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*Designing Complex Services for Multiple Stakeholders: An  
Application to Electronic Health Records*

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*À minha família*



## ABSTRACT

In a world of accelerating change, people, organizations, resources and information are integrated in a complex network of interactions and value co-creation. People aim to improve their quality of life that depends on many service systems, such as healthcare, transportation, energy, education, security and others that serve other people and must be sustainable. Sustainability has also a systemic nature and relies on reducing waste, inefficiencies and expanding systems' capabilities on its three pillars (economic, social and environmental) to guarantee that future generations also have the capability to achieve their goals. Designing sustainable services for such complex value networks requires new approaches. Healthcare is one of the most important service sectors that has strong impact on peoples' quality of life and is currently affected by systemic inefficiencies. The application of new service design approaches in this sector can positively influence citizens' wellbeing, while responding to the call for designing for sustainability and transformative service research.

The challenges described introduce the motivation for the dissertation research, which studied sustainability and its intrinsic relationship with complex value networks in the healthcare sector. This research aimed at contributing to understanding value co-creation in complex network realities and applying this knowledge to develop a new method for designing complex services in value network contexts. To attain these objectives, the research project comprised three stages: The first involved a qualitative study to understand organizations' practices regarding service design and sustainability incorporation into their services. The second entailed a qualitative study to understand each actor service experience in the context of complex value networks, their role in the value co-creation with other actors and the impact of their actions in the value network. Finally, the third stage applied design science research to develop SD4VN – a new method for designing services in value network contexts.

Thus, the present dissertation contributes to: (1) better understanding sustainability and its application to services and service design processes. The second study allowed for (2) an evolution of previous conceptualizations of value-creation in network contexts involving multiple actors, with iterative and non-linear aspects. This second stage supported (3) the development of a new method for designing services for value networks. From a managerial perspective, this research dissertation also had a societal

impact by improving Portuguese healthcare through the collaboration in the design of a national EHR service system. This system allows patient and practitioners' integrated access to patients' healthcare information regardless of the time or locale of healthcare delivery.

## RESUMO

Num mundo em constante e rápida mudança, pessoas, organizações, recursos e informação estão integrados numa rede complexa de interações e de cocriação de valor. As pessoas desejam melhorar a sua qualidade de vida que está sempre dependente de múltiplos sistemas de serviços: o sistema de saúde, os transportes, a energia, a educação, a segurança, entre outros, que servem também outras pessoas e têm que ser sustentáveis. A sustentabilidade é também de natureza sistémica e tem como objectivo reduzir os desperdícios e ineficiências, aumentando as capacidades dos sistemas nos seus três pilares (económico, social e ambiental) de forma a garantir que as futuras gerações também têm a possibilidade de atingir os seus objectivos. O desenho de serviços complexos no contexto de redes de valor que se desejam sustentáveis requer novas abordagens. A saúde é um dos principais sectores que afecta a qualidade de vida das pessoas e é atualmente afectado por uma ineficiência sistémica. A aplicação de novas abordagens de desenho de serviços neste sector, pode influenciar positivamente o bem-estar dos cidadãos e ao mesmo tempo responder à necessidade de desenhar serviços sustentáveis e transformativos.

Os desafios descritos são a grande motivação desta tese que investiga a sustentabilidade e a sua intrínseca relação com as redes de valor complexas, no contexto da saúde. Esta investigação tem como objectivo contribuir para o conhecimento profundo do processo de cocriação de valor em redes de valor complexas e aplicar este conhecimento no desenvolvimento de um novo método de desenho de serviços complexos no contexto de redes de valor. Para alcançar estes objectivos, o projeto de investigação compreendeu três etapas: A primeira envolveu o desenvolvimento de um estudo qualitativo para perceber como desenhar serviços sustentáveis e quais as práticas das organizações relativamente ao desenho de serviços e à incorporação da sustentabilidade nos seus serviços. A segunda compreendeu um estudo qualitativo para compreender a experiência de serviço de cada ator num contexto de rede de valor, o seu papel na cocriação de valor com outros atores e o impacto das suas ações na rede de valor. Finalmente, a terceira etapa aplicou a metodologia *design science research* no desenvolvimento do SD4VN – um novo método para o desenho de serviços em contextos de rede de valor.

Desta forma, a presente dissertação contribui para: (1) um melhor entendimento do conceito de sustentabilidade e da sua aplicação aos serviços e aos processos de desenho de serviços. O segundo estudo contribuiu para (2) evoluir as conceptualizações prévias do conceito de cocriação de valor em redes complexas envolvendo múltiplos atores, com aspectos iterativos e não-lineares. Esta segunda etapa suportou (3) o desenvolvimento de um novo método de desenho de serviços para redes de valor. Numa perspectiva prática, esta dissertação também teve um impacto social, proporcionando melhorias no sector da saúde em Portugal, através da colaboração no desenho do registo de saúde electrónico nacional. Este serviço de base tecnológica permite aos pacientes e profissionais de saúde um acesso integrado à informação de saúde do paciente, independentemente do local ou altura da prestação dos cuidados de saúde.

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# 1 Introduction

Services now represent the dominant economic activity in developed countries (OECD 2014) and keep growing, while traditional goods, manufacturing and agriculture sectors are declining. Today, the rapid expansion of human knowledge and technology has resulted in many new value-added services for individuals and organizations, now offered through complex service systems and value networks (Gummesson 2006). It is easy to take complexity for granted when we watch television, travel by jet, or receive a health care test. Such acts seem ordinary to us and we tend to forget the complex service systems that support them.

Simultaneously, sustainability became one of the major concerns for European leaders, who are defining more demanding environmental policies and are promoting new social inclusion initiatives, while trying to guarantee the financial equilibrium of European countries (Basch et al. 2011; Baumgartner 2009; Walshe et al. 2013). In other words, EU is nowadays focused on achieving the triple bottom line (Elkington 1997), which stands for the balance between the three pillars of sustainability.

Considering Vargo and Luch's (2008) new service-dominant logic perspective, rather than a traditional goods perspective, value is no longer pre-produced. Instead, value is jointly co-created by customers and service providers at the time of the service delivery. This perspective can be a motivation factor for organizations to innovate their offerings moving from goods production to the development of innovative services. In this context, service design is essential to this innovation process, because it brings service organization's strategy and innovative service ideas to life (Ostrom et al. 2010). Following this idea, designing new service offerings in today's complex value networks requires systemic design to support each actor's activities and the value co-creation interactions among actors. New service design methods are needed to support the design of complex services in value network contexts while addressing the challenges of sustainability and transformative service research (Anderson et al. 2013). The full potential of service design to address complex value networks and sustainability is yet to be achieved, and these areas still have important challenges ahead.

## **1.1 Motivation**

### **1.1.1 Sustainability**

Sustainability has become critical in modern society, and interest in the design community on sustainability is also growing (Ostrom et al. 2010). Sustainability is defined as the challenge of meeting the basic human needs, aspirations and desires of today's generations, without compromising the ability of future generations to meet their own needs (United-Nations 1987). As sustainability becomes a major concern for modern society – the EU's common policies for Horizon 2020, and the healthcare policy in particular, define sustainability as one of the major socio-economic transformations that Europe should lead (Basch et al. 2011; Walshe et al. 2013) – the need for designing sustainable services is getting more important day by day.

Sustainability is intrinsically related to the complexity phenomenon because it is systemic. In other words, every actor in a value network is integrated into a complex service ecosystem and their actions impact other actors, therefore making the sustainability of the service ecosystem dependent on the actions of each actor.

In this context, understanding how organizations can incorporate sustainability in their services become increasingly relevant and can provide further insights on how to positively influence citizens' wellbeing, while responding to the call for sustainability and transformative service research (Anderson et al. 2013).

### **1.1.2 Complexity and Value Networks**

Service offerings today are enabled by complex service systems, involving interdisciplinary areas, and are strongly supported by technology (Spohrer et al. 2007). This technology infusion and the increasing complexity of service systems poses new challenges to service design and innovation, requiring interdisciplinary competences, integrating computer science, engineering, service management, social sciences and arts (Fisk 2006; Forlizzi, Zimmerman and Evenson 2008). A service system can be defined as an arrangement of resources that “includes people, organizations, shared information, and technology, all connected internally and externally to other service systems by value propositions” (Maglio et al. 2009; Spohrer et al. 2007). This definition of service system is more focused on the organizational level, where one service provider develops offerings for its customers. However, customers increasingly co-create value through the

combination of service offerings from multiple firms. These constellations of service offerings constitute systems of service systems, where the multiple actors' service systems develop many-to-many relationships thus forming a value network (Patrício et al. 2011). The evolution of the service environment and technology has led to the emergence of complex value networks with multiple actors, where supplier networks interact with customer networks (Gummesson and Mele 2010). Service research has recognized the importance and pervasiveness of value networks and it became a research priority (Ostrom et al. 2010).

Traditional approaches applied in complex systems suggest breaking it into small parts to reduce its complexity. However, doing that, there is a risk of losing the sight of an holistic vision that comprehends the interconnections between the sub-systems (Gummesson 2007). Local optimization can be an undesired result of these approaches. Some approaches (Normann and Ramírez 1993; Patrício et al. 2011; Tax, Mccutcheon and Wilkinson 2013) already address such complex realities, but they still focus on designing a service for a specific customer or customer segment. New approaches are needed that take into account the active role of each actor in value co-creation and their interactions with other actors.

### **1.1.3 Healthcare**

The health sector is a rich case of service complexity, as it comprises many value networks of multiple interdependent actors. Healthcare is a critical service sector in every society. According to information from the IBM Institute for Business Value, relative to the world's other major systems, the global healthcare service system "is the least efficient and has the highest potential for improvement" (Korsten and Seider 2010), and is globally affected by systemic inefficiency, which wastes 2 trillion USD each year in USA only. In the current context, it is important to improve both efficiency and quality of health services and make them citizen centered. Healthcare is a rich example of a value network of interdependent actors (Vargo and Lusch 2011) involving doctors, nurses, pharmacists, managers and others, who interact and integrate resources so the patient can receive proper healthcare. Only with this perspective can the needs of every actor be fulfilled and the system as a whole be made sustainable. Healthcare is also an

important context for a variety of research priorities (Ostrom et al. 2010) and a fertile field for service research (Berry and Bendapudi 2007).

#### **1.1.4 Value Co-Creation**

Addressing the complexity of the service context requires an in-depth understanding of value co-creation processes in this new environment. The role of customers as co-creators of value is central to service research (Holbrook 1996; Lusch and Vargo 2006) and is changing from a passive to a proactive participation (McCull-Kennedy et al. 2012). According to Service-Dominant logic (Vargo and Lusch 2004), value is co-created through customer interactions with other actors in the value network integrating resources (Vargo and Lusch 2008). However, the process and dynamics of value co-creation in value network contexts still needs further research. Despite comprehensive conceptualizations of value co-creation in the service field, empirical applications showing the relationship and interaction phenomena from a multiple actor perspective are scarce (Payne, Storbacka and Frow 2008; Woodruff and Flint 2006). Previous research has mostly focused on dyadic relationships between customers and service providers (Tax, Mccutcheon and Wilkinson 2013). Further research is therefore needed to understand value co-creation in complex environments.

#### **1.1.5 Service Design**

The complexity of the service environment also requires the design of new services that enable firms to position their offerings in the context of value networks and to develop integrated solutions to the different network actors. Service design (SD) is a human-centered process based on a deep understanding of users and their context, service provider, market strategies and social practices (Holmlid and Evenson 2008). It is a discipline that attempts to blend the worlds of business, marketing, and design for a multidisciplinary approach to the sustainability of services (Saco and Goncalves 2008).

As a growing field, SD methods and tools have been developed in different disciplines over 30 years. However, current service design methods and tools do not support the creation of services that are specifically target to value networks. Existing methods consider the value network mostly as context, but still focus on the dyadic interaction between the service provider and the customer. Designing services for the value network requires a change of perspective where the service is provided to the value network as a

whole and to its interdependent actors. This requires shifting from a dyadic perspective between a customer and a supplier to a network perspective, where multiple actors contribute value and expect value in return (Gummesson and Mele 2010; McColl-Kennedy et al. 2012; Vargo, Maglio and Akaka 2008).

## **1.2 Research objectives**

Taking into account the challenges of the service environment, the research objectives were threefold. The first objective was to understand how service organizations view sustainability and incorporate it in their practices. Pursuing this objective led to an understanding that sustainability is tightly linked with a value network approach that takes into account the value co-creating connections among actors and value co-creation for the network as a whole.

