aiming to achieve certain goals for organizations.Therefore, understanding what product and service is meant to accomplish should always ranked first, and early interviews sometimes may be the only opportunity to achieve so.

2.2.3 Tools and methods

When impossible to involve the whole stakeholder groups in the design process, it is essential to find approaches to embrace a user perspectives and facilitate creative collaboration among stakeholders (Kaario, Vaajakallio, Lehtinen, Kantola, & Kuikkaniemi, 2012).

Interviews and ethnographic methods help to obtain latent needs and current context to find out potential improvement (Kronqvist & Satu-Mari, 2012). Theatre-based methods (e.g. body storming or role-play) are often employed to visualize interaction among various stakeholders through touch-points.Visualization tools of service design (e.g. User journey map, Service blueprint, Stakeholder map, & Prototypes) benefit in the presentation of a context, a concept, a system, a service experience, etc.(Giordano et al., 2018). By using visual representations, designers can understand, analyze, and further design new solutions. These visualization tools are used alone to represent and communicate, and collaboratively to trigger discussion in a design process, thus support the collaboration of different people in multiple ways. Customer personas and storytelling are typical service design methods adopting a human-centred approach (Kronqvist & Satu-Mari, 2012).

Customer journey map

The customer journey map is widely used in service design, involving customers and internal resources as contributors of input(Følstad, Kvale, & Halvorsrud, 2014). A customer journey map visualizes a holistic view of service experience from a user's perspective, showing a journey constructed by all interactions through touchpoints (United Kingdom Design Council, 2015; Lawrence et al., 2010). A typical customer journey is multi-channel and time-based (Lawrence et al., 2010). Channels refer to human interactions which involve stakeholders and also human to machine interactions which happen through touchpoints (Stickdorn et al., 2018). Understanding the exchanges and links of channels used by the user provides a comprehensive view of a multi-channel experience. The customer journey maps make intangible service experience and motivations visible

and enrich empathy with targeted users through the story told in a diagram. Mike Press points out that in similar fields to emergency service research where communication is challenging, a customer journey map enables conversations between boundary objects about services that move the authorities and users toward mutual understanding (Stickdorn et al., 2018). Another vital element of a customer journey map is the emotion curve, which helps us to find the problem areas where negative moods (depressed or nervous, etc.) appear. The journey also allows me to define the magic moments, where the service works well, and the pain points where require urgent improvement or provide opportunities for innovation (United Kingdom Design Council, 2015; Lawrence et al., 2010). Listing the magic moments and pain points can help to envision future services (Stickdorn et al., 2018).

Service blueprint

Stickdorn et al. (2018) describe a service blueprint as an extension of customer journey maps, focusing on the touchpoints of a re-designed service. There are still significant differences between these two methods (see Table 4). It visualizes interactions between the user and all relevant parties, and also details of customer actions, frontstage actions, and backstage actions (Lawrence et al., 2010). Customer actions are distinguished from frontstage actions with lines of interaction to present a direct connection between users and frontline staff, while a line of visibility can reveal an interaction between frontline staff and backstage staff, which is invisible to users (Stickdorn et al., 2018). The outcome of a service blueprint can help to introduce the updated service to all stakeholders as well as give evidence of which part of the service requires a user test (Lawrence et al., 2010).

Method	Customer journey map	Service blueprint
State	**Current-state:** to visualize the current experience of an existing service to find gaps for improvement.	**Future-state:** to visualize the potential experience helps people to imagine, understand, and prototype to test the service.
Focus	**Experience-centered:** to reflect how touchpoints are embedded in the overall experience with situational context.	**Product-centered:** to show only steps representing an interaction between a customer with a service.

Table. 4 The comparison between customer journey maps and service blueprints adapted from Stickdorn et al. (2018)

User personas

Personas are fictional user-profiles developed from previous research data (in-depth interviews), including elements that can represent distinct groups of individuals (Miettinen & Koivisto, 2009). Alan cooper claims that when we discuss the target group to whom our research or design outcome is directed, the term "user" is too general and uninformative (as cited in A. Per & C. Per, 2007). Describing details beyond the context of the system designed, which are everyday life elements of the characters (name, personalities, behaviors, e.g.) as well as precise needs and goals, can create a vivid image of a realistic role. With reference to Blomquist and Arvola (2002), according to the principal goals and needs, designers should establish a primary persona that cannot be satisfied with solutions for other personas while created other personas based on different secondary needs without conflicting with the fundamental needs. Each persona consists of name, age, appearance, job, and a story related to emergency services. The enhancement of the audience's empathy is realized through this visualization of understanding the service users. By creating personas, the entire research team can unify and always define the focus of improvement in the subsequent research process. Blomquist and Arvola (2002) suggest this method is appropriate as a bedding for the following tasks using scenarios.

Stakeholder map

A stakeholder map illustrates the interplay between various groups involved in and impacting a particular service (Stickdorn et al., 2018; Lawrence et al., 2010). Stickdorn et al. (2018) further pointed out that the stakeholder map should reflect the major and minor relationship between stakeholders. In a user-centered research project, the user is always at the center of the stakeholder map, surrounded by internal and external stakeholders in order according to their importance and influence to form a sufficient coverage of all service content. This analysis method can reveal some groups that are easily ignored (such as support staff without direct reaction with the users, emergency contacts, the design team, etc.). Rethinking these new characters and interactions can help to highlight the design gaps needed to improve the services. Understanding the responsibilities of various stakeholders in the service process can also help researchers to ensure that all important stakeholders appear in the service scenarios in the subsequent experience prototype process. The outcome of the stakeholder map is presented in the form of an illustration, visualizing to audiences not only human-human interactions but also human-machine and machine-machine interactions(Stickdorn et al., 2018). Stakeholder maps can also be used as a tool for conversation

between multiple actors to express their own perspectives and gain a mutual understanding of each other(Giordano, Morelli, De Götzen, & Hunziker, 2018).

Brainstorming

Brainstorming is an ideation technique for generating alternative solutions and opportunities efficiently during the concept-designing phase (United Kingdom Design Council, 2015). The ideation process was displayed to all participants in real-time by handwriting notes along with the conversation, according to United Kingdom Design Council (2015). These potential solutions were then reclassified based on the touchpoints (eg, mobile phone software, wearables, etc.), while some of the solutions were deleted due to less cost-effective or achievable. Brainstorming resulted in quick capture of a large volume of ideas, which are then reduced down to several key concepts to be developed further (United Kingdom Design Council, 2015). The analysis and exploration in the form of discussion can make full use of the rich perspective brought by the different backgrounds of the participants, and achieve shared high member satisfaction.

2.3.0 Conclusions

Through the literature review, it is clear that although the field of service design has experienced a rather short history, due to the support of flourishing service design networks, to an extent, it is well-developing from an academic perspective.

Because the driving force for the birth of service design is derived from economic needs, many pieces of literature generally focus on service design from a business and marketing aspect, which means that service design outcome will eventually be tested and launched. And this also reveals in the common standardized process involving an implementation stage. However, many of the students can only end the design process where they achieve a relatively perfect design proposition due to the limited time and resources. Besides, many references have proved the necessity of co-design with primary stakeholders. However, in the area of service design for the public sector, many stakeholders (especially the authorities) are inaccessible to students. From the literature review it becomes clear that certain gaps in the research remain open for further exploration. These gaps can be framed as: to develop useful models of service design process under the context of lacking connections with key stakeholders; to generate acknowledgment about service design benefits from a research-led perspective; and to reduce the negative impact of the lack of resources related to the

public sectors through appropriate stakeholder engagements with the usage of service design tools and methods. These are the research gaps I would like to further explore.

3.0. Methodology

Methodology provides a theoretical perspective to discuss how the research problem is related to corresponding research methods (Hesse-Biber, 2010). In more detail, as a guide to this methodology chapter, Schensul (2008a) points out that methodologies will include not only the specific research actions and degree of execution, but also the reasons for these measures.

Saunders, Lewis, and Thornhill introduced the metaphor of 'Research Onion' which clearly illustrates the relationship between essential elements in the overall research design (as cited in Saunders & Tosey, 2013). The authors put data collection techniques and analysis procedures at the center of the Research Onion as this is the final decision of research design, surrounded by the other four main elements layer by layer (Saunders & Tosey, 2013). I exclude research philosophy layer and time horizon layer that goes beyond the scope of a master's thesis. Then we have got an appropriate directory order for thinking and discussing our research methodology summarized as steps from general framework design to detailed implementation (see Figure 2).

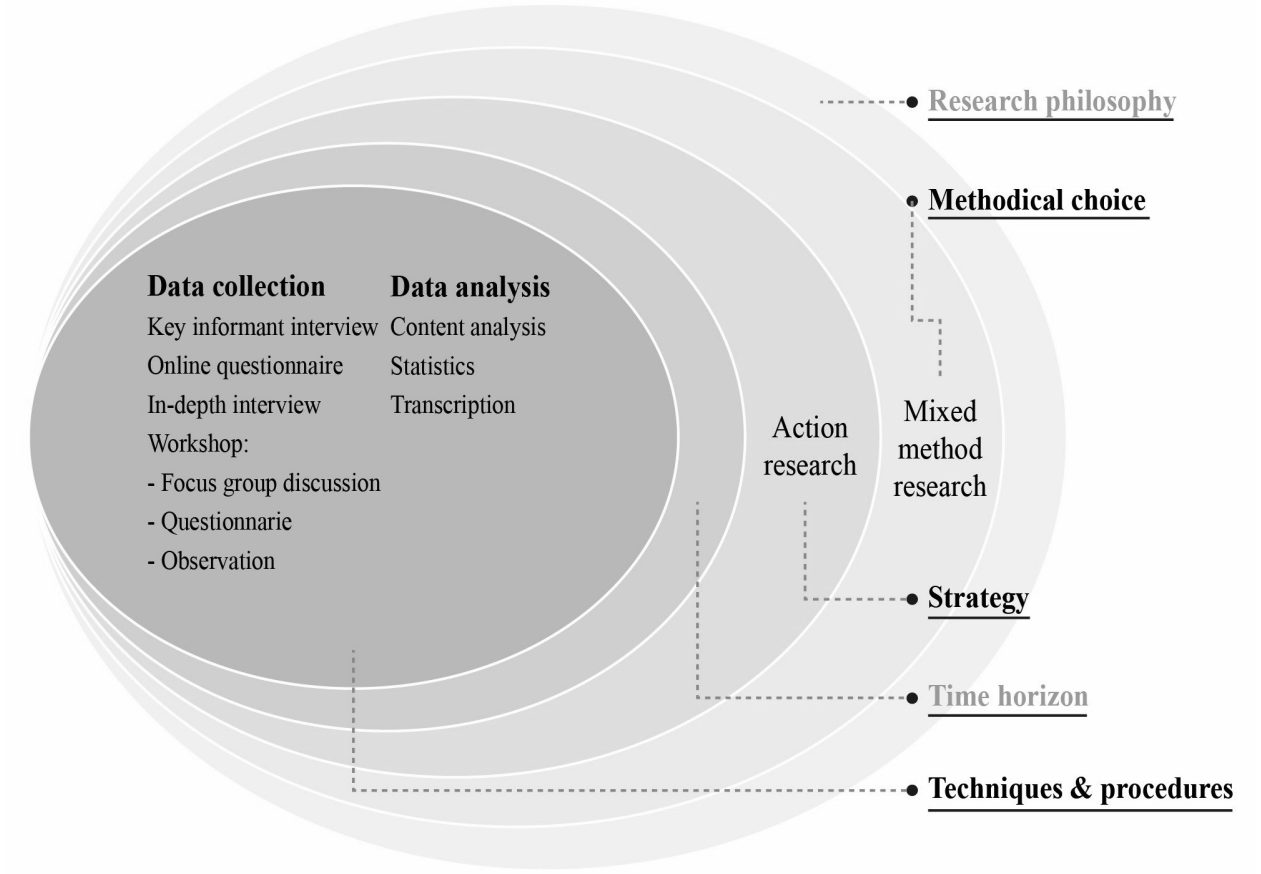


Figure. 2 The research onion adapted from Saunders and Tosey (2013)

3.1 Methodological choice

According to Saunders and Tosey (2013), I will decide whether to use quantitative method(s), qualitative method(s) or a mixture of both in this stage.

Creswell (2009) proposed that the choice of research approach is based on the essence of the research question. This study asks:”How to improve the emergency ambulance experience in Rovaniemi from a human-centric perspective”. Effective delivery of information, Extreme weather conditions and user anxiety in emergency events are essential factors that I cannot ignore.

Quantitative research is an approach of deductively testing an objective theory by examining the relationship between variables measured by instruments against bias and alternative interpretations with generalizable and replicable findings (Creswell, 2009). Qualitative research is an approach, honoring an inductive style, to explore and understand a social or human problem by explaining the meaning of behavior of related individuals or groups in correlative situations by involving participants in the simulated scene (Creswell, 2009). In response to the needs of social science research, more research is tendentiously in between the continuum with quantitative research and qualitative research as endpoints, rather than identified as sheer quantitative research or qualitative research (Creswell, 2009). Emphasizing a more comprehensive understanding of a research question through the integration of both qualitative and quantitative approach rather than using either approach alone, mixed methods with elements of both stays in the middle of this continuum (Creswell, 2009).

Hanington (2003) named the research in the early phase of a human-centered design project as generative research. In this early stage, the project team used various methods to gain an in-depth understanding of the process of Rovaniemi's emergency ambulance services and the users' experience and feelings. In contrast, evaluative research positions at the end of the project. I tested and evaluated our design solutions by user testing. Hanington (2003) provides some standard methods and classifies them into three types: traditional, adapted, and innovative. I picked appropriate traditional methods for generative research and innovative methods for evaluative research. These two parts illustrate our methodical selection (see Table 5).

Research stages	Generative research *Traditional methods* →	Evaluative research *Innovative methods*
Methods	- Key informant interview - Online questionnaire - In-person interview	**Design workshop:** - Observation - Questionnaire - Focus group discussion
Instruments	- Email - Online survey platform - Audio records	- Field notes - Photographic records - Video records

Table. 5 The methodical selection

The mixing of quantitative data and qualitative data occurs in both generative research and evaluative research. Creswell (2008) categorizes forms of mixing into three—merging, connecting, or embedding. Based on the reasons for use, mixed method design can be divided into four types: concurrent mixed methods design, exploratory sequential mixed methods design, explanatory sequential mixed methods design, and embedded mixed methods design. I used all four types of mix methods design in our research. Looking at the entire research as a whole, we can attribute our mixed method design to an advanced one as a multiphase mixed methods design. According to Creswell (2009), I mainly used concurrent or sequential strategies in tandem over time to best understand a long-term program goal, which is commonly evaluation or intervention.