Based on these findings, the second objective was to gain a deeper understanding of value co-creation in network contexts, characterized by many-to-many service interactions, with an application to healthcare. Building upon this understanding, the third objective was to evolve service design methods for the creation of new services for value networks, with an application to the design of the Portuguese National Electronic Health Record. Figure 1 details the research framework objectives:

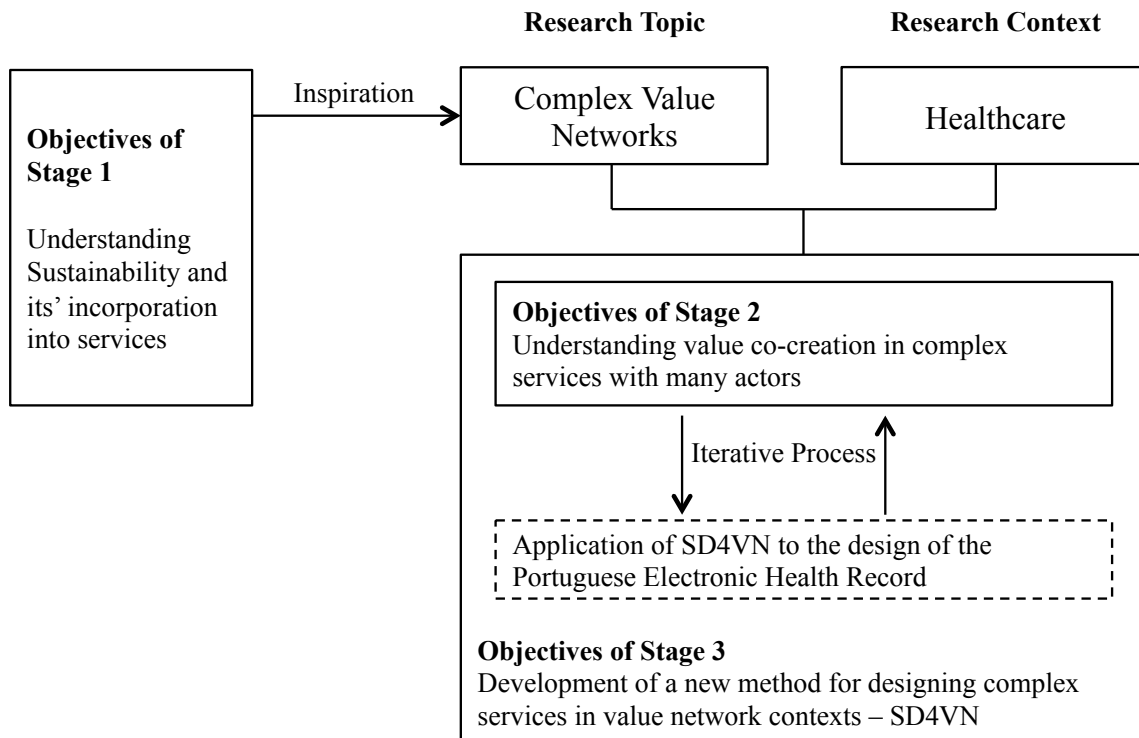


Figure 1 - Research Framework Objectives

### 1.2.1 Objective 1: Understanding of Sustainability and its' incorporation into services

The first stage of the dissertation research was integrated in the Carnegie Mellon Portugal Sustainable Interaction with social Networks, context Awareness and Innovative Services (SINAIS) project, in the service design area (Project Reference: CMU- PT/CPS/0004/2008). The project aimed to study customers attitudes and sustainable behaviors as well as the organizations' perspectives and practices towards sustainability.

To address and invert the current negative trends regarding sustainable practices, this research stage focused on developing an in-depth understanding of service providers' views of sustainability and how they incorporate sustainability in their services. Sustainability is intrinsically related to value networks, due to its systemic nature. For an ecosystem to be sustainable, it must take into account the complete value network and not only the separated sub-systems (Ostrom 2009). Although the major focus of the thesis was service design for value networks, the initial understanding of sustainability incorporation in services was important to provide organizations and service researchers

a reference model for classifying the different aspects of sustainability. Novel insights such as the incorporation of sustainability through values (as principles) or the need for sustainability incorporation in services at different levels (internal backstage processes, new service offerings, and value network initiatives) provide a foundation for further service research on how to design sustainable services.

### **1.2.2 Objective 2: Understanding value co-creation in complex services with many actors**

The second stage of the research dissertation was integrated in the Portuguese Ministry of Health project for designing the national Electronic Health Record (EHR). This dissertation stage aimed at understanding the concept of value co-creation in the context of value networks and at responding to the call of service research for the operationalization of the value co-creation concept in empirical contexts (Payne, Storbacka and Frow 2008; Vargo and Lusch 2008; Woodruff 1997).

The Portuguese EHR service provided a rich empirical context needed for understanding value co-creation in value networks of multiple interconnected actors. The study contributed to service research by providing important insights on how actors participating in a value network integrate resources and interact to co-create value. The study identified a new type of value co-creation factors and outcomes that consider the contribution of the customer and of the other actors involved in the network, showing that value co-creation depends on a set of interactions and interdependencies between actors. The study also provided empirical evidence of the dynamic roles and activities different actors can assume over time. This knowledge was vital to fulfill the purpose of designing a service for the different needs and requirements of each actor in a complex value co-creation environment, taking into account a balanced centrality perspective (Gummesson 2007).

### **1.2.3 Objective 3: Develop a new method for designing complex services in value network contexts**

Stage three of the dissertation was also integrated in the Portuguese Ministry of Health project for designing the national Electronic Health Record (EHR). This stage

comprehended the development and application of a new method for service design in value networks.

One of the main objectives of this research was to respond to the lack of methods for designing services in value network contexts (Ostrom et al. 2010), contributing to service research by expanding the service design methods beyond single customer segments to support the creation of new services in the network context. This objective was fulfilled by the development of a new method for Service Design For Value Networks (SD4VN) and applying it to the creation of the Portuguese Electronic Health Record. Stage three of the dissertation also contributed to service research showing how SD4VN can support the creation of integrated services for value networks where multiple actors' service systems develop many-to-many relationships. The next chapter describes the research design process undertaken to accomplish the dissertation.

## 2 Research design

To address the challenges defined in Chapter 1, the research design used a combination of methods through different stages to pursue the objectives mentioned in the previous section.

To gain a better understanding of sustainability incorporation in services, Stage 1 involved a qualitative study (Neuman 2006) using grounded theory (Charmaz 2006; Corbin and Strauss 2008). This method was considered adequate because it provides an in-depth understanding of the unexplored phenomenon of relating sustainability with service research. This study provided insights on how service providers view sustainability, what their practices towards sustainability are and how they incorporate it into their services and service design processes.

The research focus then moved to developing service design methods for value network contexts, comprising two stages. Stage 2 adopted a qualitative study to respond to the challenge of understanding each actor service experience in the context of complex value networks, their role in the value co-creation with other actors and the impact of their actions in the value network. Again, grounded theory was considered appropriate because co-creation in value network contexts was an underexplored phenomenon. The study results provided important insights for the design science research process for developing SD4VN that followed. The conceptual development of SD4VN was built iteratively as it will be explained later.

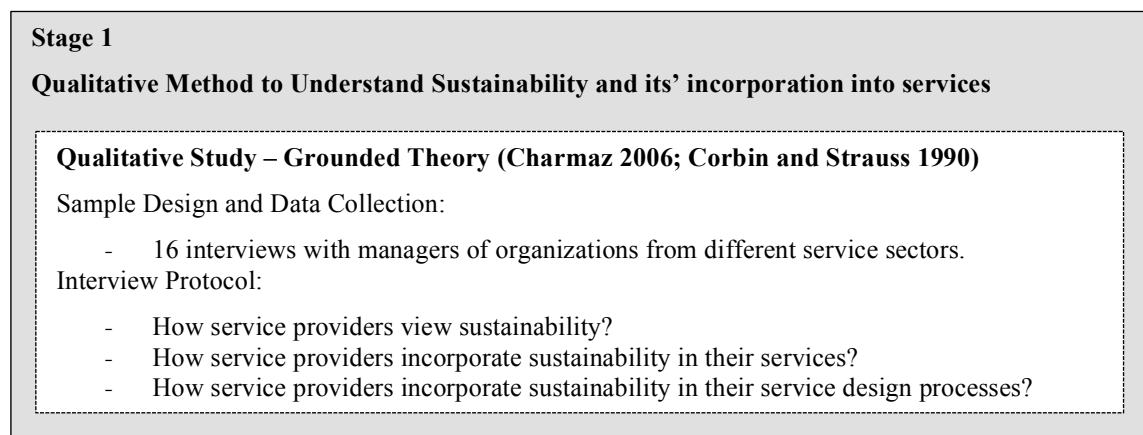
Finally, design science research (Aken 2004; Hevner et al. 2004) was applied in Stage 3 to respond to the dissertation objective of developing a service design method (SD4VN) applicable to complex service systems with many-to-many relationships between actors. Design science research methodology was selected because the objectives of Stage 3 regard the development of new or enhanced models, as well as a new method, which is aligned with design science research purpose (Hevner et al. 2004; March and Smith 1995). Figure 4 depicts the phases employed in the process of developing SD4VN method.

The following sections detail each stage of the dissertation research process and the applied methodologies.

## 2.1 Stage 1 – Qualitative Study to understand sustainability and its’ incorporation into services

In Stage 1 of the research design, a qualitative study of 16 service organizations from different service industries was undertaken with semi-structured interviews adopting grounded theory methodology (Charmaz 2006; Corbin and Strauss 1990). This strategy was chosen to pursue Objective 1 of understanding what service organizations mean by sustainability. The study also detailed organizations’ practices regarding sustainability and how they designed their services to include sustainability concerns.

Literature review was mostly undertaken after data analysis, but we did a moderate review of sustainability area to get a first understanding of the topic. Taking into account researchers were not totally free of knowledge and experience (Charmaz 2006) about the subject under study, grounded theory was applied as an abductive method (Charmaz 2006; Corbin and Strauss 1990), which entails an iterative process that builds upon previous knowledge. The in-depth understanding was as heterogeneous as possible, because the study involved diverse set of organizations with theoretical relevance, which provided diverse perspectives on service sustainability.



**Figure 2 - Stage 1: Sample design, data collection and interview protocol**

Semi-structured interviews were used to ensure that all the topics were addressed in a systematic manner. They followed a semi-structured protocol (Fontana and Frey 2000; Froddy 1993) divided into three main parts covering the main research questions (see Figure 2). To assign significance, coherence and meaning to the data collected, we completed a literal transcription of the recorded interviews to NVivo 9. Following grounded theory guidelines, the theory was built iteratively. Open coding and selective coding were used to classify categories and sub-categories, which provide the necessary

abstraction level so the research can produce theoretical concepts (Charmaz 2006; Corbin and Strauss 1990). This iterative process ended when no new themes or patterns emerged. We used axial coding whenever relations between categories and sub-categories became more visible. Here, we were able to make generalizations and create new theories.

Although in the beginning of the research dissertation, Stage 1 was not directly related with the development of SD4VN, the study results from Stage 1 provided important insights for Stage 2. These results showed that services provided in a value network context should be sustainable, and the complex systems nature of sustainability emerged as an important issue to take into account when designing sustainable services. In other words, in both addressing sustainability and value network contexts, one must view the service system as a hole, because actions of one actor impacts on others.

## **2.2 Stage 2 – Qualitative Study to understand value co-creation in complex services with many actors**

Stage 2 and 3 were both integrated in the Project for designing the Portuguese EHR. In Stage 2, a qualitative study involving 48 citizens and healthcare practitioners (doctors, nurses and pharmacists) was undertaken to accomplish the objective of understanding value co-creation in complex services with many actors.

**Stage 2**  
**Qualitative Method to understand the value co-creation in complex services with many actors**

**Qualitative Study – Grounded Theory (Charmaz 2006; Corbin and Strauss 1990)**

Sample Design and Data Collection:

- Exploratory study with key actors and informants – 5 in-depth interviews.
- Card-sorting (to identify the priority actors).
- In-depth interviews + Focus groups with Citizens, Doctors, Nurses, Pharmacists (43 Actors).

Interview Protocol:

- How actors participating in a value network integrate resources and interact to co-create value?
- How value co-creation factors and outcomes are interconnected?
- How value co-creation for each actor depends on his/her own actions and the actions of other actors, in a complex set of interactions and interdependencies?

**Figure 3 - Stage 2: Sample design, data collection and interview protocol**

Value co-creation is an understudied subject, especially regarding empirical studies in value network contexts (Payne, Storbacka and Frow 2008; Vargo and Lusch 2008), hence grounded theory was considered appropriate to apply in stage 2 of the research process.

The qualitative study involved citizens and healthcare practitioners from public and private health care organizations. To fine-tune the interview protocol (Froddy 1993), an exploratory study was undertaken involving five semi-structured interviews with the EHR national project manager, one Citizen, one Doctor, one Nurse and one Pharmacist. In order to systematize the interviews, card sorting (Nielsen 2004; Nielsen and Landauer 1993) was used through which interviewees were asked to identify and sort the actors involved in the EHR value network and identify the priority actors they related with. This allowed covering a diverse set of actors with theoretical relevance, which provided different perspectives on value co-creation in value network contexts due to the different interconnections between them.

Following the exploratory study, in-depth interviews and focus groups were conducted in a complementary way. While the interviews provided in-depth knowledge, the focus groups provided more discussion and group dynamics, enriching the data collected. Eight in-depth interviews and four focus groups with citizens, doctors, nurses and pharmacists were combined using theoretical sampling until saturation of results was reached (Corbin and Strauss, 2008). The same interview protocol was applied in both in-depth interview and focus group sessions. All sessions were literally transcribed and analyzed using NVivo 9 software.