The mixing of methods for generative research is more complex and diverse (see Figure 3). I mixed a structured interview, questionnaire, and semi-structured interviews in the form of connecting them from the data analysis step of the first source of data to the data collection step of the second source of data so that one source builds on the other or helps to explain the other (Creswell, 2009). In the early stage of the research, by analyzing an interview with former fire station staff and related documents she provided, I gained a general understanding of Rovaniemi's emergency service system and associated design trends. From this, I found some starting points for improving services. To quickly obtain the knowledge and feelings about the emergency service from users' aspect, the project team used an online questionnaire. We structured the questionnaire with mainly close-ended questions while few open-ended questions embedded in to provide additional information. This mixing of quantitative data and qualitative data is called embedded mixed methods design. The reason for this mixed structure interview and questionnaire is to follow up on initial exploratory findings. The specific type is exploratory sequential mixed methods. After that, the project team conducted several in-depth interviews to gain experience details of using emergency service in

Rovaniemi. Here is another type of mixed methods - explanatory sequential mixed methods design - as we use a qualitative method to explain the initial quantitative results better.

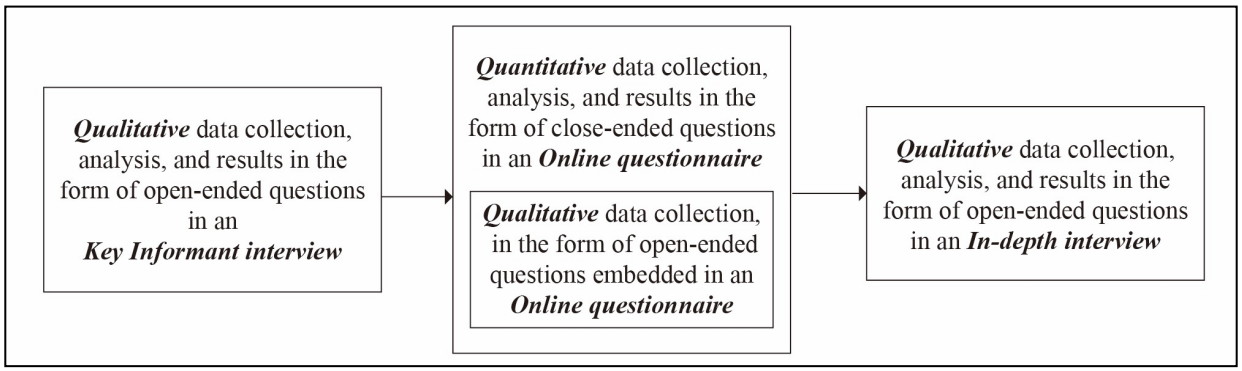


Figure. 3 The mixed method design in generative research

The project team used a design workshop for the evaluation phase, which included another type of mixed method design (see Figure 4). We invited participants to join some simulations of service scenarios. They used the application and wearable device through a high-fidelity prototype while recording some real-time thoughts and opinions through questionnaire forms. The participants further discussed the experience and the content of the questionnaire in a focus group discussion later. In this design workshop, we tended to collect both qualitative and quantitative data at the same time. The specific type of mixed methods is concurrent mixed methods design. A concurrent mixed methods design refers to merging quantitative data and qualitative data collected by researchers for analysis to form an interpretation of data（Creswell, 2008). This interpretation will provide quantitative information in terms of quantity and frequency, as well as qualitative data provided by participants from an individual perspective and from the context in which they comment on the research problem（Creswell, 2008).

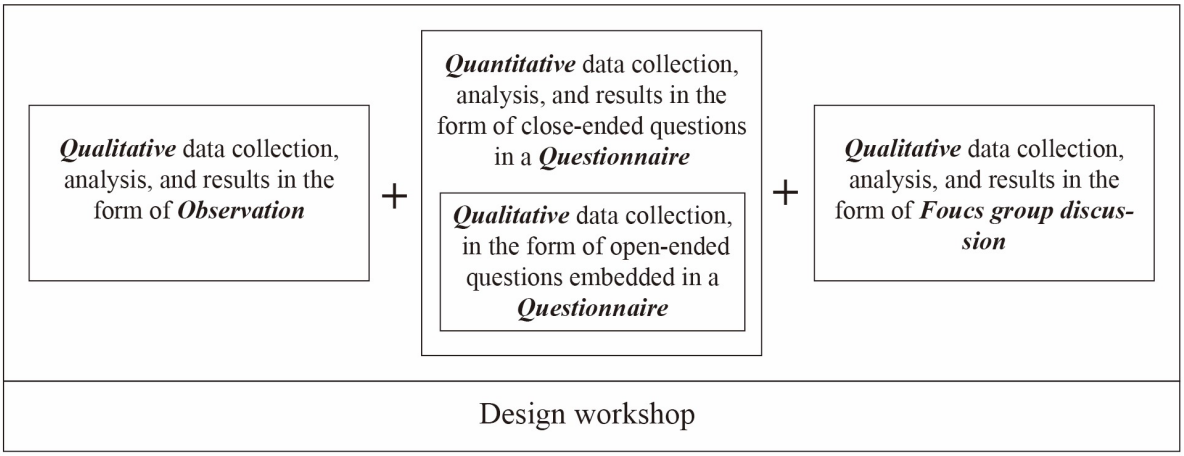


Figure. 4 The mixed method design in evaluative research

3.2 Strategy(ies)

Following the methodological choice layer, the strategy layer indicates how researchers plan to go about answering research questions (Saunders & Tosey, 2013).To adopt action research, I established a collaborative and iterative research strategy.

Somekh (2008) defines action research as a flexible research methodology uniquely suited to researching and supporting change. Action research provides an iterative research model that combines theory and practice through change and reflection in a situation worth improvement (Avison, Lau, Myers, & Nielsen, 1999). Its purpose is to seek to improve and understand the world by changing it and learning how to improve it from the impact of change(Kemmis & McTaggart, 1988). A distinguishing feature of action research is to engage participants in real situations.

Action research is a suitable strategy for some reasons. Collaborative action research gives the policymakers more precious insights into practice, while practitioners can play an active role in policy development and implementation (Somekh, 2008). This combination allows the emergency ambulance service led by the official department to reach users' prompt response and feedback and also allows users to have a deeper understanding of service processes. Another reason to apply action research is that it involves problem-posing beyond only problem-solving (Kemmis & McTaggart, 1988). It is highly in line with service design thinking that researchers are not starting with creating or applying solutions but gaining a deep comprehension of the situation and judging if it needs change.

Kemmis and McTaggart (1988) provide some critical steps to put action research into practice. It begins with the identification of the thematic concern, which indicates the substantive area to focus its improvement strategies. Then four fundamental aspects of the action research which form a spiral of cycles stand forward. Kemmis and McTaggart (1988) explain the spiral of cycles in detail by giving some instructions for action:

- to develop a plan of critically informed action to improve what is already happening,
- to act to implement the plan,
- to observe the effects of the critically informed action in the context in which it occurs, and
- to reflect on these effects as a basis for further planning, subsequent critically informed action and so on, through a succession of cycles.

I merge Figure ‘Model of Action Research’ (Somekh, 2008) and Figure ‘The action research spiral’ (Kemmis & McTaggart, 1988) into a new figure to illustrate the specific steps of action research in this research (see Figure 5). I structured my research strategy into three cycles. In the first cycle, I mainly gathered inspiration and insights into the current emergency service in Rovaniemi. The collection of information and the generation of ideas gradually expanded. I preliminarily tapped the needs of users, and some initial ideas began to sprout. The second cycle, in which I rationalized all possible changes through collecting further data. I narrowed down all potential changes to a reasonable range through classification and identification of the focus points. For the third cycle, I developed the created solutions, prototyped, and tested it. This phase contributes to the refinement of the imminent changes-in-practice.

Due to the high degree of completion and time constraints of the research, I end the spiral of cycles by this cycle. Looking forward to future actions, I can improve these finalized and launched changes by an unlimited number of user tests and feedbacks as more iterative cycles into the research.

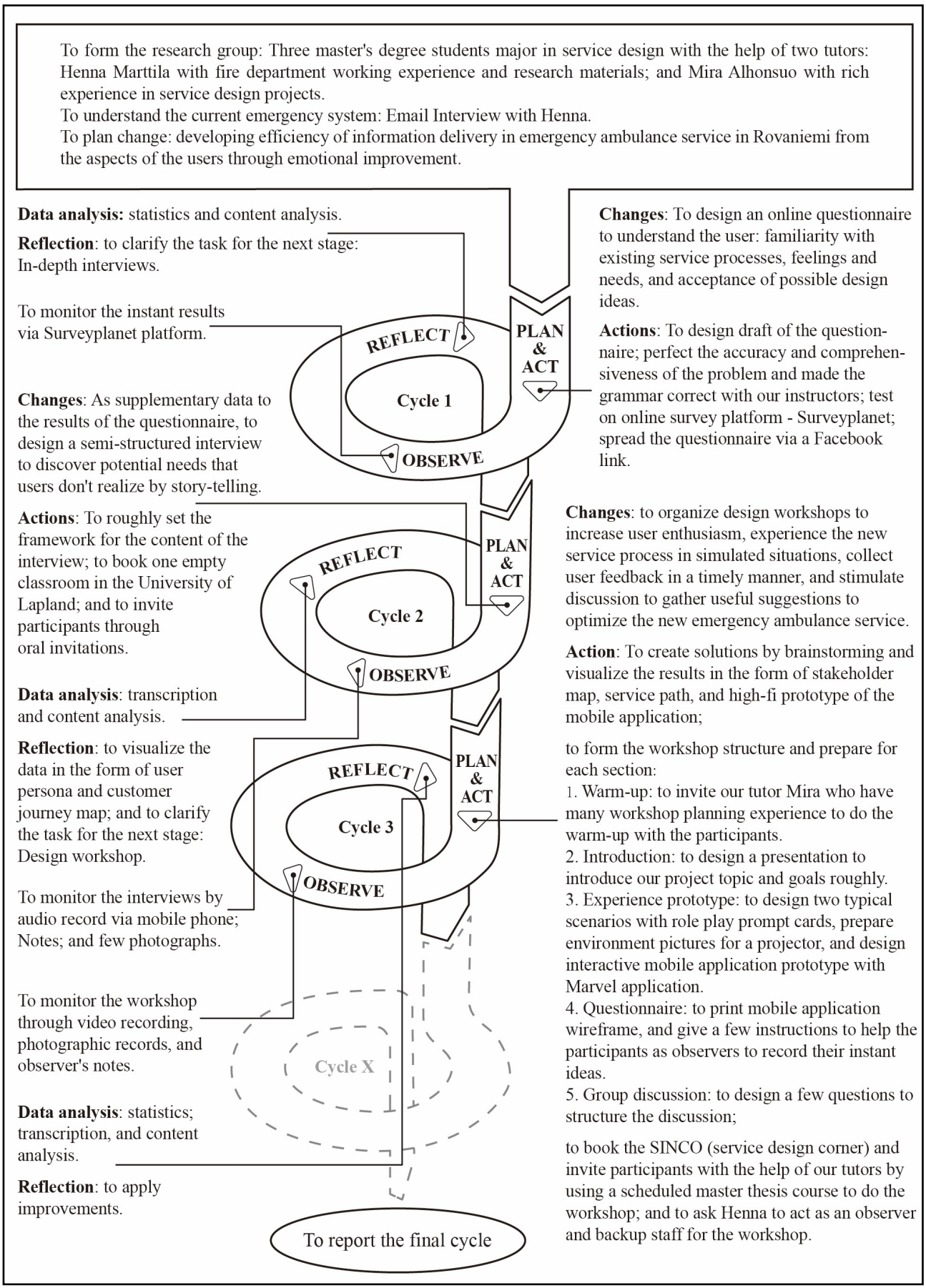


Figure. 5 The action research spiral adapted from Kemmis and Mactaggart (1988) & Somekh (2008)

3. 3 Data collection and instruments

In the previous Methodological choice section, I mentioned dividing research methods into three categories, according to Hanington (2003). The traditional methods I used are key informant interview, questionnaires, and in-depth interviews. These methods are involved in the traditional range of market research. Proper usage of these traditional methods can provide an efficient means of implementation, analysis, and visualization as well as to reach large numbers of people (Hanington, 2003). In contrast to innovative methods, these methods are more suitable for recognizing and explaining facts rather than unearthing else-unexplored information. Innovative methods represent credible ways of collecting data through creative means, which are characteristic by their participatory nature,creative engagement and outcome, and their particular use to design research (Hanington, 2003). Based on such standards, the project team held a design workshop.

Key Informant and Local Expert Interview in form of email interview

Schensul (2008b) claims that key informant or local expert interviews are open-ended, involving a small number of questions that cover general topics. As interaction with the interviewer, the key informant provides lengthy responses to questions to share knowledge about the research issue (Schensul, 2008b). My key informant was Henna Marttila, a researcher of the Service Innovation Corner team for CRICS project. According to the project introduction, CRICS represents Critical Communication, Safety and Human-centered Services of the Future, developing simulation-based education, critical communication in healthcare, and social services. The project was already in its final stages. Our project team discovered the possibility of extending this research subject from the perspective of users. Henna, as a tutor for our university project management course, maintained a close and continuous relationship with us in our research. In addition to understanding the background of the project, another reason for interviewing Henna was her previous work experience at the fire station. Her working experience and knowledge obtained from earlier studies with the authorities linked us with the official departments that are not accessible. The interview with Henna is unpaid.

An email interview is an online qualitative method featuring synchronicity and reduced cues (Egan, 2008). Asynchronous communication means that Henna can choose a time to respond to our questions according to her time management rather than an instant conversation, and reduced cues pointed out that there was no face to face communication during this interview. The project team structured a few questions about the general emergency service process in Finland. We also gave

short questions about Henna's background information at the beginning. These questions were displayed in a Microsoft Word document and sent to Henna by email. In this way, Henna was able to give back data of high quality in response to enough reflecting time. The answer to the interview questions was sent back through email in the form of a Microsoft Word document. I stored the document on Google drive.

Questionnaire

The questionnaire is an instrument for collecting individual data about specific topics, consists of standardized questions following a fixed scheme (Trobia, 2008). After gaining an initial understanding of Finnish emergency services through interviews with the key informant, online questionnaires allow me to study larger sample populations quickly. By collecting the comparable data of participants of different age levels and nationalities, I could approach to target our primary needs and serve the community. Questionnaires usually consist of three parts: the cover letter, the instructions, and the main body(Trobia, 2008). The project team presented the cover letter with textual information, which briefly introduced our project theme and the purpose of collecting this questionnaire. We guaranteed acceptable time costs and anonymity to motivate participation. Clear instructions were given by the online survey platform automatically.

The main body was mainly composed of closed-ended questions and a few open-ended questions. We put general and neutral questions (demographic questions, basic knowledge of Finnish emergency service) at the beginning part, which allowed participants to build self-confidence and gradually invest in more complex questions that followed. Then more complex close-ended questions are listed according to different topics in the following order (national differences in first aid process, service preference, personal experience when an emergency occurs, acceptance of authorities' use of personal information, personal experience after emergency occurred, information wanted after an emergency). The types of close-ended questions are selection among nominal categories and checklists. We added the "Other" option in some of the questions to cover the situations that the respondents could not choose the most suitable option. The participants could further specify the "Other" options with few words. In this way, the disadvantages of inaccurate answers caused by the inability of the respondent in the self-administered questionnaire to communicate with the publisher can be avoided. A small number of open-ended questions (information wanted during an emergency, suggestions for emergency service, and suggestions for

our research) required respondents to think more and organize the language in the form of an short essay.