The results provided understanding of how value is co-created by multiple actors in complex environments. More specifically they allowed: (1) identifying value co-creation factors and outcomes; (2) understanding how value co-creation factors are interconnected; and (3) understanding how value co-creation for each actor depends on his/her own actions and the actions of other actors. This information enabled mapping the overall customer experience of each priority actor, their daily activities, the EHR service related tasks, and the elements of their surrounding context.

Stage 2 provided important insights for Stage 3 regarding, on the one hand, the development of new and enhanced tools to characterize the customer experience in contexts of many-to-many actors, and on the other hand, an holistic vision of the value

constellation experience at the network level (explained in detail on Paper III) expanding the knowledge regarding the Portuguese EHR Service System and its application.

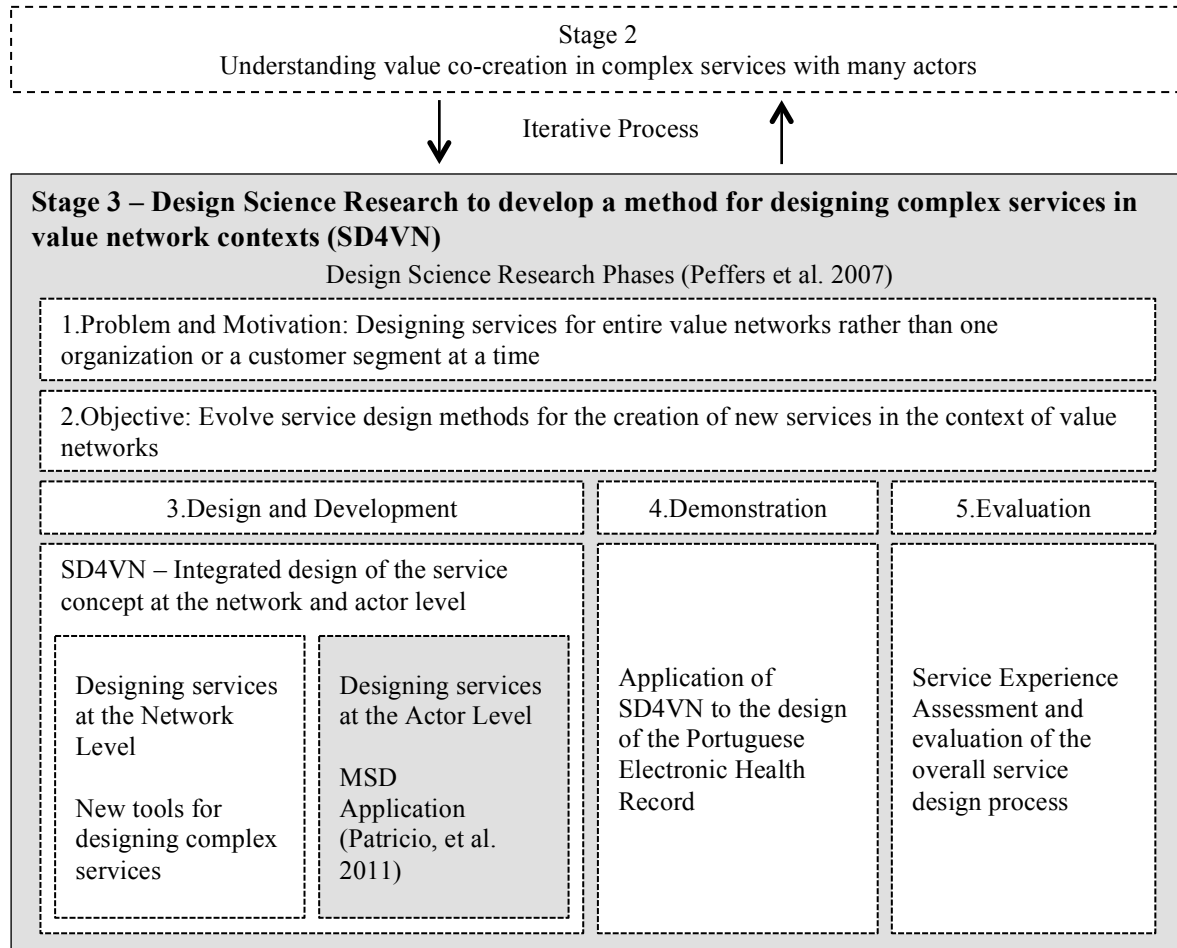
### **2.3 Stage 3 – Design science Research approach to the development of SD4VN**

Stage 3 adopted a design science research approach to develop a new method for designing services for value networks. Design science research is a well-established methodology that has its roots on information systems research area (Gregor and Hevner 2013; Winter 2008), but it has been spreading to service research as well (Beloglazov et al. 2014). According to Merton (1968), Sutton and Staw (1995), in design science research contributions to knowledge can be partial theory, incomplete theory, or empirical generalizations in the form of a new design artifact. The artifacts may take the form of a construct, a model, a method or implementations that are innovative, valuable and solve problems (Hevner et al. 2004). Design theory formalizes knowledge providing prescriptions for design and action: it says how to do something (Gregor and Hevner 2013). In design science research, knowledge and understanding of the design context and the development of the proposed solutions are achieved in developing efficient and effective applications of the designed artifact in the real world (Aken 2004; Hevner et al. 2004; Lee 2007).

To address the objective of developing SD4VN, Stage 3 extended and evolved existing service design methods (the artifact) to a new method for the creation of services provided to multiple interdependent actors in a value network. As such, a design science research approach was considered adequate to develop and validate the SD4VN method. Given the complexity of designing the Portuguese EHR, design science research provided step-by-step guidance to evolve and validate the research process.

According to March and Smith (1995), design science consists on building an artifact for a specific purpose and evaluating how well the artifact performs. Methods for design science research are available in different forms (Hevner and Chatterjee 2010; Vaishnavi and Kuechler 2008). We followed Peffers et al. (2007), who propose a more detailed research process with five main steps that should be followed iteratively: (1) Problem and Motivation identification; (2) Objectives definition; (3) Design and Development of

the artifact; (4) Demonstration through application of the artifact to solve the problem; and (5) Evaluation. These stages are not linear, and can be iterated between them. Figure 4 depicts the steps of the overall design science research approach adopted in the project.



**Figure 4 - Process employed in the dissertation research - Stage 3**

Following Peffer et al. (2007) approach, design science research process therefore comprises the research phases depicted in Figure 4 that will be explained as follows:

1. Problem and Motivation Identification: the first phase falls back on literature review in value networks and service design to formulate the problem and its motivation. As stated in Chapter 1, we focused on SD methods and tools that have been developed in different disciplines, but realized that they did not support the creation of services for network contexts. As such, we also covered relevant literature on complexity and value networks, value co-creation and healthcare (as the area of application of the artifact) to identify the challenge of creating an artifact to design services with a network perspective where multiple

actors contribute value and expect value in return (Gummesson and Mele 2010; McColl-Kennedy et al. 2012; Vargo, Maglio and Akaka 2008).

2. Objectives Definition: Building upon Peffers et al. (2007), a qualitative objective was defined as a new artifact – method - that supports solutions to problems. Stage 3 therefore comprises developing a new method for designing services for value networks – SD4VN, which is an underexplored area.

3. Design and Development: this phase comprehended the development of SD4VN method, its integrated tools and implementation process.

Stage 2 of the dissertation provided important insights for the development of the method because designing services at the network and actor levels, requires deep understanding of the value co-creation experience of the different actors at both levels. Stage 2 therefore helped understanding the context of creating an integrated method for designing the service concept at the network and actor level.

The development and implementation of the method was made iteratively, through a constant dialogue between the literature review of service design methods and tools, and the feedback obtained by its integrated implementation.

Based on this approach the method and models evolved iteratively through the application in the design of the Portuguese Electronic Health Record that is described in the next phase. This corroborates Hevner's et al. (Hevner et al. 2004) recommendations to instantiate the artifact to demonstrate the feasibility and suitability to its intended purpose (defined in the phase 2).

4. Demonstration: this phase regards the implementation of SD4VN method with the Portuguese Ministry of Health Team, in the design of the Portuguese Electronic Healthcare Record. The implementation process involved weekly meetings with more than 20 different actors involved in the design team, and two participatory service design workshops were undertaken with 32 and 35 different actors respectively to evaluate if the design decisions were taking the right direction and get feedback on possible improvements.

The iterative cycles of participatory design sessions and meetings were also adopted to generate and test new service concepts, both at the network level and actor level. Participatory design (Schuler and Namioka 1993) involves the inclusion of the different service actors in the design team (Edvardsson et al. 2006) and assumes they are the true experts in their domains (Sanders 2008). By using engaged involvement and pluralistic techniques, participatory design helps operationalize the needs and desires of the different actors (Holmlid 2009).

In the context of designing a complex service such the Portuguese EHR service, participatory design allowed the holistic understanding of different actors' experiences, their interactions, priorities and conflicts of interest.

During the implementation phase, the research team accompanied the Ministry of Health, which was responsible for implementing the EHR in the field. The Portuguese EHR is online since 2014.

5. Evaluation: phase 5 verified how well the artifact supports the solution to the problem adopting four criteria (process, invention, relevance and extensibility) set by Forlizzi et al. (2008) to evaluate the contributions of new design methods. Literature review attests the uniqueness of the proposed method, as it addresses gaps regarding the inexistence of tools, models and a service design method to design services in value network contexts.

To evaluate the results of the application of SD4VN method, an additional qualitative study of the implementation was conducted to understand the experience of healthcare professionals with the new EHR in primary care and hospital care units, analyzing its impacts with 37 healthcare professionals in these different contexts. The follow-up study results showed that the Portuguese EHR was well received by healthcare professionals and contributed to the validation of the SD4VN approach as it showed that the method could be successfully applied to a large scale value network context.

The application of SD4VN in the design of the National Electronic Health Record demonstrates the contributions to the service design process that existing methods cannot offer. It is now possible for 41,000 healthcare practitioners (PDS 2014) to access accurate and meaningful information through the patient summary record provided by the system. The Portuguese EHR system is a foundation for huge improvements in patient safety, treatment effectiveness and

sustainable healthcare. This thorough application in a complex national project, suggest that these contributions can be extended to other contexts.

The contribution of Stage 3 is thoroughly described in Paper III so that the design process can be replicated and the rationale for the tools selection is understood.

The design science research process was evaluated according to Hevner's et al. (2004) guidelines for effective design science research. To ensure a comprehensive understanding of how design science research was applied in Stage 3 of this dissertation, we now detail how Hevner's guidelines were followed.

Design science research requires the creation of a purposeful new artifact, being a construct, model, or method (Guideline 1). In this case, we developed a new service design method – Service Design for Value Networks (SD4VN) for a specific problem (Guideline 2) of designing services for contexts with multiple interdependent actors in value networks. The thorough development of the method (Guideline 3), first required a qualitative approach (Corbin and Strauss 2008) to gain an in-depth understanding of the value co-creation experience in complex services with many actors. Then, based on the study results and literature review, the method was iteratively developed through the application to designing the Portuguese EHR.

Taking into account Hevner's et al. fourth Guideline, the SD4VN method is innovative because it supports one of the main challenges of this dissertation research: designing services for entire value networks rather than one organization or a customer segment. Research rigor (Guideline 5) was pursued through careful definition and application of Peffers et al. (2007) design science research process (see Figure 4) that supports the different process stages of developing SD4VN and its formal representation (see details on Paper III).

The method application to designing the Portuguese EHR enabled an iterative dialogue between conceptual development and empirical validation. The positive feedback obtained from the follow-up study confirmed SD4VN as an effective and valid service design method that can be a solution for the defined problem (Guideline 6). The SD4VN method and its application are detailed in the Paper III.

In summary, Stage 3 adopted a design science research approach following Peffers et al. (2007) approach and Hevner's et al. (2004) guidelines, to attain the objective of developing a new method for designing services for value network contexts. The empirical ground of the research undertaken in the design of the Portuguese Electronic Health Record Service involved a multidisciplinary team of 138 persons (Citizens, Doctors, Nurses, Pharmacists and Healthcare Technicians) from public and private organizations, 7 Managers of the Ministry of Health, and 5 researchers from the University of Porto.

### **3 Thesis outline**

This section outlines the organization of the dissertation and summarizes the constituent chapters. The first chapter introduced the dissertation research, explained its main motivations and challenges, and overall objectives. The theoretical background was briefly discussed in order to introduce the most relevant topics and gaps associated to service design in the context of value networks. Chapter 2 described the research design undertaken, starting by the overall design science approach, which, following the dissertation rationale is divided in three major stages, as depicted in Figure 5.