Before administering the questionnaire, we have revised the draft questionnaire several times through pilot tests with the comments of our tutors. We tested multiple online questionnaire sites and finally identified the one that was most satisfying from visual typography to functionality - the Surveyplanet. Collecting the questionnaire data online was because it could be disseminated more quickly, and the collected data was automatically stored. The questionnaire was activated for three days and spread through a link uploaded in Facebook and WeChat group for students in Finland. In this way, we could guarantee that all respondents were having or had a history of Finnish residence and can use electronic equipment. We got a total of 23 participants. The collected data was stored in the form of pie-charts and text online and also in the form of a table file on the computer.

In-depth interviews

Milena, Dainora, and Alin (2008) define in-depth interviews as a prevalent qualitative data collection technique that guides respondents to lively illustrate their view of a research topic. We can expect personal feelings, opinions, and experiences from the interviewees to gain their insight into the situations (Milena et al., 2008). Rosenthal (2016) suggests a sequence of steps for undertaking the in-depth interview: to cautiously determine the opportune data collection approach, to construct the interview guide, and to collect the sample of participants. In this second cycle of our research, where we had already determined that the existing emergency service process is deficient at the user level and has initially constructed some possibilities for improvement, we required more specific practical experience of users. In-depth interviews were our preferred method, inspiring people's nature of story-telling (Holstein, 2002). Although interview questions are not designed verbatim, the needed types of open-ended questions are definite. We used five of the six types of questions Rosenthal (2016) enumerated: (1) experience or behavior questions, (2) sensory questions, (3) opinion or value questions, (4) knowledge questions, and (5) feeling questions. Combining these questions, we can complement the existing service flow diagram in our minds with the exact process, the key emotional changes, and missing service points. We can also confirm whether some of our design ideas are acceptable to users. For interviewees without any emergency service experience, we set out to learn from them about their local service processes.

In the previous questionnaire results, we found that foreigners know very little about emergency services in Finland and have hardly experienced them in Finland. Locals with more practical experience dominate in our interview sample. We orally invited six interviewees from our social networks, whom we already know about their background to ensure their qualification. Four of them are Finnish people, and the other two are foreigners. Three of them are local residents in Rovaniemi. All of them can speak fluent English.

We booked a free classroom for one afternoon at Lapland University, which was easy-reaching for all the interviewees. Since 5 of the participants have had recent higher education experience at the University of Lapland, interviews held in the classroom guarantee relaxation through familiarity. The other one interview took place in the interviewee's apartment. Our research team had three members, each of whom was responsible for two participants who were more closely related to them. Three interviews were conducted simultaneously in different corners of the classroom. We estimated the time required for the first three interviews and set aside a short time for a brief group discussion within our research group. The last two interviews started at a later meeting time.

We first informed respondents that the interview was for academic use. Respondents filled out the online questionnaire as a warm-up to ensure they have read our project introduction and had a general understanding of the research content. Each interview took approximately 25-30 minutes. We recorded the interview with a mobile phone in the form of an audio record after obtaining permission. At the same time, we also highlighted some key points of the conversation through the interview notes. The interview conducted in the apartment was only recored in the means of interview notes.

Design Workshop (experience prototype, questionnaire and focus group discussion)

The design workshop is a creative research method that can involve users in creative visual activities (Hanington, 2003). Hanington (2003) points out that using innovative methods can stimulate the user's enthusiasm for participation more than the traditional method and uncover needs and desires that may be unknown even to the user. The benefit of the workshop is that it can be combined with design methods (here referred to experience prototype in the form of role plays) to obtain multiple data in one activity. A Questionnaire, a focused group discussion, and the observation of video recordings of role play enabled the project team to collect data related to the usage of the new service process from multiple perspectives. Getting participants to give instant

feedback to iterate the service quickly is an essential part of the experience prototype process. The participants recorded and shared feedback during and after the role plays through two data collection methods (questionnaire and focus group discussion).

Elina Härkönen, a teacher of the University of Lapland, kindly offered us a chance to use one session in our "Arctic Art and Design Project" course in the SINCO laboratory to arrange our workshop. SINCO (Service Innovation Corner) is a service design prototyping environment physically located at the University of Lapland, offering tools and devices to support the concretization of ideas, testing, and agile co-creation (Rontti & Lindström, 2014). We had 4 participants, one tutor as an observer and one tutor as an assistant in the workshop. The four participants came from different countries with different life experiences. Three of them were graduate students at the University of Lapland, and the other was a teacher at the University of Lapland. They all had more or less some knowledge of service design.

The individual assignments of the research team members needed to be designed in advance. Our tutor Mira, as the assistant of the workshop, was responsible for hosting warm-up activities, taking pictures of the workshop and participating in group discussions. Mira was also responsible for guiding us to use facilities in SINCO and conduct pre-workshop simulation tests. Another of our tutors, Henna, joined the whole process as an observer to give feedback to role-plays and acted as a backup staff for the rest of the time. Since fewer participants were present than we expected, we had to assign a researcher to participate in role-plays to play non-user roles. Another researcher focused on controlling the electronics to ensure the process runs smoothly.

- *Questionnaire*

We embedded a questionnaire in the role-play process. The main content of the questionnaire (see Appendices 2) is the low-fidelity paper prototype of the mobile application. We turned it into a closed-ended form with a simple text instruction-"Mark the function that makes you feel useful with heart shape.". The questionnaire also involved an open-ended question to gather participants' detail suggestions about specific functions. A paper questionnaire was given to the participants shortly before the role play started. In this way, the participants were given time to understand the instruction thoroughly but not possible to read the content of the mobile application in detail beforehand. The four participants acted as either an actor or an audience in two role-plays to give

real-time comments from two perspectives. Another participant in the questionnaire section was our tutor, Henna, who provided feedback from the perspective of an observer of the role plays.

- *Focus group discussion*

With individual data collected from the questionnaire, a focus group discussion is a preferred option to gather opinions from a range of participants immediately after. Focus group discussion is a qualitative method generating data with the usage of participants' discussion on topics under the control of the researcher (Morgan, 2008). Our focus group discussion was semi-structured, and we kept the discussion topics in an effective range by starting with participants using the high-fidelity prototype of the mobile application. Participants could express deeper opinions and exchange ideas with other participants base on the textual information of the questionnaire. By answering participants' questions, we could determine whether their views on specific functions were limited by the effectiveness of the interface design. We led participants to think and discuss service improvement measures.

- *Observation*

After the workshop, I observed the video recordings of role-plays to compare the participants' behavior in the simulation of the service process with the behavior we envisioned. Observation is one of the most fundamental research methods to learn about phenomenons related to the research topic through impressions of the world use one's senses systematically and purposefully (McKechnie, 2008). I used indirect data collection methods-video recordings to observe the participant's behavior multiple times to extend the original effective time limit of the observation method and its accuracy. My observation focused on the actions, words, expressions, and interactions of participants in playing a role in the service process to dig out their understanding of behavior patterns of roles hidden behind.

The role-plays, and the focus group discussion were recorded with an automatically shooting camera set in advance. Our assistant Mira also took photographs during the workshop. The video documents and pictures were shared through Google Drive and saved in computers. I stored the questionnaire data in the form of photographs, taken from the paper questionnaire. The data of observation were recorded in terms of field notes. Field notes are core data log in observation involving written descriptions of what was observed (McKechnie, 2008). Another part of a field note is a speculative personal reflection on what has been observed (Brodsky, 2008).

3. 4 Data analysis

Researchers make interpretations of the statistical results analyzed from numeric information or insights that emerge from the text information (Creswell , 2009). I used statistics to analyze quantitative data and content analysis to analyze qualitative data. Krippendorff (1989) claims that "The most obvious sources of data appropriate for content analysis are texts"(p. 404). Before content analysis, various forms of data need to be converted to text through transcription (see Figure 6).

Data collection	Format	Format conversion	Anaylsis method
Key informant interview	Email-text		Content analysis
Online questionnaire	Close-end questions		Statistics; Content analysis
	Open-end questions		Content analysis
In-depth interviews	Audio recordings	Transcription	Content analysis
Observation	Field notes		Content analysis
Questionnaire	Quantitative data		Statistics
	Textual information in photographs		Content analysis
Focus group discussion	Video recordings	Transcription	Content analysis

Figure. 6 The selection of analysis methods

- *Transcription*

Transcription is a means of converting audio or video recordings of data into textual representation for subsequent analysis (Poland, 2008). This method is very suitable for data collected from methods (in-depth interviews and focus group discussions) conducted in the form of conversations. The recordings were browsed repeatedly to ensure that all conversations were recorded verbatim. High audio quality was first checked and confirmed. My and another researcher in our project team working as co-transcribers could effectively improve the quality of the transcription. Because a team member withdrew from the project team for personal reasons and could not participate in the transcription, the transcription of the interviews he conducted was supplemented by his interview notes.

I transcribed the data individually and exchanged the text with the other researcher for further inspection and correction. In this way, no detail information was considered ignored during this preliminary analysis phase. McGinn (2008) mentions that spoken discourse or movement is difficult to record in the transcript fully. As my analysis would focus on the content of the conversation,

which means what is said rather than how it is said, spoken discourse or movement was uniformly removed to ensure the readability of the transcript, except for ones considered related to the research content. I marked this extra information with a unified notation system negotiated.

Content analysis

Julien (2008) defines content analysis as an intellectual process of making inferences from textual data, through reducing data (categorizing qualitative textual data into clusters of similar entities, or conceptual categories) and make sense of them (identify consistent patterns and relationships between variables or themes). This analysis is performed in a specific context based on the meaning groups of individuals gives them (Krippendorff, 1989). The identified unit of analysis in my study is each participant in the data collections, regarded by Krippendorff (1989) as having meanings independent of one another. Participants in each of our data collection methods, either randomly or specified, were restricted to a valid range in advance, and their number was not significant. So I did not delete any sampling units to ensure the representativeness of the samples.

Hsieh and Shannon (2005) describe the coding process as the main factor that influences the success of content analysis, during which organizing considerable text into fewer content categories (patterns or themes). According to Hsieh and Shannon (2005), I figured the guide of actions in this process as identifying relationships among categories and creating or developing a coding scheme (the process and rules of translating data into categories). In order to perform this step correctly, I sought a more subdivided type of content analysis. Focusing on the source of category and development of the category system, Marying (2004) subdivides the content analysis method into inductive and deductive. I decided which type to use based on the location of the different data collections on the timeline since the depth of my understanding of the research is generally proportional to the time the research was conducted.

In the early days of my research, when I knew very little, I discerned whether the aspects of the content was worth my account based on the research question and theoretical background. And then, I developed picked aspects as tentative categories, which gradually were deduced and revised with a feedback loop. In such an inductive manner, the main categories finalized by reduction. This type of content analysis was applied for the key informant interview and the online questionnaires(only open-end questions), which occurred in the early stage of my study. Despite the early time point, the closed-ended questions in the questionnaire, for which the coding process was

already done when the questionnaire was designed, Julien (2008) suggests applying content analysis in a deductive manner. This resulted in a frequency of preselected categories or values with specific variables, such as touchpoints that people prefer.

As time progressed, it became feasible to preset formulated and theoretical derived aspects of analysis, and connect them with the text, according to Marying (2004). I was committed to organizing text into a process divided into pre-emergency, during-emergency and after-emergency (including for example behaviors, feelings, touchpoints, pain points and magic moments,etc.) The deductive category application is completed step by step and revised with the process of analysis, involving to give explicit definitions, examples, and coding rules for each deductive category and to determine precisely under what circumstances a text passage can be coded with a category (Mayring, 2004). The transcription of in-depth interviews and focus group discussion, field notes of observation and textual information of the paper questionnaire were analyzed in such a deductive manner.

Statistics

Statistics is a science of gaining insight from data (often but not always numerical), which include methods usually involving mathematics (Chance & Rossman, 2006). In this study, statistical analysis was mainly applied to the data obtained from closed-ended questions in the online questionnaire. The very initial stage of statistics was to set out the results into statistical tables or figures with proportions over frequencies, so-called descriptive statistics. Gilliam (2008) divides the questions into two categories: one is about the questionnaire sample information, and the other is about the research topics. The demographic questions provide subject descriptors-categories considered probably relevant to research topics, which offer variables to divide up the answers of questions about research topics and also help to image the sample(Gilliam, 2008). I figured out the relationship between important variables by comparing the patterns of response divided in this fashion. Then inferential statistics is to make valid and generalizable inferences, according to the proportions, from a representative sample to a population (Schreiber, 2008). I integrated the inferential statistics into qualitative research in the context in a sequential way. Refer to Schreiber (2008), the quantitative study was conducted to test the hypotheses from the previous key informant interview with a larger sample, and then the quantitative information was used to refine the sample and identify potential research questions for the later in-depth interviews.

4.0 Results and Finding

In this chapter, according to the standard process of service design, I will categorize and present the research results and findings into three parts: stakeholders engagement in research activities, human-centerd ideation activities, and stakeholders engagement in prototyping. The discussion mainly focused on the relationship between the value of stakeholder participation and the planning of the service design process.

4.1 Stakeholders engagement in Research activities

In this part, I will present the results of the data collected through the key informant interview, the online questionnaire, and the in-depth interviews. Base on these data, I will explain the benefits of appropriate stakeholder participation and how to implement them in research activities.

4.1.0 Results of the key Informant Interview

Considering together the experience and knowledge of the key informant (see Table 6), I can say that she is the best candidate to act as a substitute for emergency staff. As a former staff from the rescue service department, she possesses subjective thinking from the perspective of emergency personnel. At the same time, she works as a researcher in related fields after leaving the department, and thus, holds an objective understanding from the perspective of an observer with academic rigor.

Experience	Knowledge
Working experience: In Länsi-Uusimaa Department for Rescue Services Espoo, Finland (during 2007 ~ 2010).	- Knowledge of TETRA phones. - Knowledge of how the authorities communicate with each other.
Project experience: One year research on rescue topic / CRICS project (started 2016).	- Observations of one working day of the authorities. - Authorities interviews (police, healthcare workers, fire fighters).
Academic experience Master thesis — “Improving the security and the community with village radio”.	- CB technology.

Table. 6 The sample information of the key informant interview

The interview transcript content includes text written by the key informant herself, as well as a small amount of text in documents or web links attached (especially the “How to use the emergency number 112 in Finland” provided by Emergency response centre agency Finland (ERC)) in the answers. There are eight versions of “How to use the emergency number 112 in Finland”, presented respectively in English, Swedish, German, Finnish, French, Russian, Estonian and an unrecognized

languages (involving mostly Czech, along with Hungarian and Irish). The major part of the content is classified by the service period into three: Pre-service, Service, and Non-service, and the rest of it classified into information from the perspective of related researches. The lacking important information is the face to face interaction between staff and reporters after emergency calls during the "service" phase, and also information about post-emergency service.

- *Pre-service:*

- Emergency education for the public in Finland

  Primary school, Lecture, Different rehearsals (EA course, Fire extinguishing education…)

- Essential knowledge for usage of the emergency service
  - Useful glossary (see Table 7):

Categories	Urgent assistance	Information	Age group	Units commonly needed	Genuine emergencies
Glossary	Help, Emergency, Emergency number, Emergency call, Emergency response centre (ERC), Call 112,	Address, Telephone,	Child, Adult, Elderly person,	Ambulance, Police, Fire service, Hospital,	Accident, Fire, Theft, Sudden attack of illness, Traffic accident, Assault,

Table. 7 The useful glossary in emergency situation

- The emergency number 112
- It is the only one emergency number, working throughout the European Union.
- It is free of charge using a landline or mobile telephone or from a foreign mobile phone connection, with no need for an area code.
- The local emergency numbers are needed outside the European Union and also used in most European Union countries alongside the emergency number 112.
- Proper/ improper use of the emergency number 112 (see Table 8):

	Proper use in genuine emergencies	**Improper use for non-urgent matters**
Situations	To inform the police if you are witnessing a crime being committed	To dial 112 by mistake (no matter to make enquiries, accidentally by your children or by yourself)
	When someone's life, health, property or the environment is threatened or in danger	As a joke
	Or if you have cause to assume this to be the case	To make enquiries
Example(s)	You fall victim to or have just witnessed a traffic accident; you notice a fire starting; you notice that property has been broken into	Call the dedicated number for the police, for example, if you need information on licences issued by the police, vehicle regulations or progress in longstanding crime investigations.
Notice	If in doubt as to whether there is an emergency, it is better to be safe than sorry – dial 112	Enquiry calls made during various disturbances (power failures and traffic congestion) may block the emergency line.
		Non-urgent calls cause delay in providing help in a genuine emergency, with potentially fatal consequences. Making misguided or hoax calls to the emergency number is a punishable offense.

Table. 8 The proper/ improper use of the emergency number 112

From this part of information classified into 'Pre-service', I can conclude that it is very necessary and totally possible to achieve to learn in advance about reporting emergency situations with clear official instruction. And such learning is highly rewarding as the only necessary action is to remember the emergency number 112. The officially provided useful glossary with Finnish translation provides coding words for subsequent questionnaires, and at the same time imply that there may be challenging language barriers in emergency situations. Besides, the limited language versions of the official guideline could be another pain point to be improved.

- *Service:*

This service process is a combination of the original version (in black text color) of the key informant and the official version (in grey text color) from the ERC she attached in the answers. Main communication device within unit (see Figure 7). This process clearly characterizes the interaction between multiple major stakeholders before entering the face-to-face stage. The important position of multiple communications is also reflected.

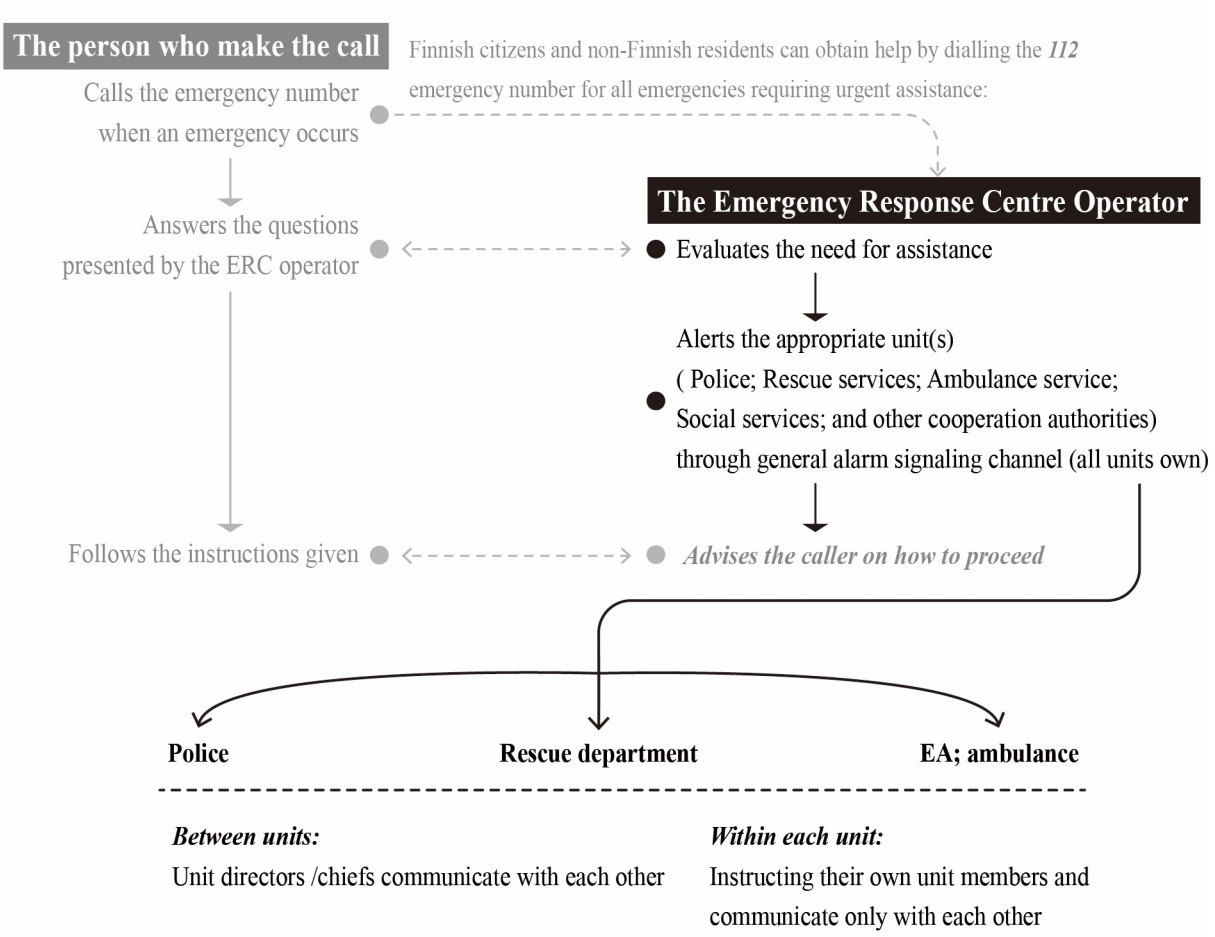


Figure. 7 The service process of an emergency call

- Information from the perspective of related researches

- Pain points of authorities communication

  Fluent communication between different authorities; Language barriers; Smooth flow of information; Long distances; Arctic context

- Authorities communication devices in 2025 (see Table 9):

Older technology	Current devices	Potential technology
CB, VHF	Mainly TETRA phones: - Mostly used models are THR880i (Police, Fireman and Ambulance) and TH1n (Hospital and Social services) - GSM, mail (not safety, no privacy or patient information), face to face, own chat - Satellite phones (really specific) Each authority organization have their own information system. Some cities (Oulu, Joensuu) have built backup networks for CB-radiophones in case of the GSM and VIRVE networks collapse	Smart phone, Application, Sensors, Wearable devices, Tattoo technology Examples - Colour-codes: Dark and snowy weather; Patient situation (green-ok, red-alert, black-dead) - Wearable device: GPS tracking, quick note to screen

Table. 9 The authorities communication devices in 2025

4.1.1 Results of the online questionnaire

Totally 23 responses were received. Variables are sorted into gender, nationality, and age(see Table 10). Because the questionnaire is transmitted online, the sample collected does not involve older people who do not frequently use the Internet. The target user group of emergency service is theoretically everyone, regardless of age, gender, or nationality. Thus, although responses from some of the target groups are missing, all samples collected meet the criteria of potential users.

Ages of Respondents by Gender / by Nationality

Age	**Female** (n=19)	**Male** (n=4)	**Finnish** (n=5)	**Non-Finnish** (n=18)
Under 18	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)
18 to 24	52.6% (n=10)	25.0% (n=1)	20.0% (n=1)	55.55% (n=10)
25-34	42.1% (n=8)	50.0% (n=2)	60.0% (n=3)	38.9% (n=7)
35-44	5.3% (n=1)	25.0% (n=1)	20.0% (n=1)	5.55% (n=1)
45-54	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)
55 -64	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)
65-74	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)
75 or elder	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)
Toal:	100%	100%	100%	100%

Table. 10 The sample information of the online questionnaire

The one variable--nationality, have shown more considerable influence on specific topics (see Table 11). For question 4 and question 5, about knowledge of basic Finnish emergency procedures, the responses from Finnish and non-Finnish respondents are diametric. The vast majority of Finnish respondents have received a certain degree of training in emergency preparedness and understand how to report an emergency situation. The only respondent who has not received any training responsively does not know how to report. And a few non-Finnish respondents have received certain training in university courses due to professional relevance. For question 9 and question 10, about personal experiences related to emergency services in Rovaniemi, the proportion of Finnish respondents who have experienced emergency services is much higher than that of non-Finnish respondents, although the proportion itself is only just over half. What is striking is that all the Finnish respondents believed that there was no difficulty in dialing 112. This result may involve improper wording in the question. In the follow-up interview, the same participant mentioned some problems in communication during the experience of dialing 112, but this was not reflected in the

questionnaire response. However, I can still confirm from the results of these four questions that if I want to learn more about the real experience, I should the major group of interviewees in the next research cycle should be Finnish participants.

Options	Finnish (n=5)	Non-Finnish (n=18)
Q 4: Did you receive any training in emergency preparedness in Finland? (n=23)		
No	20.0% (n=1)	88.9% (n=16)
Yes (please specify)_____	80.0% (n=4)	11.1% (n=2)
	First Aid *4; *"CPR"* *1; *"Fire-extinguishing"* *1; *"Safety pass on tourism course"* *1	
Q 5: Do you know how to report when you see an emergency situation as a first person in Finland? (n=23)		
No	20.0% (n=1)	72.2% (n=13)
Yes (please specify)_____	80.0% (n=4)	27.8% (n=5)
	Call 112 *9; Follow instructions *2 ; *"Calmly state the situation, location and your name"* *1	
Q 9: Have you ever used emergency services in Rovaniemi by calling 112? (n=23)		
No	60.0% (n=3)	94.4% (n=17)
Yes (please specify)_____	40.0% (n=2)	5.6% (n=1)
	"Work related" *1; *"Giving birth"* *1	
Q 10: Did you face any difficulties when you called 112? (n=23)		
No	100.00% (n=5)	88.9% (n=16)
Yes (please specify)_____	0.00% (n=0)	11.1% (n=2)
	"*Didnt know the exact location"* *1; *"If they only speak Finnish"* *1	

Table. 11 Questionnaire results about Knowledge of basic Finnish emergency procedures and personal experience related to emergency services by nationality

Questions 6, 8, 11, and 15 are related to responders' preference for touch-points, post-service, and potential design solutions (see Table 12). Questions 7, 12, and 13 are for gathering facts about the usage of emergency services (see Table 13).

Q 6: How do you prefer to get knowledge about emergency services when you arrive at a foreign country? (n=23)

Variable	Website	Brochure	Authorities	Text message	Local residents	Other: E-mail
N	18	10	7	6	5	1

Q 8: In which way do you prefer to report an emergency condition? (n=23)

Variable	Making a phone call	Using mobile applications	Other_____
N	17	6	0

Q 11: Considering a device which can record your physical informations (location, heart rate, blood pressure,…) and send the information to the emergency authorities, which option is more acceptable for you? (n=23)

Variable	The emergency authorities can always access to your information provided by your device.	When an emergency occurs to you, the device will automatically send your information to the authorities.	The information can never be sent without your own permission.	Other
N	3	16	4	0

Q 15: What kind of service do you think should be provided after an emergency condition? (n=23)

Variable	Resettlement of the affected people	Post-disaster psychotherapy	Other_____ *"The process of the events"; "Phone, online and physical services for psychological and medical help."*
N	16	16	2

Table. 12 Questionnaire results about preference

Q 12: How do you usually be informed about emergency events? (n=23)

Variable	Social media	Television	News website and services	Radio	Newspaper	Authority websites	Other: Friends
N	18	10	7	6	5	1	1

Q 7: Do you think that the differences of emergency rescue process between your country and foreign countries may cause problems when emergency occurs? (n=23)

Variable	No	Yes, please specify	
N	12	11	- Simply stand positive to this question *2 - Provide specific problems: Language barriers *2 *"Specific places to go"* *1 *"First aid gestures"* *1 The emergency number *2 (one mentions the possible confusion on number due to pop culture)

Q 13: Do you usually follow the news and reports when an emergency situation happens? (n=23)

Variable	No	Yes, please specify	
N	10	13	- Why If local related *2; If relatives and friends related *1; If recently occurs *1 - What *"To know what happened, in which condition, where, if or is allowed to go outside…"; "…to be aware of what's happening and be ready to react according to the situation."; "reasons, by whom, location,number of victims"* - How Television *1; News *1; Radio news *1; Messages from friends *1; Posts on social media platform *1; Local news websites *1; Social media *1; Facebook *1

Table. 13 Questionnaire results about facts for the usage of emergency services

The purpose of the three open questions 14, 16, and 17 is to discover the relatively highly-demanded functions or pain points in emergency services. The results of Question 14 can be explicitly classified by coding (see Table 14). As for the result of question 16 “Do you have any advice to improve emergency services in Rovaniemi based on your experience?”, after removing the meaningless greetings to the research, there are no duplicates. So I will list the answers and analyze them one by one. The content of answer from Respondent 20 “Information about shelters and available therapy/medical personnel” is overlapping with question 14 and can be classified as the highly requested information. Respondent 18, saying “Rovaniemi is good but in northern Lapland it might take hours to get help.”, proposes a pain point that has not been mentioned before, the long distance. Respondent 1 expresses dissatisfaction with existing First aid education and specifically points out the negative impact of language barriers on this, writing as “The first aid course for the tourism sector is a joke. None of the staff speaks english, even though Rovaniemi is a tourist town.”. The answer “reduce prices” by non-Finnish respondents 23 is ambiguous. Since non-Finnish citizens can reimburse the cost of emergency services through insurance companies, it means that there is almost no real expenditure for emergency services. So one guess about the objection to the price is that since Respondent 23 has not experienced the emergency service in Finland, she does not know about the charges. In addition to Respondent 23, the reply "i have no experience" of Respondent 21 also reminded that the inexperienced person may lack emergency-service-related knowledge and ability to give suggestions. Respondent 13 affirmed the need for the dissemination of knowledge related to emergency services by saying “Let more people know”.The only two meaningful answers “There is a big need for providing emergency information to all international residents and visitors” and “Would like to have more knowledge about this (public propaganda)” to question 17 "Do you have any other comments related to this research or survey? Free word." also support this view.