The papers that are part of this dissertation are included in Chapter 4 and follow the three research stages. As shown in Figure 5, the first stage of research involved the study of sustainability, starting with a qualitative approach to understand the meaning and practices of designing services that incorporate sustainability concerns. Paper I was developed in this stage and the results explain how service providers view sustainability, and how they incorporate sustainability into their services and service design practices. Stage two of the research design involved a qualitative study to fill the gap of understanding value co-creation in the context of value networks. Paper II presents the results of this study to understand value co-creation in complex services with many actors. The third stage of research design entails a design science research approach to develop a new method for designing services for value networks involving a multidisciplinary team of 138 persons from public and private organizations (Citizens, Doctors, Nurses, Pharmacists, Healthcare Technicians). Paper III reports the process and results of the development of Service Design for Value Networks (SD4VN) method, and its application in the design of the Portuguese Electronic Health Record.

### Stage 1 – Qualitative Method

**Paper I:** The Meaning, Practices and Design of Sustainable Services: An In-depth Study of Service Organizations

Methodology: Qualitative Study – Grounded Theory

- 16 interviews with managers of organizations from different service sectors.

Objectives:

Identification and detailed characterization of Sustainability and its' incorporation into services:

- How service providers view sustainability?
- How service providers incorporate sustainability in their services?
- How service providers incorporate sustainability in their service design processes?

### Stage 2 – Qualitative Method

**Paper II:** Understanding value co-creation in complex services with many actors

Methodology:

Qualitative Study – Grounded Theory

- Exploratory study with key actors and informants – 5 in-depth interviews.
- Card-sorting (to identify the priority actors).
- In-depth interviews + Focus groups with Citizens, Doctors, Nurses, Pharmacists (42 Actors).

Objectives:

Identification and detailed characterization of value co-creation in complex services with many actors:

- How actors participating in a value network integrate resources and interact to co-create value?
- How value co-creation factors and outcomes are interconnected?
- How value co-creation for each actor depends on his/her own actions and the actions of other actors, in a complex set of interactions and interdependencies?



Iterative Process



### Stage 3 – Design Science Research

**Paper III:** Service Design For Value Networks: A New Approach for Designing Complex Service Systems with an Application to Electronic Health Records

Methodology: Design Science Research

1. Problem and Motivation: Designing services for entire value networks rather than one organization or a customer segment at a time

2. Objective: Evolve service design methods for the creation of new services in the context of value networks

3. Design and Development

4. Application

5. Evaluation

SD4VN – Integrated design of the service concept at the network and actor level

Designing services at the Network Level  
New tools for designing complex services

Designing services at Actor Level  
MSD Application (Patricio, et al. 2011)

Application of SD4VN to the design of the Portuguese Electronic Health Record

Service Experience Assessment and evaluation of the overall service design process

Figure 5 - Process employed in the dissertation and papers' organization

The overall results and contributions of the dissertation are discussed in Chapter 5, taking in consideration the main objectives identified in Chapter 1. The research and managerial contributions are detailed, taking in consideration the understanding of sustainability and actor's value co-creation processes in many-to-many contexts, and enabling its incorporation in the development of a new method for designing services for value networks (SD4VN). Managerial implications are also discussed taking into account value as a result of a dynamic view of value networks, and the application of SD4VN in the design of the Portuguese Electronic Health Record. Finally, dissertation conclusions, limitations and future research directions are presented in Chapter 6.



## **4 Papers**



**PAPER I**



# **The Meaning, Practices and Design of Sustainable Services:**

## **An In-depth Study of Service Organizations**

### ABSTRACT

**Purpose** – Sustainability has become quite important in modern society, but incorporating sustainability into services still needs substantial research. This paper contributes an in-depth study of what service organizations mean by sustainability, how they incorporate sustainability into their services and their practices regarding sustainable service design.

**Design/methodology/approach** – This paper presents a qualitative study of 16 service organizations from different industries using grounded theory methodology and semi-structured interviews.

**Findings** – The results showed that organizations have many different perspectives on what sustainability means, but they always included the temporal dimension. All organizations in the study believed that sustainability was already embedded in their mission and values. However, most organizations lacked perspectives and methods for specifically incorporating sustainability into their services. Furthermore, only a few organizations applied a systematic process for designing their services. Sustainability is not explicitly incorporated in service design, but is conveyed mostly through values statements. The complex systems nature of sustainability emerged as a key concern for designing complex service systems

**Originality/value** – This research provides a reference model for classifying different aspects of sustainability and offers service organizations a clearer understanding of the concepts of sustainability and sustainable service. Novel insights on developing sustainable services are also offered, which provide a foundation for further service design research.

**Keywords:** Sustainability, Service Design, Values, Complexity.

## INTRODUCTION

In the twenty first century, human societies worldwide face the daunting challenge of meeting the basic human needs, aspirations and desires of today's generations, without compromising the ability of future generations to meet their own needs (United-Nations, 1987). Sustainability is a major concern for modern society and is one of three major socioeconomic transformations that Europe has proposed to lead (European-Commission, 2007).

The design community has been aware of the need for designing sustainable services for a long time (Crul and Diehl, 2006). With the cumulative effects of unsustainable behaviors, interest in sustainability is also growing for both customers and service providers (Edvardsson and Enquist, 2009). Moreover, design for sustainability has gained increased attention since research has shown that 80% to 90% of a product or service's environmental impact is determined at the design stage (Crul and Diehl, 2006; Design-Council, 1997; Schvaneveldt, 2003). As such, service design can be a viable practice to incorporate sustainability into service organizations. However, there is no consensus about how to incorporate sustainability practices into services. There is some detachment between what organizations proclaim in their mission and values statements and the sustainability of their actual practices. Moreover, most sustainability research has focused on product design. The large size of modern service economies means that they generate significant pressure on the natural environment (Grove et al., 1996) and, therefore, demand more efforts on service design for sustainability.

We argue that to develop sustainable practices for service, it is important to start with an in-depth understanding of what service organizations mean by sustainability and what are their sustainability practices. This paper contributes an in-depth study of what service organizations mean by sustainability, their practices regarding sustainable service design and how they incorporate sustainability into their services.

A qualitative study of 16 service organizations investigated:

1. What do service organizations mean by sustainability?
2. How are organizations incorporating sustainability into their services?
3. How do organizations incorporate sustainability through service design?

With these objectives in mind, the first section of this paper presents the theoretical framework of sustainability and its incorporation into services and examines the relationship between sustainability and service design. The second section describes the research methodology with a qualitative study of 16 service organizations, using a grounded theory approach. The third section presents the results of the qualitative study with service organizations, structuring the findings according to the three research questions.

## THEORETICAL FRAMEWORK

### **Sustainability and its three pillars**

Sustainability is derived from the Latin *sustinere* (*tenere*, to hold; *sus*, up) (Hornby and Ruse, 1995). Sustainable development can be defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (United-Nations, 1987). Since the 1980s, the term sustainability has been used in the sense of human sustainability, and it has become associated with integration of economic (jobs, prosperity, wealth creation), social (social inclusion, communities) and environmental (natural and renewable resources) spheres (Adams, 2006). The three overlapping circles in Figure 1 are not mutually exclusive and can be mutually reinforcing (Adams, 2006; Blewitt, 2008; Buchenrieder and Göldenboth, 2003).

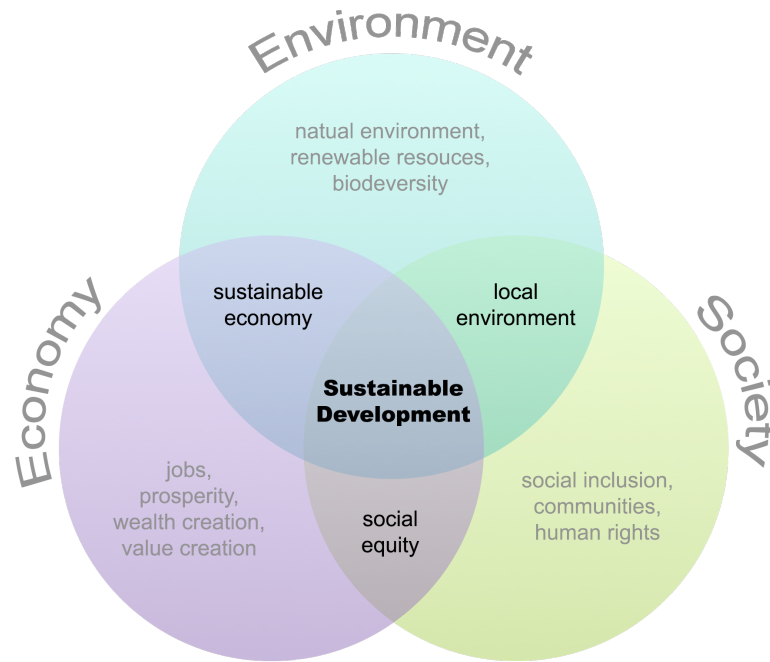


Figure 1 – The three pillars of sustainability, adapted from Forestry Commission (2009)

Vucetich and Nelson (2010) incorporated an ethics framework by defining sustainability as “meeting human needs in a socially just manner without depriving ecosystems of their health” (p. 539). Elkington argues that a business is sustainable when it reaches long-term financial stability by minimizing its environmental impact and meets the community’s social expectations, too. This definition is based on the Triple Bottom Line (TBL) principle, which emphasizes the importance of equilibrium among three pillars of sustainability: economic prosperity, social equity, and environmental regeneration (Elkington, 1997; Elkington, 2001). Achieving sustainability is one of the most important modern challenges that organizations face. However, we need to know how service organizations view sustainability as a first step to developing new methods to help them create sustainable services.

### **Incorporating sustainability in services**

The concept of service have been defined in multiple ways (Quin et al., 1987; Vargo and Lusch, 2004). According to Lovelock, a service is an “act or performance that creates benefits for customers by bringing about a desired change in—or on behalf of—the recipient” (Lovelock and Wirtz, 2010, p. 6). The emerging service logic has challenged the distinction between products and services, and the service framework/mindset applies to every offering. In Service Dominant Logic, “service is defined as the

application of specialized competences (operant resources—knowledge and skills), through deeds, processes, and performances for the benefit of another entity or the entity itself” (Vargo and Lusch, 2008, p. 26).

Incorporating sustainability in services needs further research (Ostrom et al. 2010). Some authors propose incorporating sustainability through values, but do not provide specific guidelines regarding the concrete impact on new service development (NSD) (Edvardsson and Enquist, 2009; Edvardsson et al., 2007). NSD is the “overall process of developing new service offerings” (Johnson et al., 2000). NSD includes the complete set of stages from the idea generation to deployment and implementation (Edvardsson et al., 2000). NSD also includes the service design stage that is present in most of the NSD process models in the literature. These earlier NSD models presented a narrow view of service design as the concretization of the service idea in models, drawings or specifications (Gummesson, 1991). In this paper, we adopt a broader and more recent definition of service design as a human-centered process based on a deep understanding of users, service providers, market strategies and social practices (Holmlid and Evenson, 2008) that permeates the different stages of NSD (Patrício et al., 2011).

Sustainability has been studied in product design and there are several common concerns when designing a product or a service, such as the connection with customer values (values resonance), the customer experience, a solid understanding of the customer needs, identification of the SET factors (Social, Economic and Technology drivers), the choice of suppliers and materials (sustainability concerns), etc. (Cagan and Vogel, 2002). However, designing a service involves several design challenges due to the complexity of service systems that are not part of the product development process, such as different customer interactions and co-creation of experiences, the service encounter (Bitner, 1990), and the integration of multiple channels, people, processes and technologies. Coping with this complexity requires integrating multiple disciplines to create new services (Patrício and Fisk, 2013).

Sustainability has also been an important concern for Product Service Systems (PSS), which can be defined from different perspectives (Manzini and Vezzoli, 2002; Mont, 2002; Kang and Wimmer, 2009). We adopted Manzini and Vezzoli’s definition of PSS as “an innovation strategy, shifting the business focus from only designing (and selling)

physical products, to designing (and selling) a system of products and services that are jointly capable of fulfilling specific client demands.” This concept shows that people do not demand products or services, but what products and services enable them to achieve. Manzini and Vezzoli developed the concept of strategic design for sustainability, which is “the capability to create new stakeholder configurations and develop an integrated system of products, services and communication that is coherent with the medium-long term perspective of sustainability” (Manzini and Vezzoli, 2003). Although this concept helps develop tools for designing a sustainable PSS, there is still the need to develop service design methods that explicitly address sustainability concerns. In the following, we explore the literature related to sustainability through values and sustainability through design.

### **Sustainability through values**

Values have a broad meaning across service marketing, service design and service management. One challenge to incorporating values into service design is that “value” and “values” (in plural) are used with different connotations. It is very important to distinguish between (1) value as the importance or preciousness of something (material concept) (Normann and Ramírez, 1993; Vargo and Lusch, 2004) and (2) and values as a person's principles or standards of behavior (ethics/morals meaning) (Hornby and Ruse, 1995).

Service design has made a strong argument around the incorporation of values (Edvardsson and Enquist, 2009; Edvardsson et al., 2007). The concept of values associated with services and service design has been gaining attention (Ostrom et al., 2010) and our findings corroborate that. As such, the focus of this paper is on incorporating sustainability through values (in plural).