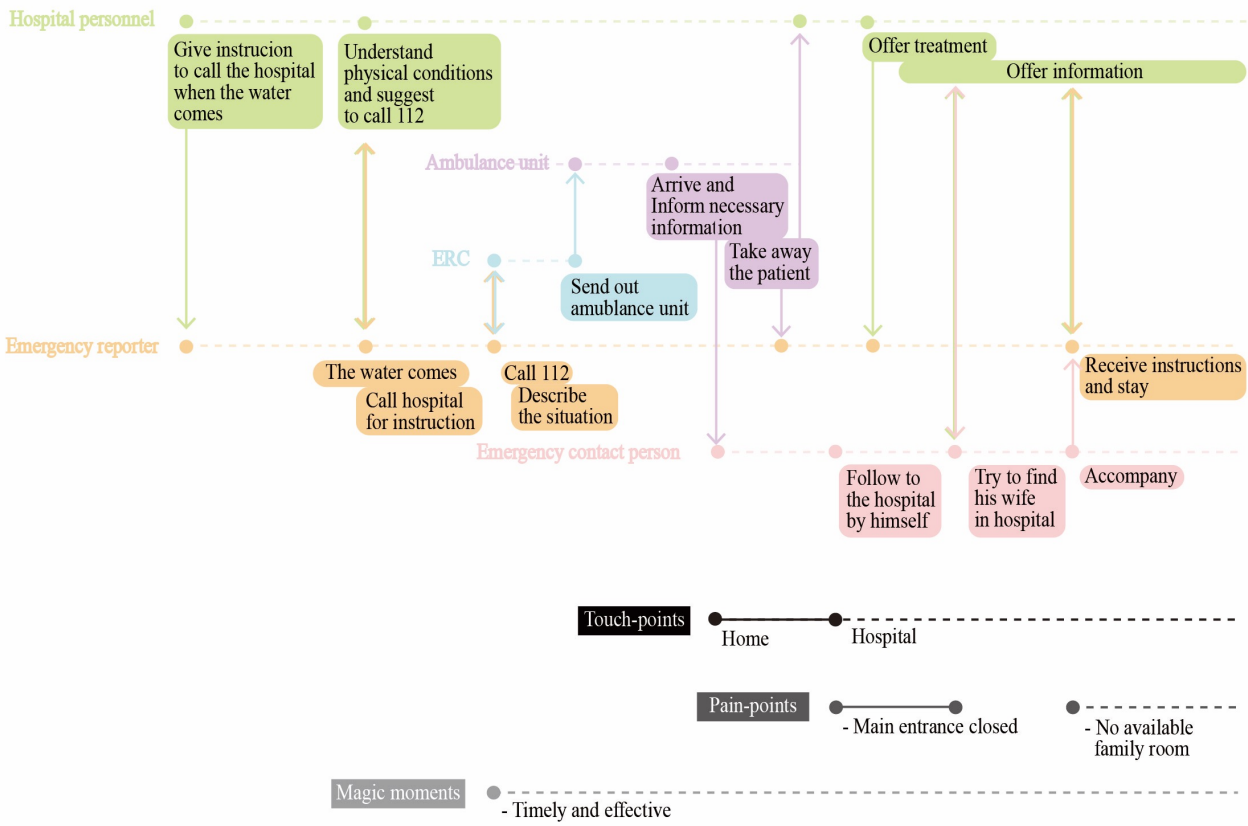
Q 14: If you find yourself in an emergency situation, what kind of information do you want to know? (e.g. the location of rescue staffs/ the safe way out or safe points to hide / information about current situation, casualties,…) (n=16)			
Category	**Code**	Counts	
General emergency information	**Current situation**	6	*"examples were fine"; "current situation"*2; "…And current situation"; "information about current situation"*2*
	Casualties	3	*"examples were fine"; "casualties"*2;*
	Emergency location	2	*"the location is the most important"; "The location…"*
Self-rescue information	**Emergency actions**	3	*"first aid gesture"; "How to save myself";"first actions in emergency situations"*
	Emergency goods	2	*"availability of safety equipment/first aid"; "place with medicines"*
	Escape route/ safety place	5	*"examples were fine"; "location of safe exists"; "The safe way out"*2; "the safe way out or safe points to hide"*
Urgent assistance information	**Instruction**	2	*"instructions on how to treat a person in specific circumstances"; "receiving the instruction form official people"*
	Rescue team	5	*"examples were fine"; "Location of rescue, is anyone going to help"; "Location of rescuer"; "if the rescue staff is on their way to the place"; "the location of rescue staffs"*
	Connection channels with emergency authorities	5	*"Who are responsible for such issue and whom I can get help from"; "where to get the emergency service"; "how to contact the rescue staffs"; "hospital, refuge center, info about embassy"; "the number of emergency"*
	Volunteer	1	*"if I can help (I have specific formations in first help and crisis situation to rescue people, like determine priorities of harmed people)"*
Communication	**Contact with relatives/ friends**	2	*"updates on close ones' situation"; "let my family know"*

Table. 14 Questionnaire results about emergency information

4.1.2 Results of the in-depth interviews

The content of the in-depth interview transcript can be classified into two parts: interviewees' experience of using emergency service, and opinions related to emergency service. I visualize the stories told by the interviewees into various experience-centered journey maps, illustrating the holistic experience from the interviewee's perspective. The elements that make up the user journey maps are the main actor (the interviewees), a sequence of steps from the perspective of the main actor(Stickdorn et al. , 2018), stakeholders, touch-points, pain-points, and magic moments. Despite the use of similar emergency services, the roles of the main actors are different. Our interviewees are acting as emergency reporters (can be further subdivided into those who himself/herself need emergency assistance and those who help others to report the emergency cases), and emergency contact person of the emergency reporter (see Figure 8). The complexity of each experience also varies. There are experiences with a few basic steps (see Figure 9), which are similar with the

service process of emergency call described by the key informant. At the same time, there are also more complex experiences (see Figure 10) that involve more stakeholders and steps, with an extended service period.

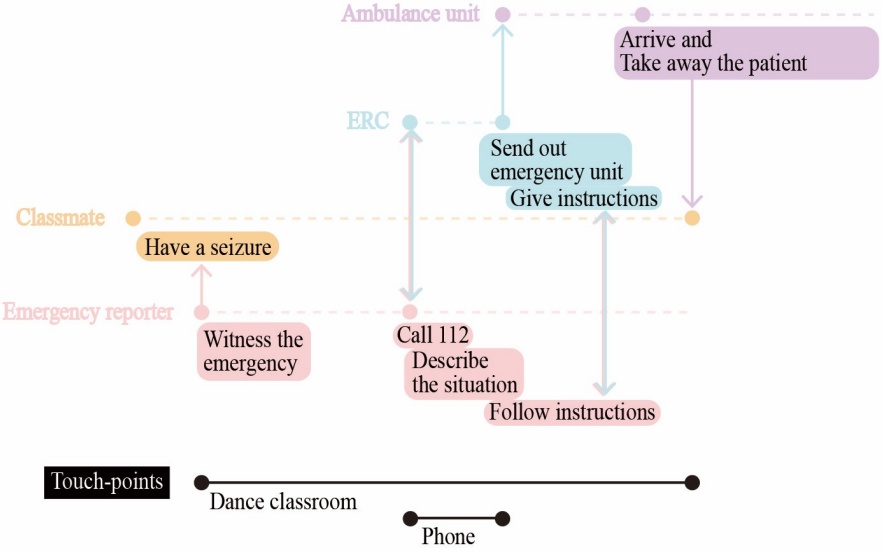


Interviewee 3

From the perspectives of an emergency contact person

Figure. 8 The customer journey map from the emergency contact person's perspective

Interviewee 4
From the perspectives of an emergency reporter



Interviewee 2
From the perspectives of an emergency reporter

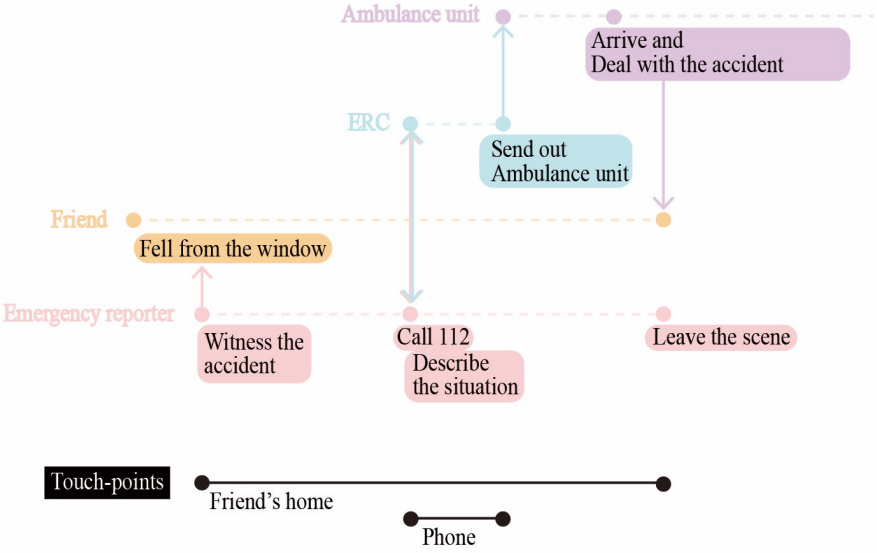


Figure. 9 The customer journey maps with basic steps

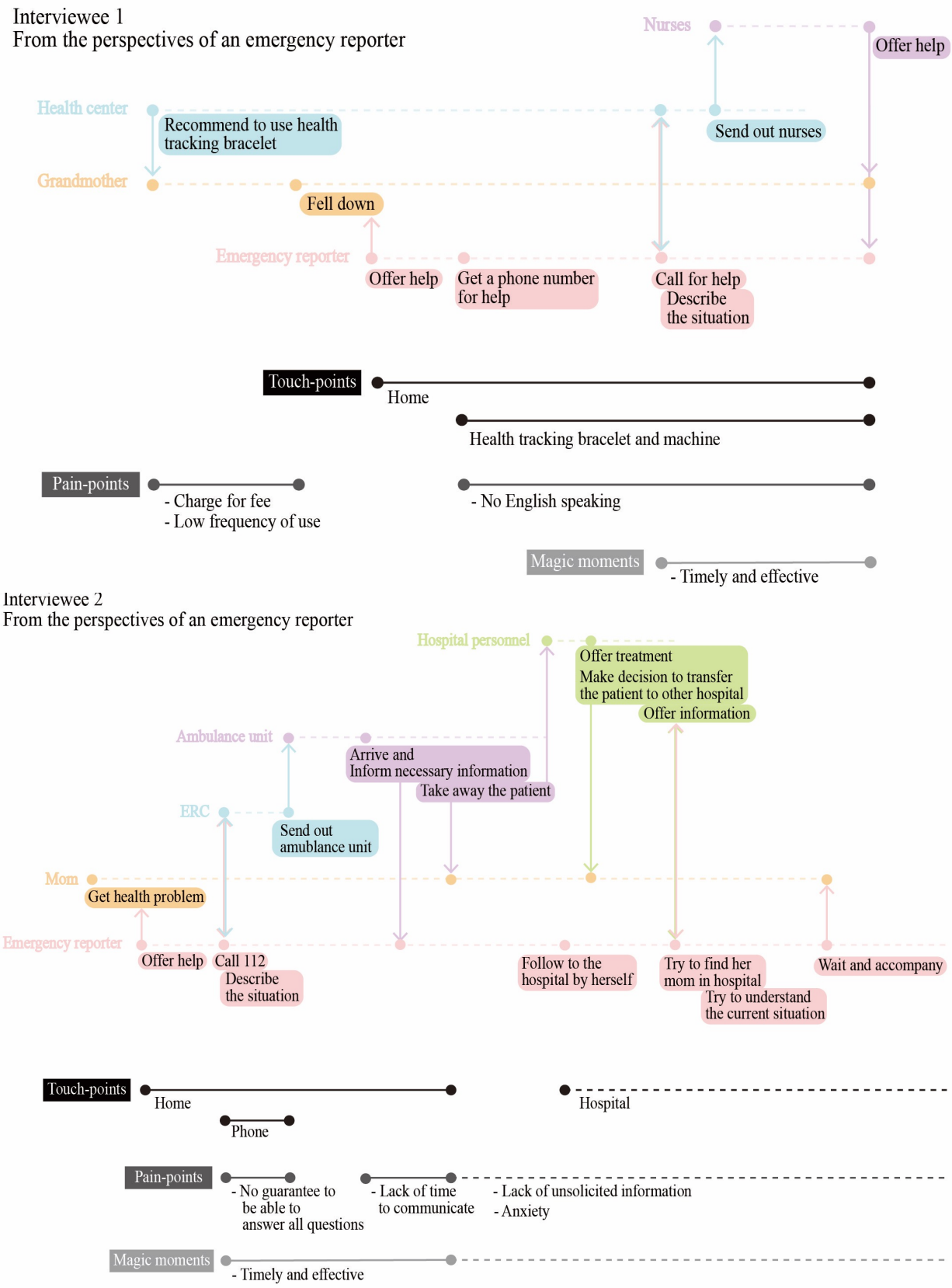


Figure. 10 The customer journey maps with extended service periods

The interviewees offer pain-points (see table 15) they recognize in pre-service and service stages, and also touch-points (see table 16) that are working well or they propose to be useful.

Pain-points					
Category	**Sub-category**	**Codes**			
		Interviewee 1	**Interviewee 2**	**Interviewee 3**	**Interviewee 4**
Pre-service	Emergency knowledge	No attempt to actively learn about emergency knowledge	No attempt to actively learn about emergency knowledge		
		Current authority lecture for university students: about crimes(drugs, alcohol, and rape), no information about emergency actions or traffic rules that may cause an accident.	Emergency training are charging for fee		
			Theoretical knowledge needs to be tested in practice		Theoretical knowledge needs to be tested in practice
Service	Information achieving	Phone call does not work for people who are enable to talk (throat swell up, deaf)			
	Emotion	Tension or fear	Tension or fear		
		Lack of attention			
	Long distance			Problematic driving (lasts for couple hours)	Extra time spent
				Extra costs for hotel	
	Information providing	Need to inform family in time		Need to inform family in time	

Table. 15 In-depth interviews results about pain-points

Touch-points or channels					
Category	**Sub-category**	**Codes**			
		Interviewee 1	**Interviewee 2**	**Interviewee 3**	**Interviewee 4**
Pre-service	Emergency knowledge	Authority lecture	Free training courses		Free training courses
		Brochures			Brochures
Service	Emergency reporting	Bracelet (in certain situation)	Bracelet (in certain situation)		
			Application	Application	
			Printing electronics		
	Information achieving	Instruction in text from authority website (which can be easily shared on social media)			
		Application (help with the insurance issues)			
		To talk in person to get instructions (family, friends or neighbor)			
				Authority for emergency alarms	
			Social media for emergency alarms		
	Information providing		Database (medical records)	Database	Database (medical records)
			Emergency contact people	Emergency contact people	

Table. 16 In-depth interviews results about touch-points

4.1.3 Finding

During the first divergent phase of a service design process-- research activities, a gradually more comprehensive range of knowledge and insights are gathered progressively. Research activities contribute to identifying stakeholder groups from general categories to detailed subdivisions, illustrating a standard service period from the most basic one to an extended one, and essentially discovering problems and needs for all key stakeholders. To correctly determine the point in time when to engage the appropriate stakeholder(s) in the service design process advances creation and implementation of a reasonable and practicable process.

Appropriate stakeholder engagement benefits in process advancement

A well-planned stakeholder engagement allows a broader depth and scope of understanding upon the current service period and stakeholder interactions. The first key point of successful design is to figure out as soon as possible, from the beginning of the design process, the most important stakeholders involved in the current service and the cost-effective and accessible stakeholders based on time and energy. Based on common sense and benchmarking of emergency ambulance service, and literature reviews, first a general stakeholder map (including user, service provider, design team) can be determined. At this stage, it is necessary to recognize the authorities (service provider) as an inaccessible source of information for most people because of policies or regulations. Therefore, a coping hypothesis is that finding a valid substitute can effectively fill the vacancy of this key stakeholder. An efficient way to reach such a goal is to search among existing available resources of the design project, by which the key informant (extended design team) is appended to the first version of the stakeholder map. At the same time, compare to the standard service design process, the engagement of service providers should be deferred until the earliest second round of prototyping. In other words, service provider engagement should be realized after the design team can provide a shaped and productive design output rather than invite with no guaranteed benefits. It is more sincere and possible to engage the service provider in the follow-up design process to test, iterate, and finally implement.

The results of the following-up key informant interview confirms the feasibility and superiority of this hypothesis. Firstly, the key informant provides two different perspectives of emergency service, as a service provider with experience of former emergency department employee and in addition as a researcher in related fields. From the service provider perspective, the key informant offers sufficient information to form the process of the basic service period to report an emergency and

figure out most of the key stakeholders recognized in the final version of stakeholder map. Another vital piece of information is that due to regulations and the purpose of confidentiality, many experiences of service providers cannot be disclosed or announced to others casually. This is suggesting that in need of a more specific understanding of stakeholders and their interactions, the design team should turn their eyes to another more free group of stakeholders, that is, those who report an emergency. From the perspective of the researcher, this view is also supported. The current or future trends in the research of emergency services are focused on improving the efficiency of communication between or within emergency service units through equipment or potential technology. In other words, it is mainstream to optimize service providers' own ability to improve service efficiency (to ensure the success of emergency assistant) rather than to promote the user's service experience (to make users feel satisfied). Therefore, gaining enough general informations, the following research activities should focus on the emergency reporter and collect the actual experience to expand the details.

In the follow-up research activities, both the results of the quantitative method and the qualitative method reflect the inclusion of a more specific classification and the diversity of response needs and problems in the primary stakeholder group--emergency reporter. Although the quantitative method conducted supplies no content about specific experiences, it contributes to the next qualitative method, which collects stories, by screening suitable groups of the participant. Qualitative method involving stakeholders is crucial, in which storytelling provides brand new categories of emergency reporters and related information.After applying these research activities, the content (actors and key actions) of the final stakeholder map (see Figure 11) has been filled. Such a complete stakeholder map indicates that the purpose and needs of research activities have been achieved and can be ended, and the next phase can be advanced.

The process of making decisions on appropriate stakeholder engagement in the right order and understanding stakeholder groups through specific activities cooperate in the way of affecting and supporting each other.

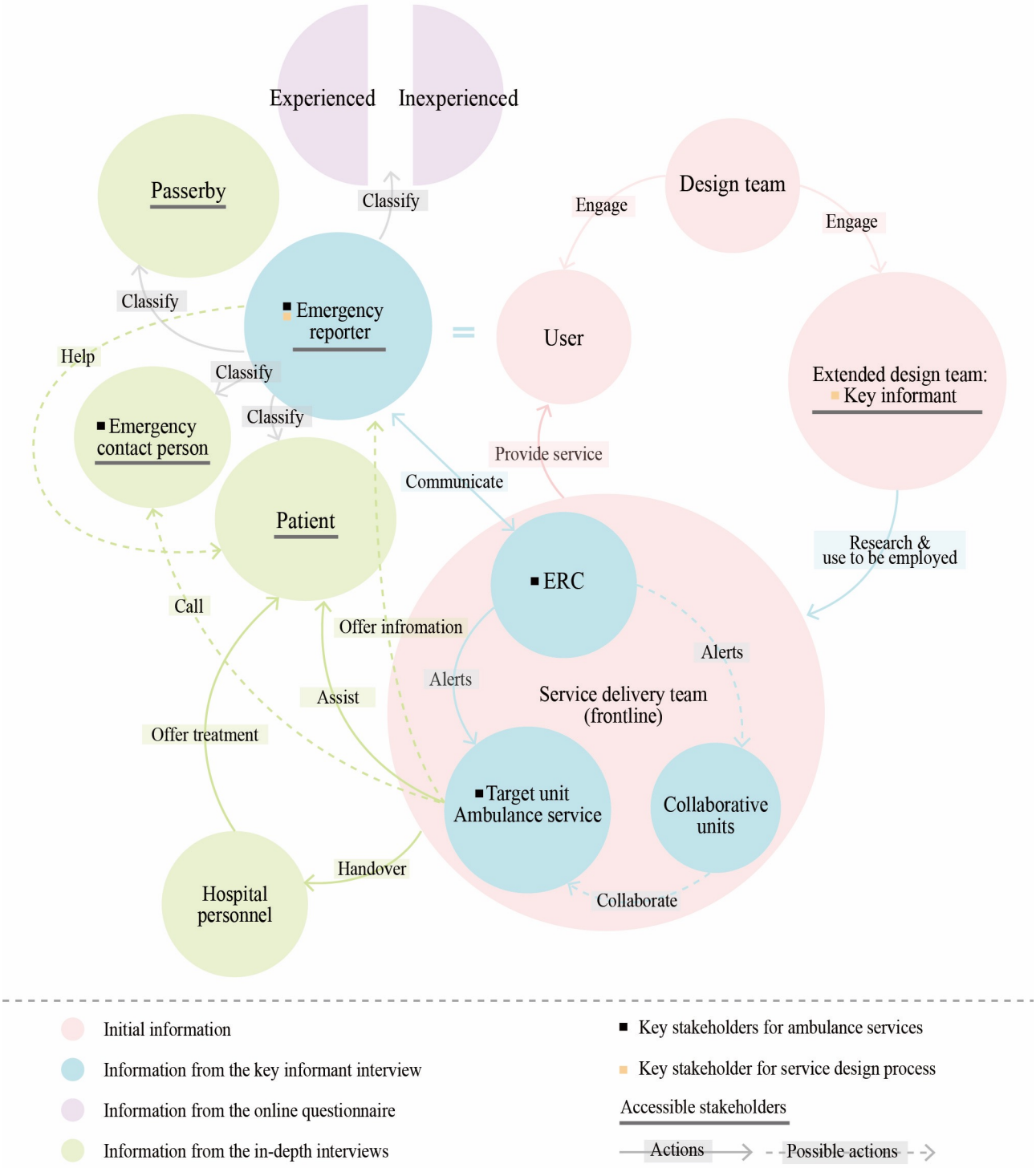


Figure. 11 The stakeholder map of current emergency ambulance service

Appropriate stakeholder engagement benefits in gather insights

Different research activities have different roles and gains in the process of acquiring stakeholders' problems and needs. It is essential to understand that these discovered pain-points are closely related to the needs and the interaction of all stakeholders.

From the results of the questionnaire, there are already many pain-points reflected, even from some respondents who have no experience at all. However, just knowing these problems and needs is not the ultimate goal of the service designer for conducting research activities. It is important to understand the reasons why these problems emerge. Considering that individual needs and personal experiences of various participants are different, their needs and problems may overlap somehow, but difference exists in for sure. If the collected pain points are comprehended separately from the specific experience, it will inevitably lead to confusion in understanding. This prompted the practice of recognizing each action or step of stakeholders and connecting them in time-order to form a complete experience. Visualization tools based on this principle are common in service design fields, such as user journey maps and service blueprints. Visualizing invisible information to enhance the communication efficiency of all participants is a major advantage. However, for designers or researchers, another benefit of sorting out the behavior of an empirical process is that it can help us find the logical order and causes of the problems and needs that we discovered.

To explain with examples, in this research, I visualize the service experience of the main user (the emergency reporter) with key stages and detailed steps (see Figure 12). The key stages identified can be used as the codes to sort the needs and gaps and the detail actions give clue to figure out where to sort them. To identify more detailed categories of the main stakeholder, find out their common or different needs, and understand these needs in time-order by illustrating their experience, is the recommended way to deal with the data collected from stakeholder engagement. With more information obtained through stakeholder participation, the scale of the service period is expanding to cover all key pain-points. The difference in the role of the emergency reporter also leads to different service experience, more specifically, different behaviors and interactions, and corresponding pain-points. These different steps and related pain-points and the expanded service period provide a bigger range of gaps discovered, and as a result, inspire more potential solutions.

Gathering as much as possible more needs and problems from stakeholders are basic purpose during research activities. To notice the diversity of individual experience through stakeholder engagement and utilize this diversity to logically and clearly understand the needs and problems of stakeholders is the key to the success of research activities.

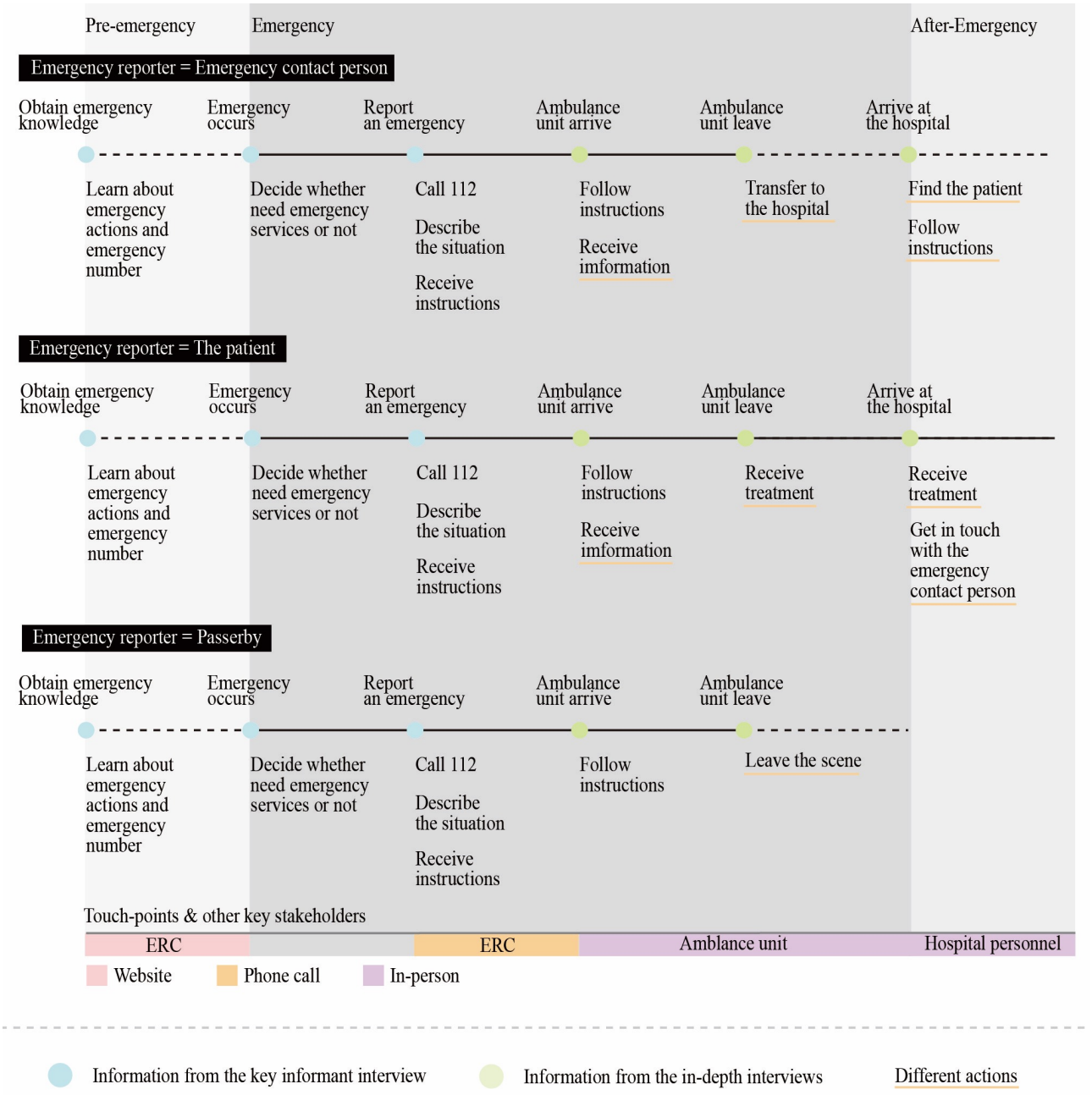


Figure. 12 The service experience of the main user

4.2 Human-centerd Ideation activities

Ideation activities are the conversion of collected insights into practical solutions. To implement the human-centred principle, even if there is no direct stakeholder participation at this stage, all decision-making is based on fully considering the needs of various stakeholders. At the same time, it is necessary to consider how to effectively introduce outcomes to stakeholders in the next stage-prototyping.

Filter ideas with stakeholders' perspective

The ideation activities follow the patterns of divergent and convergent actions. Using brainstorming method can fully generate a large number of scattered creative functions of the productive outcomes (see Figure 13). Usually, not all ideas will be adopted. These ideas will be filtered and then connected by a small number of actual products, events, or systems.