Customer value includes not only economic value but also value that is linked to values (in the sense of ideals). According to Holbrook (2006), customer value rests on 4 pillars: is interactive, relativistic, refers to a judgment of performance or outcome; and resides in a consumption or use experience. This perspective enhances service as a value-creative endeavor and is consistent with Vargo and Lusch's Service Dominant Logic (SDL) (2004; 2008). This paradigm posits that value (value in use) is co-created with the customer and is experienced and assessed when service is used within the customer's

own context. Therefore, organizations can only make value propositions that have the objective of supporting customers in their own value-creating activities.

Combining Service Dominant Logic (SDL) (Vargo and Lusch, 2004) with values-based business model facilitates a sustainable values-based service business (Edvardsson and Enquist, 2009). A values-based business is grounded in the paradigm of SDL and firmly based on core organizational values as well as social and environmental responsibility.

Building upon SDL, Shirahada and Fisk (2011) created a broader conceptualization of service and value. They proposed a tripartite model of value co-creation that includes both human to human relationships and human to nature relationships. Their model includes a new value concept they call “Value in Keep” that goes beyond value in use, value in context, and value in exchange. Value in Keep means the long-term value achieved from preserving natural resources for the future.

According to Vucetich and Nelson (2010), sustainability requires “tending its ethical dimension across all levels of society, even though we cannot ever expect to arrive at a final determination of its meaning.” (p. 540). The incorporation of the ethical dimension in new business models can foster values resonance (Edvardsson and Enquist, 2009), which occurs when the values of customers and other stakeholders are in accordance with the core organizational values, the social and environmental values. The higher the congruence between customer’s values and the service provider’s values, the higher the customer loyalty (Mascarenhas et al., 2006). As such, organizations can co-create value with their customers by resonating with their values, and therefore supporting them in pursuing their values.

From the previous definitions we can conclude that a sustainable values-based service business model makes a long-term commitment and is values-driven (rather than short-term and financially-driven). It must also incorporate the ethical dimension and be in harmony with the sustainable development concept and the TBL principle. However, values-based service research does not provide guidelines on how to incorporate values into services. These guidelines should be developed to support organizations as they attempt to systematically incorporate sustainability values (as principles) into services. These guidelines should also establish a strong long-term commitment to enhancing and

transmitting the compatibility of the core organization's values and the customers' values.

### **Sustainability through Design**

Early EcoDesign perspectives focused on incorporating environmental issues into the product development process with the goal of reducing the total environmental impacts of design (Dewberry and Goggin, 1996; Van den Hoed, 1997). The EcoDesign perspective evolved to the concept of sustainable design, which incorporates the socioeconomic dimensions of sustainability (Sherwin, 2004). From this new perspective, sustainable solutions are “products, services, hybrids or system changes that minimize negative and maximize positive sustainability impacts – economic, environmental, social and ethical – throughout and beyond the life-cycle of existing products or solutions, while fulfilling acceptable societal demands/needs” (Charter and Tischner, 2001).

The relationship between sustainable design and product innovation leads to the concept of Design for Sustainability (D4S). EcoDesign has evolved from Design for Environment (DfE) to the broader concept of Design for Sustainability encompassing the TBL principle (Crul and Diehl, 2006; Sherwin, 2004). Although the concepts of EcoDesign and Sustainable Design are not new, extant research has focused mostly on sustainability in process or product design (McAloone and Andreasen, 2004; Sharma and Starik, 2002; Shrivastava, 1995; Waage, 2007). The use of service design methods can help incorporate sustainability in services, as they provide guidance to systematic incorporation of sustainability concerns. These design methods can spread sustainability concerns into the service design process and positively influence the final result. Process maturity models for integrating sustainability (Silvius et al., 2013; Silvius and Tharp, 2013) consider the full life-cycle of a specific project, from its conception to its disposal, and can be a useful tool to assess the integration of the concepts of sustainability into services. They can also provide guidance for action plans and incorporation of sustainability from the design stage.

### **Service Design for Sustainability (SD4S)**

Service design is a human-centered process based on a deep understanding of users and their context, service provider, market strategies and social practices (Holmlid and Evenson, 2008). It is a discipline that attempts to blend the worlds of business,

marketing, and design for a multidisciplinary approach to the sustainability of services (Saco and Goncalves, 2008). Adopting an iterative design thinking approach (Brown, 2008; Stickdorn and Schneider, 2010), the service design process involves four steps from service ideation to service implementation and requires orchestrating a set of service elements through different levels, from the deep understanding of the customer experience to the specific design of the service solution (Patrício et al., 2011). Service design methods and tools can bridge the gap between research results and new service concepts (Patrício and Fisk, 2013).

As an emerging field, service design methods and tools have been developed in different disciplines over almost 30 years. Shostack (1984) developed service blueprinting for mapping the activities in service delivery and production processes. Dubberly et al. (2008) with “The Analysis-Synthesis Bridge Model” helped bridge the gap between research results and the design of new service concepts. Stickdorn (2010), Mager and Gais (2009), Miettien and Koivisto (2009), and others provided tools to ensure that service interfaces are useful and desirable for the customer, and effective and distinctive for the service provider. Patrício et al. (2011) created Multilevel Service Design, which provided a holistic, integrated and interdisciplinary approach by synthesizing contributions from interaction design, service science, management and engineering. Manzini and Vezzoli (2003) were two of the first researchers to relate sustainability to service design. They defined a sustainable service system as one that maintains or enables high “context quality.” By this, they mean that a sustainable solution must be combined with an improved quality of both social and physical life.

However, service design requires further research to incorporate sustainability into the design process. Since concepts such as customer experience design and EcoDesign have gained increased attention, more work is needed to establish connections between frameworks and models from the different contributing fields (Grove et al., 2009; Ostrom et al., 2010).

Service Design for Sustainability (SD4S) adopts innovative approaches that consider sustainability during the design stage and helps reverse current unsustainable service development. SD4S goes beyond how to make a ‘green’ service, which only addresses the environmental pillar of sustainability. SD4S also embraces socioeconomic

challenges and the need to meet consumer needs on a systematic level and influence their attitudes and loyalty behaviors. SD4S takes social, environmental and ethical concerns as key elements of long-term product innovation strategy along with their economic concerns. In SD4S, organizations should take a holistic view of their services and incorporate sustainability throughout the supply chain and service delivery, valuing their socioeconomic and environmental surroundings, as well as the evolution of the service environment. This evolution has strong effects on the organization's strategy and by continuously adopting a holistic approach, more sustainable services will develop.

In other words, organizations should incorporate sustainability into their service ecosystem supporting long-term perspectives and the emergence of a more collaborative society and economy through transformative services and transformation design (Sangiorgi, 2011). To clarify the Service Ecosystem concept we refer to the biology definition of ecosystem that describes it as a system that includes all living organisms in an area, as well as its physical environment, functioning together as a unit through interactions (Odum and Barrett, 2005; Ricklefs and Miller, 2000). In the context of services, a Service Ecosystem can be defined as “a spontaneously sensing and responding spatial and temporal structure of largely loosely coupled, value-proposing social and economic actors interacting through institutions, technology, and language to co-produce service offerings, engage in mutual service provision, and co-create value” (Vargo and Lusch, 2010, p.176). This service ecosystem perspective supports SD4S by transforming customer aspirations into stakeholder aspirations, the firm view into a Service Ecosystem perspective and incorporating the time dimension (Patrício et al., 2010). In other words, designing for the future, not just the present. However, current service design methodologies do not systematically incorporate sustainability concerns (Dubberly et al., 2008; Manzini, 2009; Morelli and Tollestrup, 2007; Normann and Ramírez, 1993). As such, there is a risk of producing unsustainable services for the organization, its customers and society at large (e.g. financial losses, environmental or social negative impacts).

Service sustainability has gained increased attention in the literature, but new methods are needed to systematically incorporate sustainability in service design. An in-depth understanding of service providers' views of sustainability and their service design practices is an important first step toward developing new service design methods that foster sustainability.

## METHODOLOGY

To understand what service organizations mean by sustainability, our qualitative study examined their practices regarding sustainability and how organizations design their services to include sustainability concerns. The companies in our sample were selected and classified in different service industries within the service sector according to Zeithaml and Bitner classification (2000), (e.g. p. 3 - Business services, Health services, Transportation, Utilities and others). Figure 2 describes the adopted methodology in the qualitative study and the different steps undertaken to answer the research questions.

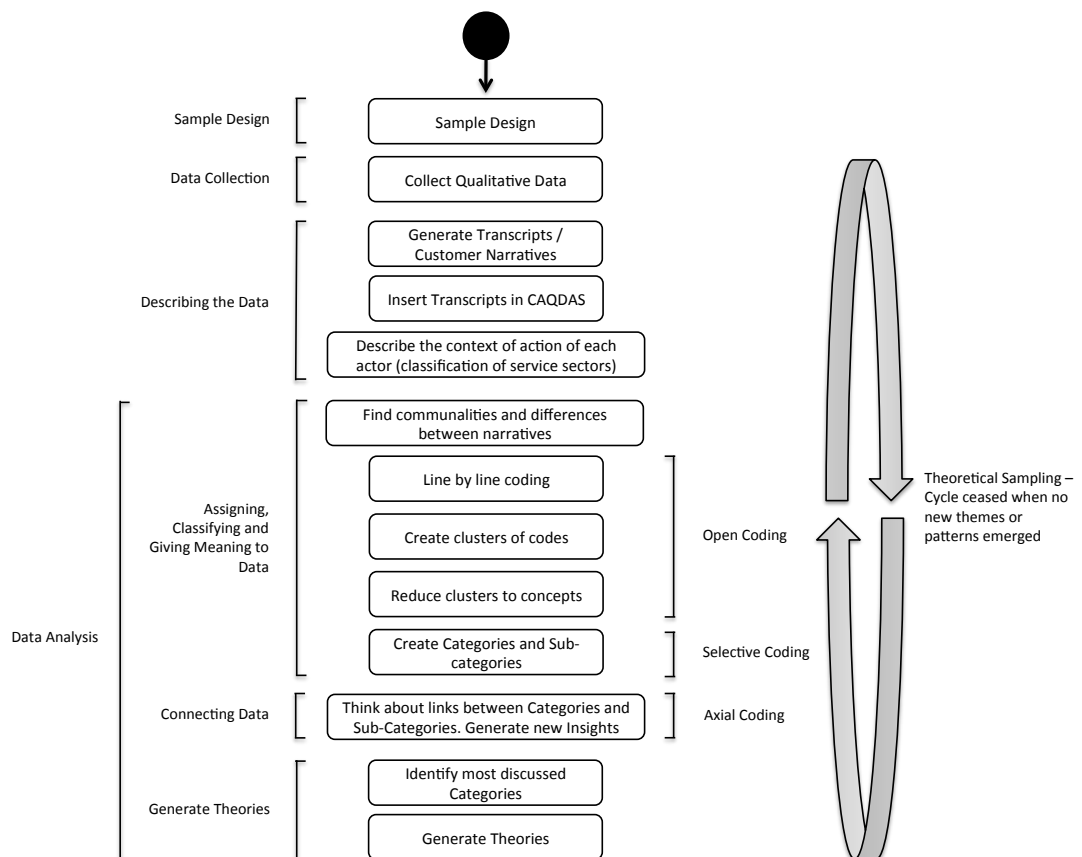


Figure 2 - Qualitative Study Methodology

Since sustainability in service design is an ongoing and unexplored research topic we used grounded theory as the methodology for our qualitative study. Grounded theory was considered particularly appropriate to provide an in-depth understanding of the unexplored phenomenon of integrating sustainability in service design. In this research approach the qualitative researcher develops theory during the data collection process (Charmaz, 2006; Strauss, 1987). This method suggests that theory is built from data or

grounded in the data. We followed more contemporary approaches, where grounded theory is not seen purely as an inductive method – as grounded theory was originally defined - but as an abductive method (Charmaz, 2006; Corbin and Strauss, 1990), that entails construction, which is not totally free of researcher's previous knowledge and experience (Charmaz, 2006). Grounded Theory enables data and theory to interact while keeping qualitative research flexible. Our research assumes a strategy closer to a more contemporary view of grounded theory (Corbin and Strauss, 2008). Literature review was mostly undertaken after data analysis, but we did a moderate review of literature in the beginning and during the study. This review was helpful to get a first understanding of the area and in naming some categories that had already emerged in the iterative process of data analysis, stimulating theoretical sensitivity (Glaser, 1978).

### **Sample design**

We used Theoretical Sampling (Corbin and Strauss, 2008). The sample covered a diverse set of organizations with theoretical relevance, which provided very different perspectives on service sustainability. To gather a far-reaching concept of sustainability and sustainable practices, we selected organizations from different service sectors (Information Technology, Education, Real Estate, Tourism, Health, Retail, Telecommunications, Energy and Utilities, Financial, Transport and Consulting). The sample includes medium and large size organizations, since the probability of having defined sustainability policies and practices would be higher. By EU standards, this means that all of the organizations had 250 or more employees. They are local and international organizations from different countries of origin, and most of them are multinational (Appendix 2). The interviews were conducted with managers involved in the design and delivery of the firm's services, or managers responsible for sustainability programs. The sampling process ceased when no new themes or patterns emerged.