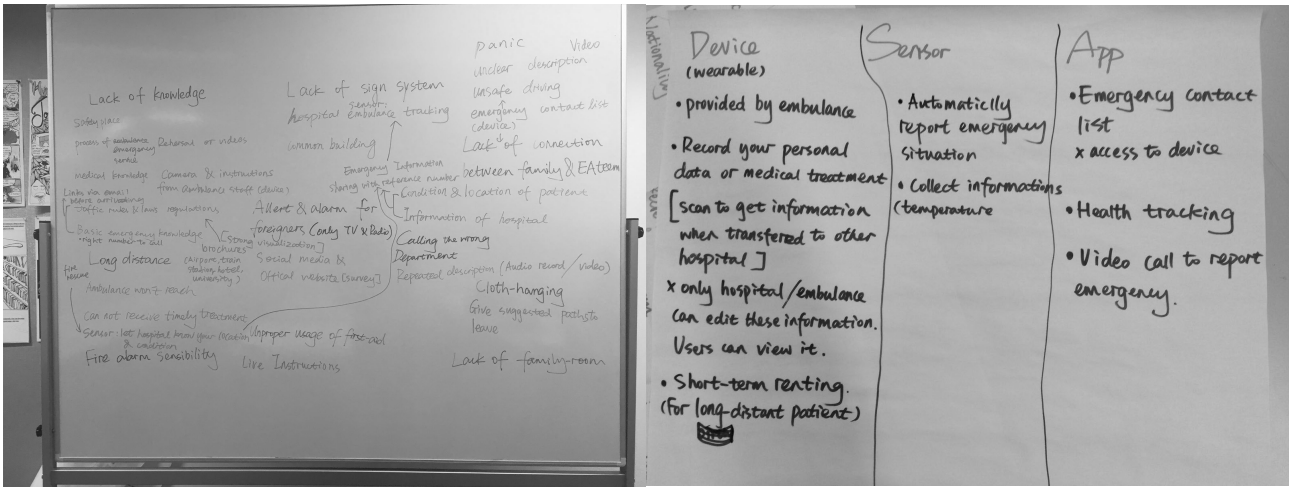


Figure. 13 The pictures of brainstorming process

The filtering process can be seen as a collaboration between the designer's perspective and the stakeholders' perspective. From the perspective of the designer, creativity, feasibility, and cost performance need to be considered:

1. Creativity: From the perspective of the uniqueness of outcomes, the functions with less competing products are more competitive.
2. Feasibility: The skills and knowledge of designers and the dependence on new technology or future technology will affect the length of time required for creative realization.
3. Cost performance: In terms of human resources, time consumption, and money requirements, high cost-effective ideas are superior to low cost-effective ones.

From the perspective of the stakeholders, the needs of stakeholders are the criteria that determine the ideas that must be retained. Different stakeholders have different contributions in terms of the amount of information provided, the proportion of involvement in the service process, and the previous focus received in related fields. The main stakeholder, such as the emergency reporter in this research, as the main perspective provider of the service period and the people who participate most in the service design process, are bound to have the most needs settled. Solving their problems will have the most significant impact on service quality. Ideas directed at the main stakeholder will

take a relatively small risk because insights of them are collected in large numbers to avoid negative comments or unnecessary ideas. For stakeholders that are out of reach, the proportion of solutions targeting them will be rather small but not non-existent. Through benchmarking or engagement of substitutes, relatively rough needs can be identified. The general demand means that it may be easy to be covered, through a small number of ideas or even those created for other stakeholders. Therefore, when selecting ideas, ideas covering all stakeholders at the same time will be the highest priority, followed by those that only focus on the main stakeholder.

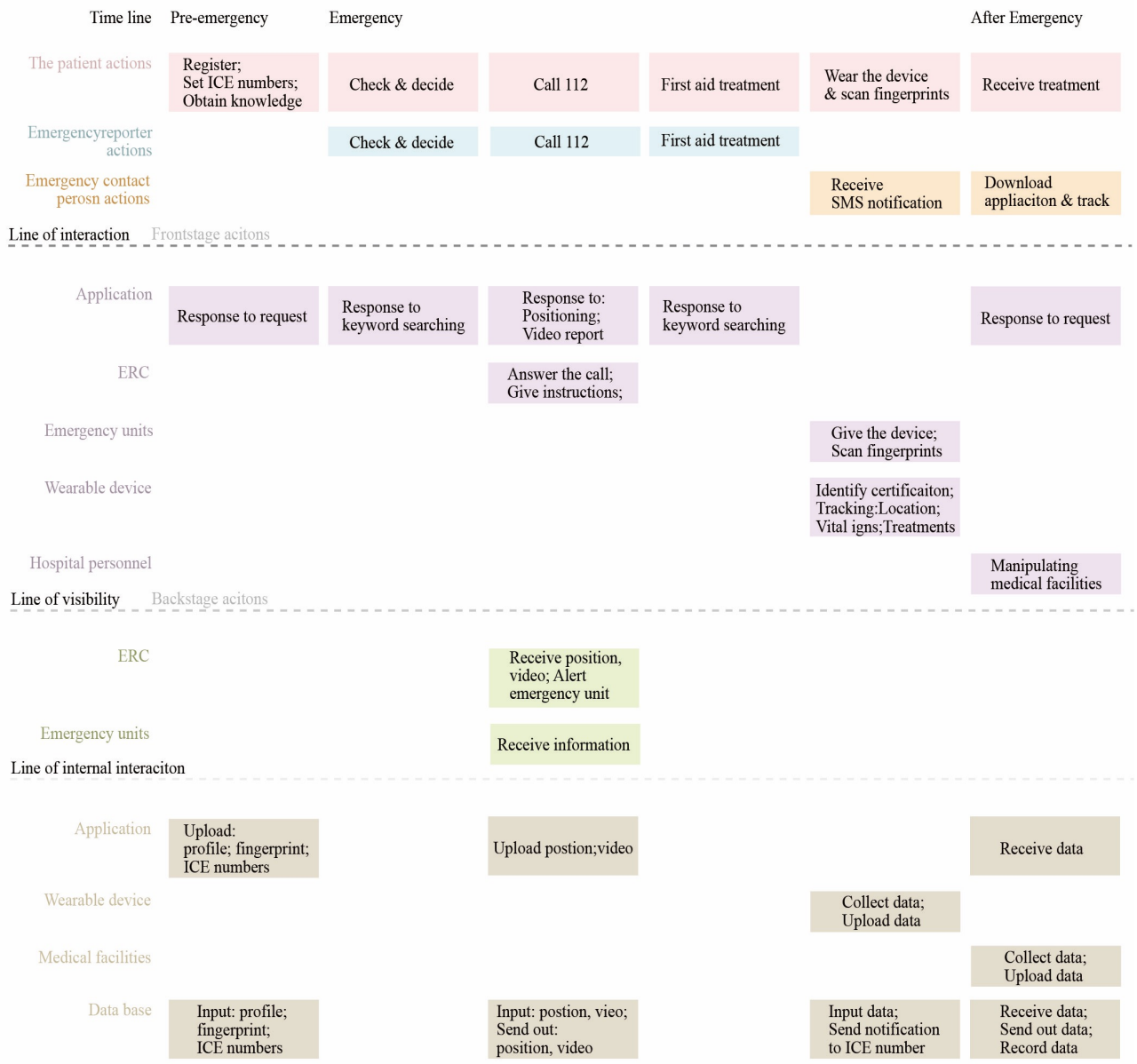


Figure. 14 The service blueprint

To improve the success of relevant ideas of stakeholders that are not accessible, it is more effective to increase the actions of the design team or technical team instead of their actions. Specifically, through the service blueprint (see Figure 14), it is to increase the participation of devices or databases below the line of internal interaction to replace changes in the frontstage or backstage behaviors of inaccessible stakeholders. In the case of minimizing the possibility of violating the wishes of stakeholders, it is acceptable to address only some of their needs.

When deciding how to combine the screened out ideas into outcomes that can be produced (the type or physical form of the solution), the widely-used touch-points of the stakeholders and their recommended touch-points are preferred. To reduce the complexity in stakeholder behavior due to excessive touch-points, it is practical to synthesize the output of multiple ideas, such as a mobile application.

Visualizing solutions promotes communication and future stakeholders engagement

Following creative activities is the prototyping stage, which again involves stakeholders' participation. Through a service design tool such as user personas, the target user groups are vividly visualized to increase participants' empathy for new services. And at the same time, personas provide ideas for establishing the main roles of role-plays in the next stage. The service blueprint, a tool for illustrating the whole service period, visualizes both visible and invisible behaviors, thereby reducing the difficulty for participants to understand a complex system. Moreover, by organizing all the touch-points, stakeholders, and interactions, the designer can prepare all the tools, scripts, and props required for the following workshop in advance. In short, the visualization tool clarifies ideas and optimizes understanding of services for participants and designers at the same time, and pushes forward the service design process.

4.3 Stakeholders engagement in prototyping

Prototyping and research activities have in common to gather insights on the needs and problems of stakeholders. Still, the difference lies in a newly established service period and a current service period. Therefore, the new challenge for prototyping is how to quickly and low-costly build prototypes and effectively introduce new services to participants. Using insights to make the right decision, whether it is to advance the process or improve the design quality, can be achieved by applying reasonable principles.

Conduct inspiring stakeholder engagement methods

In the earlier introduction and methodology chapters, I have introduced the primary method used for prototyping is a workshop that combines experience prototypes (in the form of role plays), a questionnaire, and a focus group discussion. Think of prototyping as an iterative process, and for each cycle, the suitable participants and the way of participation will be different.

As far as the first round of prototyping is concerned, it would be more beneficial for the participants to be those who have been involved in the service design process all along. Before prototyping, each participant viewed the entire service period from the perspective of his/her individual roles. At this stage, as the service designer did in the first two design stages, it is the correct time point to try to allow participants to broaden their perspectives. By playing other roles and experiencing different behaviors with different aims, responsibilities, and skills, participants will be stimulated to discover cognitions they have never realized. Participants offer brand-new, more specific, and more practical evaluations and suggestions, which was something many participants failed to do in the research activities, especially those who had never used emergency services.

Through visualization tools such as the service blueprint and personas, participants have a shallow but clear enough understanding of the new service period. From the observation of role plays, the whole process can be considered to be proceeding smoothly, without noticeable stuttering or overwhelming phenomena. The feedback received can also reflect this as the opinions given by the participants are all related to the specific function of the outcome, not the service period itself. However, compared to playing a role that they are entirely likely to cover in reality, when playing service providers, the participants' behavior is more stereotyped. One of the essential reasons comes from the lack of participation by key stakeholders that may be insufficiently accessible, or not at all, to the research. Whether it is a design team or other stakeholders, most people lack practical contacts and vivid understandings of this stakeholder group. The participants play the role of missing stakeholders based on the provision and acceptance of information from a personal perspective. However, the worse situation than knowing nothing is that reality is different from what you thought. The gap between the thoughts and needs of the service providers in this research and what others believe cannot be filled without actually adding the missing perspectives (through engagement). This situation suggests that in the next cycle of prototyping, missing stakeholder participation must be planned and implemented.

Whether it is due to the instinct of participants to think for themselves, restrictions in resources, or the limitations of design tools (many visualization tools is illustrating from one specific perspective), the lack of one key stakeholder perspective throughout the design process must be resolved. After all, communication and interaction are two-way, and thus the voices of all participants are crucial. The deficiencies that are acceptable in the research activities cannot be rationalized throughout the whole design process. By experiencing the service period from the perspective of other stakeholders, it can not only stimulate undiscovered insights but also provide key support for decision-making upon the planning of the service design process.

Enable sufficient participant feedback

Participants' familiarity with the service design field or research field will have a certain impact on whether the feedback they give presents maximized effectiveness. Especially joining creative methods such as a workshop, participants are often asked to give immediate feedback. It is possible that the shorter thinking time is likely to lead to insufficient opinion expression and losing opportunities to grab great ideas. The paper-based data collection method that can be used to record ideas from the beginning of the experience prototype is highly recommended. Taking this research as an example, a paper questionnaire with both qualitative and quantitative features works well through the entire workshop. It allows participants to capture fleeting ideas and prepare for focus group discussions with writing down notes or text. This helps to stimulate the enthusiasm of participating in the discussion through adequate preparation. The focus group discussion allows participants to obtain the opinions of others to re-measure their own ideas. This makes the retained feedback firmer and screens out some inaccurate feedback. One participant suggests as “Would be really interesting to know which one “Don’t” or “Do” should be at first? (you give faster first aid if the ‘Do’ is first, right?)” and later notes that “After discussion: depending on the case.”.This result reflects the self-censorship of the participants through discussion. Applying the appropriate methods of collecting feedback can indeed optimize the results received in a short time.

Reasonably adopt or abandon participants' insights

The data collected during prototyping is not only presented in different formats but also differs in its applicability. Quantitative data are presented in precise numbers, without rarely ambiguity (see Table 17). Such selections representing optimistic evaluation very clearly points out the functions that are performing outstandingly and worth-developing. Designers can sum up from such results to

assess whether the prototypes of design outcomes have reached a basic qualifying line to be described as successful.

Mark the function that make you feel useful with heart shape. (n=5)						
Log in	Sub-category	Log in	Sign up	Create profile	Relationship	Profile
	Code counts	1	1	0	1	1
Track	Sub-category	Tracking pop-up	Enter code	Track page	Home page notification	Ending pop-up
	Code counts	1	1	2	1	1
Call 112	Sub-category	Calling options	Call with live video	Video call	Track ambulance	End tracking
	Code counts	1	1	2	2	1
Search for first-aid instructions	Sub-category	Home	Search	Don't	Do	Call 112
	Code counts	1	1	4	2	2
Find official links	Sub-category	Menu	Link			
	Code counts	0	0			
Set allert for tracking	Sub-category	Allert				
	Code counts	1				

Table. 17 The results of close-ended questions in the paper questionnaire

The qualitative data collected through the questionnaire includes positive or negative evaluations, suggestions for improvement of existing functions or new ideas. Among them, suggestions or comments on the improvement of the user interface for the application owns a relatively high acceptance rate and are fairly easy to achieve. Here are a few examples of results: wording change of "Medical Notes" to *"History"*; *"This is a bit unclear… maybe because so small* ✚ *and* ━ *buttons. Should it go straight to the video or film-mode while pressing the icon?"*; and Very tiny improvement of feature —*"It would be nice to have a kind of checking list…for patient. maybe make click box (because people would be…)."*, *"Maybe better to have different language, Finnish, Russian, Swedish, Saami"* and *"These numbers don't tell me much. How to show these (usually if i see my blood pressure, i go to google the numbers)"*. Such details-oriented changes that do not conflict with the current functions can be directly accepted without hesitation. Some changes that need to add new features require more consideration, whether it is necessary or if it conflicts with existing insights. It's worth adopting for the repeatedly mentioned suggestions, such as *"voice instructions: because you might not be able to write, you're helping the patient or it's hard to write"* and *"That you can hear advised if you need your both hands."* are both proposing to add voice-

instruction function. Proposals that accordingly address some negative evaluations from others are also valuable. For example, when talking about the log-in function, apply for Log-in access with fingerprint (*"Finger print log-in"*) may solve the problem of privacy safety (*"XX's biggest worry is the safety of information."*); look on first-aid searching function, adding samples (*"Maybe some sample show up here, key words for finding easier. - fractures."*) for key words can increase search efficiency and accuracy (*"can be problematic, because you can't always say what happens exactly- and if you wrote something wrong- you might act wrongly…"*).

Some proposals need to be improved slightly before they can be adopted. There is one participant wondering as *"Can ambulance stop tracking when they arrive?"* for ending the tracking process during calling 112, instead of ending by the user. In this case, adding extra steps of service providers violates the conclusions drawn in the ideation activities. However, it is a reasonable suggestion to reduce unnecessary operations of the user. Therefore, it can be adapted from it to add a function to terminate the tracking process automatically through the backstage technique.

Although service design focuses on solving the real needs of users, this does not mean that designers need to solve all the problems of users. The time and resource constraints of design projects, and the limitations of personal skills all together indicate that some unachievable proposals need to be abandoned. In this research, asking designers to solve the pain caused by death in an emergency (*"Think about the case when the patient dies (screen, sentence)"*) is a request that does not need to be accepted.

5.0 Conclusions

Comprehensive stakeholder engagement is an indispensable practical operation to realize the human-centred and collaborative principles of service design. In this research, by implementing and understanding stakeholder engagement, the most appropriate, reasonable, and practicable service design process is customized, focusing on stakeholder impacts. This particular service design process is applicable when the design team spontaneously improves a service rather than being hired by others, especially when the stakeholders of the service provider are hard to reach.

Recognize the value of participation by stakeholders

Identifying the various stakeholders and their relationships， this cognitive process and the planning and implementation of stakeholder engagement are mutually influencing and advancing rather than separate. The basis of such a saying is to be aware that the impact and contribution of various stakeholders are different, whether it is for the current service period or the process of generating new service. According to the influence of a stakeholder group on the quality, evaluation, or operating efficiency of service experience during a service period, stakeholders can be divided into the main user (essential stakeholder), key stakeholders, and other stakeholders. The service designer team, as the most special stakeholder group, through stakeholder engagement, aims to gather a comprehensive understanding of the holistic stakeholder relationship reliably. With the capabilities and skills of the service designers, stakeholders are connected and involved in the design process and contribute to the outcomes to varying degrees. The human and material resources and time invested by service designers should be allocated according to the importance of stakeholders. It is crucial for designing a reasonable and feasible service design process to find out as early as possible whether the resources that you own or potential resources allow you to reach all key stakeholders.

Compose the service design process with engagement by various stakeholders

The service design process, in essence, is iterative, repeating the divergence and convergence process in different scales through of gathering insights, transforming insights into ideas, filtering ideas to form design proposals, and testing to gain feedback. Stakeholder engagements make all information acquisition reliable and credible, eliminating prejudice or inherent impressions. Based on the standard service design process, I illustrate a customized service process (see Figure 15).

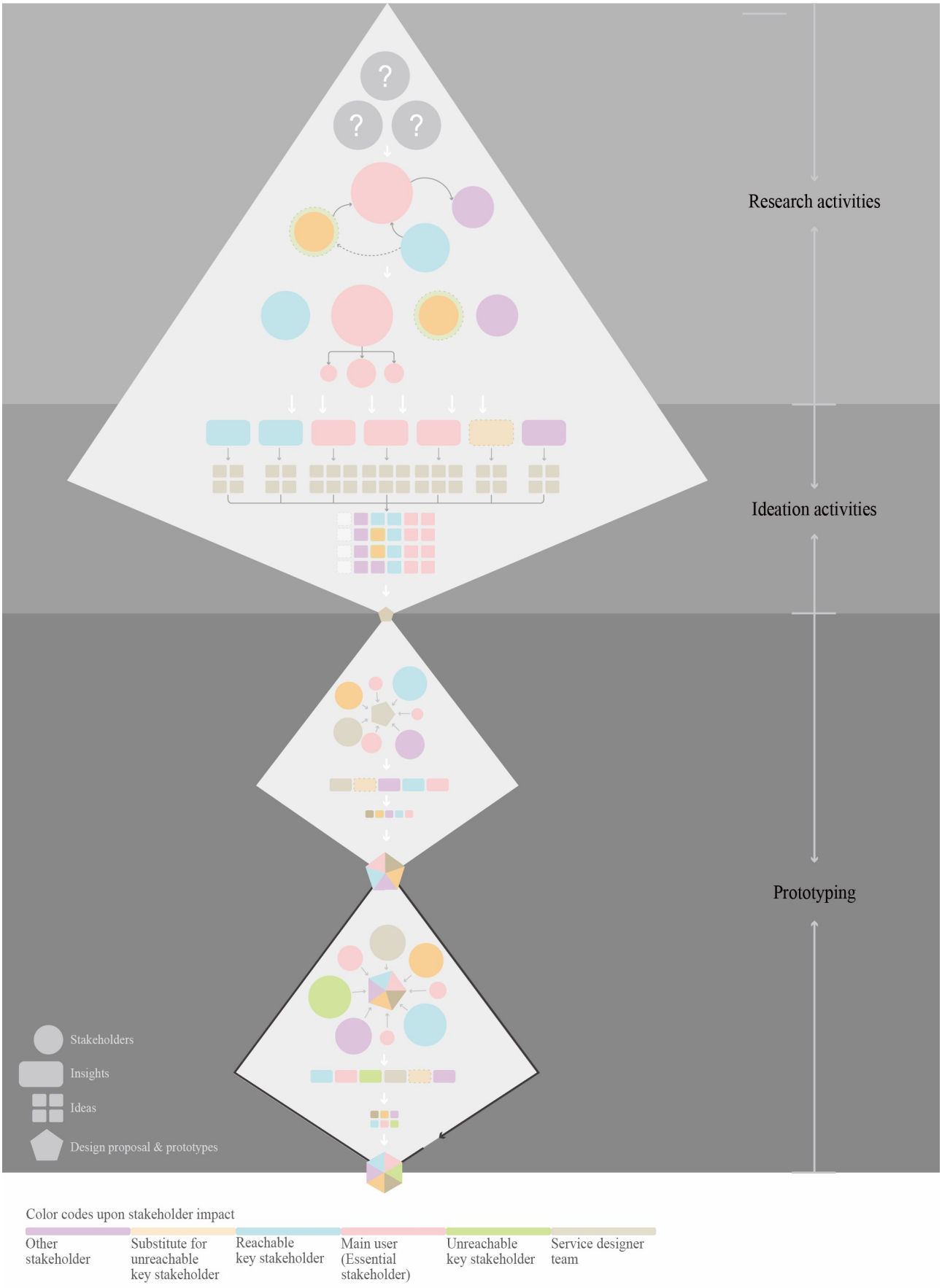


Figure. 15 The customized service design process

- Research activities and ideation activities

By collecting and analyzing different experiences for the same service from different perspectives, research activities are put into effect while ideation activities are inspired.

Research activities: Diversity is welcome at this divergence stage. Through recognizing the more diverse stakeholder groups, as providers of different perspectives, designers are the more likely to form a complete understanding of current services without personal prejudices or preferences. A more specific classification of a particular stakeholder group can help designers to obtain a broader range of insights or suggestions on different needs and problems by collecting different real experiences at a more detailed level. To pursue the high efficiency and cost-effectiveness of the service design process, not all stakeholder groups need to be further classified and studied, usually the main user. Some stakeholders who are challenging to reach can be represented by substitutes, which can provide enough information to help generate impressive output to strive for the participation of unreachable stakeholders in the subsequent design process. At this stage, iterative stakeholder engagements are implemented separately between the designer team and various other stakeholders (or substitutes).

Ideation activities: This is a formative stage for the corresponding solutions inspired by the insights gained from the research activities. This stage is gradually convergent through idea filtering by mostly the level of impact on service improvement or urgency to solve the problems or fulfill needs, and besides, the ability, skills, and preferences of the designers, current technology limitations, and budget or time constraints. In this process, the designer team is the only stakeholder recommended to participate. First of all, designers are the single group of stakeholders who have a holistic understanding of the service period through research activities. Second, other stakeholders are not high-yield providers in terms of innovation because of skill limitations. Service design is human-centred, which indicates that the designer's wishes also need to be satisfied. Compared with other design majors, service design significantly weakens the designer's subjective creation and decision-making. Although it is limited to benefit stakeholders effectively, the individual participation of the designer team in ideation activities can enhance satisfaction from the level of creation and realization of design proposals. To promote communication upon the new service with other stakeholders in the next stage, visualization tools are highly recommended at this stage.

- *Prototyping*

In the prototyping stage, the contradiction or generation in negative comments and suggestions on the design output are gradually reduced through the iterative process. The designer team creates an environment for stakeholders to experience the same service together and provide them an opportunity to experience or understand the perspectives of other stakeholders. Stakeholders are allowed to understand the new service more comprehensively and collaboratively offer insights and creative ideas, just as the designer team does in research and ideation activities. The theater-based methods, in which stakeholders are gathering, are preferred at this stage to quickly and cheaply simulate service scenarios. Usage of such method helps to stimulate stakeholder participation and creativity. Focus group discussion is a suitable way to achieve feedback, which enables views-exchange that allows stakeholders to gain empathy and reflect on their own opinions, thereby providing more valuable evaluations. At this stage, the gradually unified trend of the evaluation of the service by various stakeholder groups is the standard for judging whether the iterative process of the prototyping stage is sufficient.

It is worth noting that at this stage, the participation of all key stakeholders is required, including even those stakeholders that are difficult to reach and represented by substitutes in the research activities. It is not compulsory to involve all the stakeholders in the first few cycles of prototyping, but it is required sooner or later. As the design proposals gradually approach to the implementation, its realizability needs to be guaranteed, and the risk of execution needs to be reduced, which inevitably requires the recognition and opinions of stakeholders (especially service providers). The difference between assumptions and reality is the main culprit that causes risk. If stakeholders who are challenging to reach cannot directly participate, their real thoughts cannot be genuinely obtained through speculation.

In short, through the correct recognition of the different stakeholders, the appropriate stakeholder engagement can be planned and implemented, thus constituting the most practical and favorable service design process.

6.0 Limitations, and suggestions for further research

Firstly, inspired by the lack of connections with key stakeholders (service provider) in an actual design project, this study has mainly figured out a useful model for a rational service design process under this particular context. To avoid being trapped due to a lack of information from unreachable stakeholders from the very beginning, the participation of inaccessible stakeholders was postponed to the second half of the service design process, and the possibility of their participation was improved through participation and contribution of a substitute. However, I have not conceived, tested, and evaluated the methods for approaching unreachable stakeholders. It is very likely to cause the design proposals to remain not established and not be finally recognized and implemented by the service provider. Therefore, it is a research topic that is worth expanding for a service design that has been spontaneously developed by the design team to motivate relevant service providers to participate in the service design process and even further recognize and adopt the design proposals.

Secondly, due to the time constraints of the right to study for the degree and design projects, and also the language barriers and resource limitations of the researcher, the sample of data collection methods in this study are relatively small. And most of the sample population is concentrated in the social network of the members in the design team. Collecting more diverse and more significant amounts of data to promote higher quality and more reliable research gains is also a possible future research direction.

Thirdly, since this research is carried out with specific design projects under a particular context, whether the research findings are applicable in other situations can also be discussed in depth by studying more design cases.

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List of figures and tables

Appendices 1: Prompt cards

- Prompt cards for Scenario 1 In Ounasvaara (report by patient)

Patient for scenario 1: (foreigner)	***Ambulance car driver:***
You were biking in Ounasvaara alone. Suddenly you fell down from your bike because of the slippery ice. Unluckily you felt intolerant pain of your left leg and were not able to move it. It is now -10°C outside.	You are one of the ambulance team. Your responsibility is to reach to the patient and help him/her to get on the ambulance car and drive them to the hospital.
Doctor for scenario 1:	***Nurse:***
You received a patient with a broken leg. You will give him a surgery. After you let hime leave the hospital, told the patient to come back to you again for further consultation.	Your responsibility is to help the patient to wear the bracelet when the ambulance car reach to the patient. And you also need to take care of the patient during his/ her stay at hospital.

- Prompt cards for Scenario 2 In city center of Rovaniemi (report by passerby)

Patient for scenario 2:	***Passerby:***
You suddenly fainted at city center of Rovaniemi. You were totally unconscious before you received a surgery. Your condition is not stable that you may need a second surgery.	You saw a stranger fainted right in front of you on the street. It seemed like he/ she was totally unconscious. You were the only person nearby.
Family member for scenario 2:	***Ambulance car driver:***
You were watching tv at home when you received a SMS message.	You are one of the ambulance team. Your responsibility is to reach to the patient and help him/her to get on the ambulance car and drive them to the hospital.
Doctor for scenario 2:	***Nurse:***
You received a patient with a stroke. You will give him/ her a surgery. Your responsibility is to take care of him/ her during her staying in the ICU.	Your responsibility is to help the patient to wear the bracelet when the ambulance car reach to the patient. And you also need to take care of the patient during his/ her stay at hospital.

Appendices 2: Paper questionnaire for the workshop

Role:

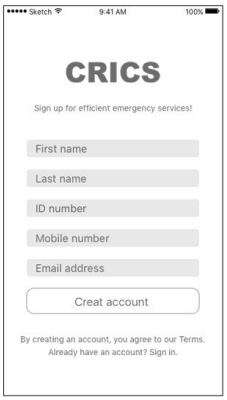
Date:

When you want to log in:

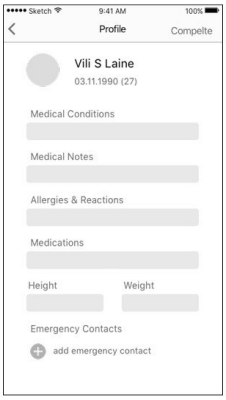
Mark the function that makes you feel useful with heart shape.

Log in

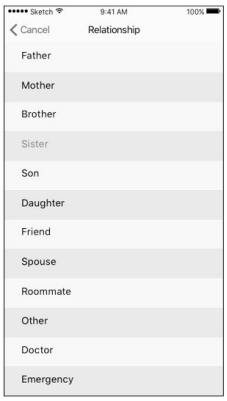
Sign up



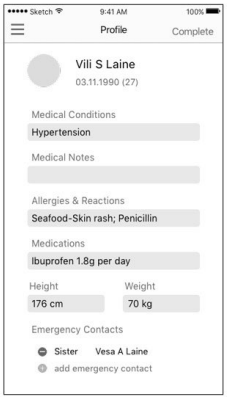
Create profile



Relationship



Profile



Please write down your suggestions below or draw on the screenshots:

When you want to track:

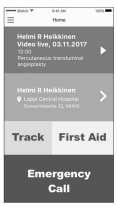
Mark the function that makes you feel useful with heart shape.

Tracking pop-up

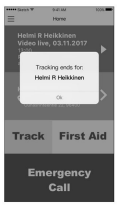
Enter code

Track page

Home page notification



Ending pop-up



Please write down your suggestions below or draw on the screenshots:

When you want to call 112:

Mark the function that makes you feel useful with heart shape.

Calling options

Call with live video

video call

Track ambulance

End tracking

Please write down your suggestions below or draw on the screenshots:

When you want to search for first aid instructions:

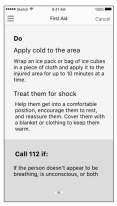
Mark the function that makes you feel useful with heart shape.

Home

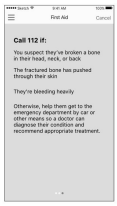
Search

Don't

Do



Call 112



Please write down your suggestions below or draw on the screenshots:

When you want to find official links:

Menu

Links

When you want to set allert for tracking:

Allert

Please write down your suggestions below or draw on the screenshots:

Mark the function that makes you feel useful with heart shape.