### **Data collection and analysis**

The interviews were performed between January and December of 2010. Semi-structured interviews were used to assure that all the topics were addressed in a systematic manner (i.e. the meaning of sustainability, current sustainability practices in services, and service design process). Open-ended questions were used to avoid constraining interviewee's answers (Froddy, 1993). Interviews followed a semi-

structured protocol (Fontana and Frey, 2000; Froddy, 1993) and lasted 45 to 100 minutes (Appendix 1). The protocol was divided into three main parts covering the main research questions. Part 1 (Sustainability) aimed at understanding what service organizations mean by sustainability and why it is important to them. Part 2 (Sustainable Initiatives) was dedicated to learning how organizations incorporate sustainability into their services and which specific sustainability practices are involved in the process. Part 3 (service design) aimed at understanding how organizations design a new service, whether they apply a structured or systematic design process, and how they specifically incorporate sustainability through service design.

The sustainability concept was not addressed directly to prevent leading questions (Froddy, 1993; Miles and Huberman, 1994). Instead, the discussion explored the topics from the interview protocol, enabling the main issues to be discovered. Moreover, to assign significance, coherence and meaning to the data collected, we completed a literal transcription of the recorded interviews to NVivo 9, with an average of 25 pages per interview.

Following the grounded theory methodology, we built the theory iteratively (Charmaz, 2006), in search of relevant insights or patterns that provided a guide for future data collection. Decontextualizing and recontextualizing procedures promoted and facilitated reduction and subsequent expansion of the data into new forms (Coffey and Atkinson, 1996; Maxwell, 1992). Open coding and selective coding were used to classify categories and sub-categories, which provide the necessary abstraction level so the research can produce theoretical concepts, rather than mere events (Charmaz, 2006; Corbin and Strauss, 1990). During the process of analysis we remained open to the unexpected and willing to adjust the direction of the research project.

We coded segments of data with labels that categorized and accounted for each piece of data. We also organized, categorized and reconstructed the interpretations of the interviewees (Blee and Billings, 1986). We then made generalizations from recurring data to general theory about sustainability, service design, and service systems to assign general theoretical significance (Neuman, 2006). This iterative process ended when no new themes or patterns emerged. We used axial coding whenever relations between

categories and sub-categories became more visible. At this stage, we were able to make generalizations and create new theories.

To give a short example of the iterative coding and data analysis process in NVivo9, we literally transcribed the interviews and categorized four main codes (one for each part of the interview protocol: 1) Meaning of sustainability, 2) sustainability initiatives and 3) Service Design, and one code for the 4) service industry of the organization interviewed). After the first coding iteration, new patterns emerged across the main code segments, like the three pillars of sustainability, or the influence of values. At this stage, we applied axial coding, connecting concepts and generating more insights such as the different pathways for an organization to become sustainable (internal backstage processes, new service offerings, and the value network). In the final stage, we were able to do cross analysis and identify patterns that allowed us to generate theories like the meaning of sustainability from the organization's perspective; the influence of the organization's values (as principles) throughout the different pathways to become sustainable; the sustainability incorporation on service design; or the difference in importance organizations in different service sectors give to each pillar of sustainability.

### **Validity of the Qualitative Study**

Validity is a critical issue for the quality of qualitative study. In this study, we followed Maxwell's framework to improve the validity of our qualitative study results (Maxwell, 1992), taking into account descriptive, interpretive and theoretical validity. In the context of our research, descriptive validity, in other words, factual accuracy in reporting interviewees' perspectives, was ensured by the literal transcriptions and the use of NVivo9. Whenever we coded a specific segment of an interview we always used the same transcriptions database, avoiding editing errors. Interpretative validity refers to how the accounts of participants' meanings are constructed by the researcher, based on participants' own accounts and other evidence (Maxwell, 1992). To ensure interpretive validity, the connection between participants' accounts and researchers' interpretation was made through the coding process with the support of NVivo9, and the results presented in the paper were also supported by interviewees' citations. Theoretical validity goes beyond interpretation to explanation of a phenomenon, by constructing concepts or categories and establishing relationships between them. In this study, theoretical validity was ensured through creating higher level categories of sustainability

meanings and practices in service organizations and establishing theoretically relevant connections between them with the help of NVivo9 and through the iterative comparison of findings with existing literature.

## STUDY RESULTS

The study results provided an in-depth understanding of sustainability meanings and practices in service organizations. They showed that organizations have diverse perspectives about sustainability and incorporate the concept differently in their services. The results are presented according to the three main research questions: the meaning of sustainability, sustainability incorporation in services, and SD4S practices. The following table summarizes the emerged theories and relates them to the main research questions.

Table 1 – Summary of emerged theories

Research Questions	Emergед Theories
1. What do service companies mean by sustainability?	TBL Principle (The three pillars: Economic, Environmental, Social)
	Time Dimension (evaluation of the impact of present actions in the future)
	Different importance given to sustainability in different service industries
	Complex systems nature of sustainability
2. How are companies incorporating sustainability into their services?	Difference between internal and external initiatives
	Different pathways to become sustainable (Value Network, New service Offerings, Backstage Processes)
	Sustainability incorporation through values (as principles or standards of behavior)
3. How do companies incorporate sustainability through service design?	Organization's adoption of service design practices
	Incorporation of sustainability into service design

The following sections present a detailed explanation of the emerged theories and how they are supported by the data.

### **The meaning of sustainability**

The results showed that the meaning of sustainability is related to the Triple Bottom Line pillars (Economic, Environmental and Social) and the time dimension. In this

section, we detail these topics as well as the systemic nature of sustainability that was mentioned several times by the interviewees, in particular by those whose services were integrated into complex service systems like health, banking or transportation.

Organization managers always refer to the temporal dimension of the definition, in other words, meeting the needs of the present without compromising the future. AXA explains: *“the services that we sell ensure the future of the people, (...) are the guarantor of the quality of people lives.”* From the interviewees’ point of view the very idea of sustainability requires a long-term perspective. Only by considering the ecosystem evolution over time is it possible to understand the impact of a service on the ecosystem. The time dimension of sustainability is also related to concerns about intergenerational equity and justice, which is the awareness of the impacts of the actions of present generations on the future ones. This finding corroborates previous research (Voinov and Smith, 1998).

### **The Three Pillars**

Study results show that most organization actions were based on the Triple Bottom Line. These concerns are present when organizations talk about the meaning, importance and drivers of sustainability, as well as in sustainable initiatives. In other words, most of them try to find a balance between the three pillars of sustainability. For example, the manager of ANAM states that *“To be sustainable is something that is durable and guarantees the society’s [Social] and organization’s welfare. [Economic] (...) is something prolonged in time and does not lead to structural damage. (...) We always care about the environment. We have been monitoring our activities for several years (noise, air pollution, etc.) [Environmental].”*

When organizations explain what they mean by sustainability, they normally separate their response by the economic, social and environmental pillars. Economic sustainability is related to the need to ensure economic and financial viability of organizations, by reducing costs and increasing productivity and profitability, as well as to guarantee the organization’s growth and development.

The environmental pillar is always mentioned by service organizations. The managers argue that it is vital to ensure a balance between consumption and maintenance of natural resources. The interviewee from Virginia Tech University explains that *“There*

*are X amount of resources in the world and we are in equilibrium. You integrate the environment where you live and you must ensure the sustainability from a long-term perspective. Don't consume more than you produce.*" There is also a concern to reduce the ecological footprint (reusing, recycling, reducing the noise produced, etc.). However, sometimes this is seen as a legal obligation and not as a priority.

The social pillar is considered a fundamental element when reflecting on service system sustainability. This relates to fair business practices toward labor, the employees' families, the community, and the region in which a corporation conducts its business. The importance of human resources was evident during our data analysis. Several organizations referred to this as a main issue to address. For example, Alert's manager argues that *"Only happy employees, well integrated into their family life, personally and professionally fulfilled, can be motivated. Obviously, this is the way to improve the organization's economic, social and environmental performance."* Most of the interviewees also related the social pillar of sustainability with helping underprivileged people. Fighting illiteracy is perceived as a fundamental way to ensure social balance by giving people access to information and helping them have sustainable attitudes and actions.

Besides these common themes, the results also showed that service organizations have different visions about sustainability. In some industries, organizations pay more attention to some sustainability pillars than others. For example, the Social and Economic pillars are the main focus of the Ministry of Health – *"Nowadays populations demand better healthcare services than 50 years ago. (...) We must respond to these demands without forgetting the most needed people [Social] but also without threatening the financial equilibrium of the state [Economic]."* On the other hand, the Environmental pillar is more important for organizations such as ISA where *"Sustainability is living in an ecosystem without compromising the equilibrium of consumption and creation of natural resources [Environmental]."* The social component of sustainability is also the main focus of organizations such as Electricity of Madeira, which are public institutions that guarantee a minimum quality of life to underprivileged people by supplying them goods and services at prices that may not be economically viable. These organizations are often supported by government funding or private donations.

## Complex Systems Nature of Sustainability

The complex systems nature of sustainability emerged from data categorization. Several organizations recognized the importance of systemic sustainability, which in this context can be described as acting units that are integrated into a complex service ecosystem and whose actions impact other units, therefore making the sustainability of the service ecosystem dependent on the actions of each unit. This concept is very clear in the speech of the executive of the Ministry of Health – "*...We have to move from this logic of isolated services (which in terms of I.T. was associated with a logic of each Health Unit itself had to have its own information system...) to a logic in which we look to all service units and see a single service system. Considering that we build a complex integrated national healthcare system that provides services to citizens, in hospitals, health centers, private organizations, mercies, etc. – what is important is to be aware that if we want to build these systemic solutions and make them sustainable, we need to think in network logic and measure the economic and social impact of each unit.*"

The study shows that some of the organizations already have sustainable systemic concerns, such as: sustainability dissemination through partnerships and supply chain contracting (i.e, forcing partners to comply with ISO 14001 standards or other requirements considered by the organization as sustainable) and promotion of alternative and complementary modes of transportation (i.e, partnerships between different transport organizations to ensure better citizen mobility in a certain city). The manager of Alert said that the organization tries to "*Promote sustainable principles throughout the value chain, not only with our employees, but also with our clients, suppliers, etc. Therefore, the company has a role in the global dissemination of sustainability... We are not talking of being internally sustainable. We do believe in a systemic sustainability in the various systems in which the company and its employees interact. (...)*". Being sustainable, once more, involves a systemic application. "*What is the impact of that sustainability in my system? What did Gaia [neighbor city of Porto and Head Quarters of Alert] win with it? How many jobs did Alert create? How did we contribute to social welfare? How did our customers benefit? What best practices did we teach our clients and suppliers, so they could get benefits and become more sustainable?"*

## **Sustainability Incorporation in Services**

This section describes how service organizations are incorporating sustainability in their services. Not surprisingly, our study revealed a considerable variability regarding the organization's understanding of sustainability incorporation in services, thus corroborating previous findings (Kelliher and Anderson, 2008; Wilkinson et al., 2001). This variability is not only because of the variety of the companies studied but also because they have different views regarding the different pillars of sustainability. Some organizations associate incorporation of sustainability with the promotion of environmental best practices; others with economic concerns about profitability, return on investment and cost control; and still others with improving quality of life for their employees and their families, or ensuring their work-life balance.

To clarify how organizations are incorporating sustainability into their services, we asked them to describe their initiatives regarding sustainability and distinguished between internal backstage processes (not related to the organization's services) and external initiatives (related to the organization's services with direct impact on their customers and value network).

Although the concept of sustainability in services is not clear for most organizations, the results revealed that organizations already incorporate sustainability in services. They recognized that sustainability is a long-term commitment and identified several different pathways to becoming sustainable. Based on data analysis, these pathways were categorized in three levels, as shown in Figure 3: (1) internal backstage processes, (2) new service offerings, and (3) the value network.

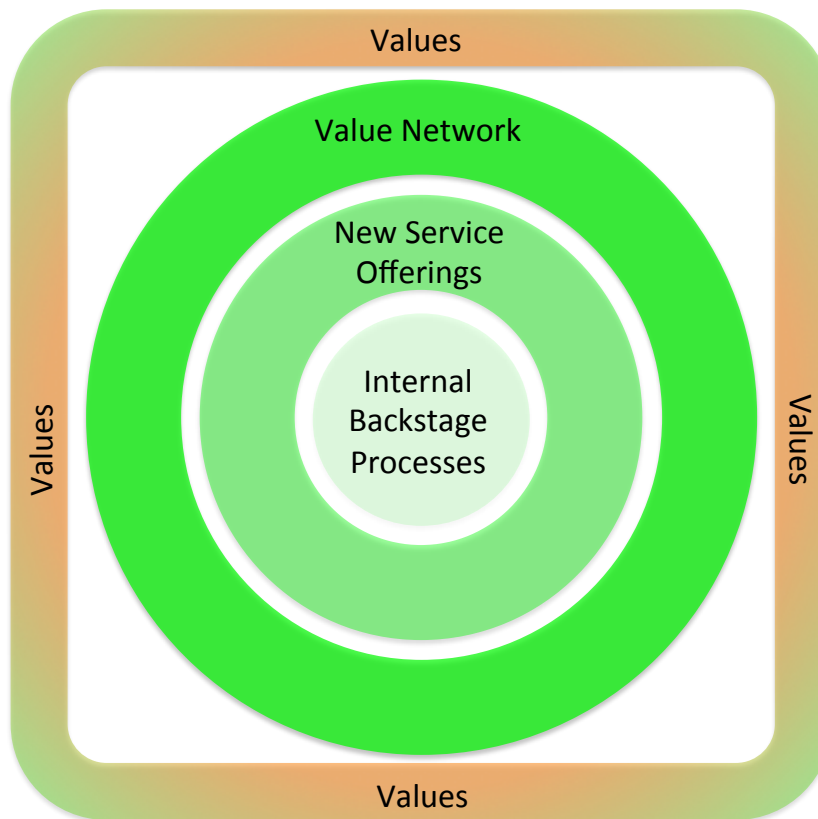


Figure 3 – Levels of sustainability incorporation in services

In the first level, organizations incorporate sustainability in their backstage processes. Internal backstage sustainability initiatives are the ones that do not directly impact the organization's clients or suppliers. Based on data analysis, we divided these initiatives into the three pillars: Economic (energy savings, fleet and process optimization); Environmental (reuse and recycle, water savings, digitization, etc.); and Social (improved work conditions like time to rest, sports facilities, collaboration and leisure rooms, car sharing, and others). For example, Horários do Funchal reuses rainwater to wash the buses. By adopting these practices, organizations are cutting costs and helping the environment. However, these actions do not necessarily have a direct impact on their clients.

The second level concerns New Service Offerings. Our results show that the most common sustainable initiatives are related to the creation of new services. These services decrease harmful impacts or create positive ones through service delivery processes or support processes. This is evident in organization's service support processes such as reusing and recycling communication appliances in the telecommunication industry, or teaching bus drivers eco-driving techniques. These practices are also evident in the

service delivery process. For example, looking at the organization's service portfolios it became evident that they already have services that apply environmental best practices such as transport optimization, visual impact reduction (energy industry) or digitization. The manager of Alert explained, *"When we are selling our software, we are promoting digitization. When we choose printers to integrate with our software, we also promote toner recycling. We teach how to recycle while our teams are in the hospital doing their implementation work."*

Sustainability initiatives also have a positive impact on the economic pillar. For example, Transdev has ongoing projects to incorporate alternative energies in their buses. This will result in cost control and return on investment, which promotes economic sustainability.

The third level is the Value Network and relates to the promotion of sustainability adoption by organization's employees, their clients, suppliers and other stakeholders. These initiatives seek to change behaviors beyond consumption of the services, and as such can be linked to the design of transformative services, that promote behavioral change towards well-being of both individuals and communities (Ostrom et al., 2010). For example, supply chain contracting was mentioned as an important process to attain environmental sustainability. ZON explained that they *"have requirements in contracts that are related to the CO2 emissions and noise issues. We include those concerns in contracts, including contracts with the operators who provide logistic services. They have to ensure that environmental regulations are met within their own facilities."* Some organizations even require their suppliers to be ISO 14001 certified. This means that to work with an organization, suppliers have to adapt their behaviors and be more sustainable.

The results show other examples of service offerings that seek to promote sustainability adoption and behavioral change through the value network, such as: fighting illiteracy through training, providing courses to society, and promoting alternative transport services. The transport organizations that participated in our study regularly go to schools to teach students about the importance of public transportation and the reasons why they should choose the bus or train instead of a private car.

Our results indicate that organizations do incorporate sustainable practices both in their service delivery process and their support processes, but without a systematic approach. These organizations believe they have sustainability strongly incorporated in their mission and values, and those are known to their employees. Managers state that their organization's values are present in their attempts to become sustainable and the way the organization communicates with their stakeholders and integrates within society. *“Our values are expressed in the way we do things. Our mission and values are in our DNA. The same applies to sustainability.”* said the manager of Alert.

### **Sustainability through Values**

The study results reveal that sustainability is incorporated in services, but mostly through values (as principles or standards of behavior). Globally, interviewees could not identify how they are incorporating sustainability into their services besides the core organizations' values. For example, the manager of BPI states *“The idea of sustainability is related with the values of BPI. I feel it and it is also the opinion of several people. (...) For us sustainability is not a statement, it is part of BPIs values. We have them in our mind in every action we do.”*

The relationship between sustainability and values is even more evident in the president of Porto Bay Resorts declaration: *“I would say that our business model objectives and the services of Porto Bay Group are based in our values, namely nature preservation, cosmopolitanism, safety and quality of service.”* This idea supports the concept of a sustainable values-based service business by Edvardsson and Enquist (2009).

Also interesting is the fact that the organization's values are positioned to be in accordance with their customers' values. The manager of BPI states *“The main dimensions of sustainability are related with assuring the consistency of our values, assuring the quality of service and also assuring that our clients see themselves in our values.”* In the context of these results, we can confirm that values resonance (Edvardsson and Enquist, 2009) is an important component to achieving sustainability.

The managers of the organizations we interviewed identified several values based sustainability initiatives in services that are not related to a particular process, service offering, or partner, but cut across the entire organization. The results show that to achieve sustainability in services, organizations need to clearly communicate their key

values (incorporating sustainability). In the same way, organization's employees must internalize those values and act in a sustainable manner.

## **Service Design Practices**

When designing a sustainable service, some service organizations point to process optimization, backstage waste reduction, or opportunities to reduce costs in service delivery. However, our results indicate that if organizations seek to design a sustainable service, they should also look at the frontstage, and understand the service impact on its customers and the value network. In other words, to design a sustainable system, it is essential to take a holistic view of the service and its impacts, both internally and externally. This section describes how organizations design their services and what considerations they take into account when they attempt to incorporate sustainability into service design.

## **Organizational Adoption of Service Design**

Organizations are at different stages in adopting service design. Only 6 out of 16 organizations interviewed use service design, and a few of them only apply structured processes when they need to outsource and control a new service.

Although the adoption of structured service design is not common, when organizations do have a structured process, the incorporation of sustainability is still basically done through values, and rarely explicit or systematic. Alert is a good example of an organization with an established design process: *“Everyone can contribute with ideas in our Wiki collaboration tool (...) these ideas may cause an investment, a product or a service. (...) We involve customers from the beginning (focus-groups, user groups) (...) The conceptualization team (which involves the CEO) produces a conceptual specification, then the process is given to the design team and we make validity tests with users. After this stage, the process is given to the group of architecture and technology specification. (...) After this, the development process begins. (...) Sometimes we prototype the interface (...) the final step is intensive testing and release.”*

Even though some organizations have structured design processes, there is no evidence of a specific stage for the incorporation of sustainability. However, there is evidence of a

holistic vision about the service impacts, both internally and externally, either by comprising a careful conceptualization stage or involving important stakeholders at the beginning of the design process.

### **Incorporation of Sustainability into Service Design**

Study results indicate that the incorporation of sustainability in service design is not restricted to a specific stage, but should be a continuous and ubiquitous process. Organizations that already have a more systematic approach to service design often state that there is no specific time to think about sustainability – it must be ubiquitous. AXA manager confirms the organization does not separate sustainability: *“We do not think: ‘Now we must see what we have in terms of sustainability’. It is in the way we develop our services. It is already incorporated in the process. It is not something apart.”* It was clear that for organizations with more systematic approaches to service design, sustainability was a concern from the beginning of the design process. For example, the BPI manager argues *“In the design stage, there is no decision to make regarding sustainability (if the service is, or is not sustainable). It is born already with the sustainability dimension (...) it is implicit in our values.”* Sonae SIERRA also does not have a specific time to think about sustainability: *“We start thinking about it from the beginning.”* These sentences substantiate the previous statements regarding incorporating sustainability in services through values.

## **CONCLUSIONS AND FUTURE RESEARCH**

This research contributes a qualitative understanding of what service organizations mean by sustainability, how they incorporate sustainability into their services, and how they incorporate sustainability into their service design processes. Study results showed that while service organizations have different visions of what sustainability means, they always include the temporal dimension. Most of the organizations base their actions on the Triple Bottom Line principle, both in the “meaning, importance and drivers of sustainability” as well as in the sustainable initiatives. The systemic nature of sustainability becomes more relevant as it relates to the design of complex systems and to organizations that are part of complex service domains (such as healthcare, banks, and government). These organizations recognize the importance of acting as units integrated

within a complex system and whose actions impact other units, and the importance of the dissemination of sustainability throughout the service ecosystem.

Study results indicate that the incorporation of sustainability in services is made at three levels: (1) internal backstage processes that promote sustainability but do not have a direct impact on the customer experience and the value network; (2) new service offerings, that decrease harmful impacts or create positive ones through service delivery processes or service support processes; and (3) value network initiatives that change behaviors beyond consumption of the services, promoting sustainability through organization's employees, their clients, suppliers and other stakeholders.

Most of the organizations in this study already incorporate sustainable practices in their services, but mostly through values. The concept of values resonance stated by Edvardsson and Enquist (2009) emerged as an important element in the design of novel sustainable services. From the perspective of the interviewees a sustainable service should reflect the organization's values and be in accordance with their target customer's values. However, to reflect the organization's key values in services, organizations need to clearly communicate those values and their employees must internalize those values and act in a sustainable manner.

Sustainability is an important concern for service providers. The study showed that organizations with sustainable policies embed sustainability in their mission and values. However, most of the organizations lack perspective and methods for incorporating sustainability into their services. Only a few of them apply an explicit process to design their services and to incorporate sustainability in this process. Although managers have their own vision about the meaning of sustainability, they do not use service design methods to systematically foster sustainability. These results point to the need to develop new methods that support systematic incorporation of sustainability into service design.

From the organization's perspective, sustainability is also very important to their customers. Several organizations state that they have done their own sustainability studies with their clients and the results were unanimous saying that it was a concern for them. However, this study only focused on sustainability from an organization's perspective. Further research should also address the customer perspective to understand how consumers value sustainability and how organizational sustainability initiatives

influence customer attitudes and loyalty behaviors toward the service provider. It would also be pertinent to investigate how the elements in the concept SD4S are applied in each Triple Bottom Line pillar in relation to the very different industry sectors.

Our study shows that sustainability has become an important organizational concern. Organizations are increasingly incorporating sustainability through values, backstage operations, and the creation of new services by transforming behaviors throughout the value network. However, our study also reveals that organizations lack methods for systematically incorporating sustainability into service design. This in-depth understanding of sustainability meanings and practices contributes to developing service design for sustainability methods that lead to creating transformative services that promote sustainable behaviors in organizations, their customers, and the entire value network.

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## APPENDIX 1 – INTERVIEW PROTOCOL

### **Part 1 – Sustainability**

1. What does sustainability mean for you and your organization?

- Why is sustainability important?
- How did sustainability emerge?
- Is sustainability an important component of the services provided by your organization? How?

2. What does sustainability in services mean for you and your organization?

- What are the aspects of sustainability that your customers value most? Do you measure that?
- How is your organization organized in terms of leading sustainability initiatives?

### **Part 2 – Sustainable Practices**

3. Which sustainability practices does your organization already incorporate in its services?

- What are the drivers for sustainable practices in your services?

### **Part 3 – Service Design**

4. Can you explain how does your organization develop/design a new service?

- Does (name of the organization) use some systematic method / structured process in the design of its services? If so, can you explain this process?
- Does (name of the organization) incorporate sustainability issues in the design of its services? If so, can you explain this process?

5. After having a new idea, when does (name of the organization) starts concerning about sustainability?

6. How do you think (name of the organization) could evolve the actual sustainability practices?

## APPENDIX 2 – SAMPLE DESCRIPTION

ID	Organization	Service Industry	Location	#Employees (2010)	Founded
1	Alert	Business Services (Private)	Portugal (HQ), Brazil, USA	800(WW)	1999
2	ANAM	Transportation Services (Public)	Portugal (Madeira)	358	1991
3	AXA	Insurance (Private)	Global presence; HQ in Paris	120000 (WW); 942 (PT)	1958
4	BPI	Depository institutions (Private)	Portugal (HQ) and Angola	9398	1981
5	Electricity of Madeira	Utilities (Private)	Portugal (Madeira)	845	1897
6	Google	Business Services (Private)	World Wide	20621 (WW);	1998
7	Horários Funchal	Transportation Services (Private)	Portugal (Madeira)	621	1985
8	ISA	Business Services (Private)	Portugal	65 (PT) 25 (ES, FR, UK, GR, BR)	1990
9	Ministry of Health	Health Services (Public)	Portugal	-	1903
10	Porto Bay	Hotels (Private)	Portugal; Brazil		1998
11	SONAE Sierra	Real Estate and Retail Trade (Private)	Portugal (HQ), Spain, Italy, Germany, Greece, Romania and Brazil.	1141 (WW); 445 (PT)	1989
12	STCP	Transportation Services (Public)	Portugal	1591	1872
13	Transdev	Transportation Services (Private)	France (HQ), Australia, Canada, Germany, Italy, Netherlands, Portugal, Spain and United Kingdom	46 000 (WW); 1200 (PT)	1955
14	University of Porto	Educational Services (Public)	Portugal	6000	1911
15	Virginia Tech	Educational Services (Public)	USA	1369 + 30 000 Full-time Students	1872

ID	Organization	Service Industry	Location	#Employees (2010)	Founded
16	ZON	Television Broadcasting and Amusement and recreation services (Private)	Portugal	1545	1999

Legend:

HQ – Head Quarter; WW – World Wide; PT – Portugal

Service industry classified according to Zeithaml and Bitner (2000).

**PAPER II**



# Understanding value co-creation in complex services with many actors<sup>1</sup>

## ABSTRACT

**Purpose** – This paper explores the concept of value co-creation in complex value networks with many actors. Electronic health records are innovations that warrant deep study to properly introduce such a complex system.

**Design/methodology/approach** – The paper describes a qualitative study based on Grounded Theory to understand value co-creation from multiple actors' perspectives in a national Electronic Health Record (EHR) service project: the Portuguese Health Data Platform.

**Findings** – Study results enabled further development of the value co-creation concept in complex environments with multiple actors. More specifically they allowed: (1) operationalizing the value co-creation concept by identifying its factors and outcomes; (2) understanding how value co-creation factors and outcomes are interconnected; and (3) an in-depth understanding of how value co-creation for each actor depends on his/her own actions and the actions of other actors, in a complex set of interactions and interdependencies.

**Practical implications** – The findings have implications for service managers seeking to understand how actors participating in the network integrate resources and interact to co-create value. The study highlights the need for designing and managing services to co-create value, not only by enabling dyadic interactions between the customer and the

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<sup>1</sup> Pinho, N., G. Beirão, L. Patrício and R. Fisk (2014), "Understanding value co-creation in complex services with many actors," *Journal of Service Management*, 25 (4), 470-93.

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service provider, but also by supporting and enabling value co-creation interactions among different actors in the network.

Originality/value – This study responds to the need for empirical studies on value co-creation in many-to-many contexts and for the operationalization of the value co-creation concept.

Keywords: value, value co-creation, service systems, value networks, Electronic Health Records, health services

Paper type: Research paper

## INTRODUCTION

The service environment has become increasingly complex, with supplier networks interacting with customer networks. To understand this new environment, a system approach is crucial to enable a holistic view that takes into account the parts of the system and their interconnections, and to enable an analysis at different levels, from the service system at the organizational level, to the system of systems at the value network level. Service systems can be defined as configurations of resources that interact with other service systems to co-create value (Maglio et al., 2009, Spohrer et al., 2007) and as such are more focused at the organizational level, where one service provider develops offerings to its customers. However, customers increasingly co-create value through the combination of service offerings from multiple firms. These constellations of service offerings constitute systems of service systems, where the multiple actors' service systems develop many-to-many relationships thus forming a value network (Patrício et al., 2011).

In this new environment, it is critical to shift from a single supplier and single customer dyadic perspective to a many-to-many perspective where customer networks interact with supplier networks. Previous research has mainly adopted a perspective centered on a service or a company (Tronvoll et al., 2011). However, the focus should be on the whole context of a complex world (Gummesson, 2007) where value co-creation depends, not only on the interaction between the customer and the service provider, but also on the interactions with multiple actors that co-create experiences. Thus, value emerges from the collaboration of actors in interactive configurations of mutual

exchange (Vargo et al., 2008). From a value network perspective, all actors collaborate and integrate resources to create value for themselves and for others.

Electronic Health Records (EHRs) provide a rich setting for studying services in many-to-many environments. EHRs are repositories of patient data in digital form (ISO, 2004) and as such, the benefits that each actor (such as a citizen) receives depend, not only on the EHR service provider, but also on inputs from other actors such as health care professionals and patients. This context raises new challenges for service design and management. The EHR service provider needs to design its service for co-creating value through the interactions with its customers. Nevertheless, it should acknowledge that the value it creates for customers also depends on the way the service supports value co-creation among different actors in the network. In face of these challenges, a deeper understanding is needed on how value is co-created in many-to-many environments, taking into account the interactions among multiple actors.

Despite thorough conceptualizations of value co-creation in the service field, empirical applications showing the relationship and interaction phenomena from a multiple actor perspective are scarce. An operationalization of value co-creation is needed that articulates its conceptual domain and identifies its dimensions. How customers engage in the co-creation of value still needs further research (Payne et al., 2008, Woodruff and Flint, 2006). This paper attempts to fill this gap through a qualitative study of EHRs involving 48 health care practitioners and citizens.

This study provides an in-depth understanding of how value is co-created in many-to-many value networks, revealing the dynamic and complex interconnections among actors. The study results enable further development of the value co-creation concept and contribute to its operationalization through the identification of value co-creation factors and outcomes. The findings show that besides the interactions between the customer and EHR service, an important component of value co-creation arises from how the EHR supports the interactions, the customer, and the other actors in the network. Moreover, the customer role is dynamically reconfigured, as patients and health practitioners can be at some point customers of the system and at other point providers of the system. The findings reinforce the need to look beyond dyadic relationships to a full value network perspective.

The next section reviews literature on value co-creation, complex service systems and value networks. The second section describes the study methodology, which is followed by explanation of the findings. Finally, the research and managerial implications are presented.

## LITERATURE REVIEW

### **Value co-creation**

The concept of value has been discussed in the literature in various ways. In earlier work (Holbrook, 1996, p.138), has defined value as an “interactive relativistic preference experience”, that is, the experience defines what is valuable to a customer and not the purchase. This author proposed a typology of customer value based on three dimensions: (1) extrinsic versus intrinsic; (2) self versus other-oriented; and (3) active versus reactive. The combination of these three dichotomies produces eight distinct types of value (efficiency, excellence, play, aesthetics, status, esteem, ethics, and spirituality), which tend to occur together in varying degrees in any consumption experience. More recently, Vargo et al. (2006) in their service-dominant (S-D) logic, say that value is always uniquely and phenomenologically determined by the beneficiary and is co-created as actors interact to integrate resources. Imagined experience or behavior is also incorporated in this view of value (Helkkula et al., 2012). In both approaches (typology of customer value and S-D logic), the value creating process of customers as co-creators of value is very important. As such, the view of the customer role in value creation is changing from passive to proactive participation (McColl-Kennedy et al., 2012, Payne et al., 2008) where customers co-create value. The value creation process occurs when the customer performs a series of activities to achieve a desired outcome (Payne et al., 2008). Thus, value is co-created when resources are used. Also, companies can only create value propositions, which are dependent on input from customers (Vargo and Lusch, 2008, Vargo et al., 2008). Thus, customer participation and experience with the service are crucial for value creation. However, customer experience should be viewed holistically and both relationships with customers and between customers should be considered (Verhoef et al., 2009).

Various definitions of value co-creation have been proposed in the literature (see McColl-Kennedy et al., 2012, p. 3 for a summary of definitions of value co-creation).

These different concepts are based on two different ways of conceptualizing value: “value-in-exchange” and “value-in-use”. These two views see the role of the producer and the customer in distinct ways. The traditional view named goods-dominant (G-D) logic is tied to value-in-exchange, where value is produced by firms and distributed to the market (Vargo and Lusch, 2008). Thus, value occurs when the goods produced by the firm are exchanged in the marketplace. In S-D logic, value is rooted in value-in-use, where the value creation process occurs through joint and reciprocal interactions among providers and beneficiaries integrating resources (Vargo et al., 2008). However, knowledge of the process and dynamics of value co-creation is still scarce (Payne et al., 2008, Vargo et al., 2008, Woodruff and Flint, 2006). Also, it is necessary to further conceptualize value co-creation by analyzing its scope, content and nature; and a better understanding of suppliers and customers roles as value creators is needed (Grönroos and Ravald, 2011).

From a value network (system of service systems) perspective, value co-creation goes beyond the firm and customer dyad to a broader perspective where all participants (e. g. companies, customers, suppliers, employees, stockholders, and other network partners) contribute to creating value for themselves and for others (Vargo et al., 2008). Thus, value creation is no longer only within firms’ boundaries but value is co-created among various actors within the service network. Also, the interactions between actors offer opportunities to facilitate value creation experiences for and with each other (Grönroos, 2008). In value network environments, value may be defined as an improvement in system well-being and can be measured in terms of a system’s adaptiveness or ability to fit in its environment (Payne et al., 2008, Vargo et al., 2008).

Recently, McColl-Kennedy et al. (2012, p. 1) defined customer value co-creation in the context of health care as “benefit realized from integration of resources through activities and interactions with collaborators in the customer’s service network”. They state that customers may integrate resources to co-create value from the service provider or from outside the traditional health care setting, extending value creation outside the firm and customer dyad. The integrated resources may include self-generated activities (e.g. cerebral activities); private sources (e.g. family and friends), market-facing sources (e.g. firms and other entities), and public sources (e.g. communal, governmental). This study focused on the customer service network investigating how customers actually

engage in value co-creation practices. However, it focused on the customer and does not address services that are provided in a many-to-many context, where different actors are simultaneously customers and suppliers, co-creating value through multiple interactions.

Despite research on conceptualizing value creation and value networks, previous empirical studies have mostly focused on dyadic relationships between customers and service providers (Tax et al., 2013). Further research is needed to understand value co-creation in complex environments, where customers co-create their experiences by combining service offerings from several companies in the customer value constellation (Patrício et al., 2011) or through do-it-yourself activities (McColl-Kennedy et al., 2012). Specifically, in health care it is important to understand the value creation process from the perspective of different actors to improve health services offerings and citizens' health. The richness and complexity of health care can also provide useful insights for other service contexts.

### **Systems of service systems and value networks**

A service system may be defined as an arrangement of resources (including people, organizations, shared information, and technology) connected internally and externally to other systems by value propositions (Maglio et al., 2009, Spohrer et al., 2007). A service system approach allows understanding its parts without losing the systemic context (Gummesson, 2007). Each service system co-creates value through integrating existing resources with those from others service systems (Vargo et al., 2008).

With the increasing complexity of the service environment, a value network perspective has been advocated. Patrício et al. (2011) propose a multilevel view to distinguish between service systems at an organizational level and customer value constellations at the network level. This value constellation can be viewed as a system of service systems that together provide integrated support to customer activities (Patrício et al., 2011). Value networks can be defined as spontaneous combinations of actors interacting to co-produce service offerings, exchange them, and co-create value (Lusch et al., 2010).

Gummesson (2007) points out the need to focus on networks instead of dyadic relationships by looking at many-to-many relationships and analyzing the whole context of a complex reality. The focal point is on the interaction between multiple actors. Actors may play a different role in the network, which may be active or passive. For

instance, in a surgical procedure the various health care professionals and the patient are actors performing different activities and roles. However, this network may be extended to the patient's family, friends, and professionals that are going to follow up the treatments, each one with different roles that may change over time. Furthermore, social structures and forces have important implications for value co-creation and resource integration in service system (Edvardsson et al., 2012).

Although, networks are important to understanding value co-creation, previous conceptualizations have missed a crucial aspect of systems. Systems are dynamic and potentially self-adjusting, having the ability to simultaneously reconfigure themselves (Vargo and Lusch, 2011). Thus, a dynamic approach to studying value networks is needed to absorb its learning, adapting and evolving properties. Traditionally, service research has studied service systems with a focus on dyadic relationships between the company and its customers. Further research is needed to address value creation in service systems that offer services not for a client, but for a value network, taking into account the interactions among multiple actors.

Electronic Health Records (EHRs) fit the definition of system of service systems and the complexity of EHRs makes it a rich empirical context to study value creation in many-to-many contexts. According to the International Organization for Standardization definition (ISO, 2004) an EHR is a repository of digital patient data, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support efficient and quality integrated health (Hayrinena et al., 2008). However, the EHR only creates value through the services it provides to the different actors in the health care system. A service perspective enables a broader view of EHRs, not just as a repository but also as a complex network involving multiple actors.

In healthcare, the role each actor plays may include being the client and service provider at the same time, which transforms the system into a complex reality of many-to-many relationships (Pinho et al., 2013). For example, a doctor accessing an EHR during a patient consultation may play the role of EHR service customer at the beginning (when searching for patient historical clinical information), and play the role of EHR service provider at the end of the consultation (providing the EHR service with the report of the

consultation or information about drugs prescribed to the patient). A citizen's role may also be of a customer (when attending a medical appointment and receiving information) or a provider (by inserting information in their EHR). Thus, to design the EHR as a value co-creating service, better understanding is needed of each actor's role in value co-creation and the role of interconnections with other actors.

## METHOD

This study sheds light on an under researched area. Qualitative methods are considered appropriate to gain an in-depth understanding of the phenomenon of interest (Corbin and Strauss, 2008) since they have the advantage of producing a wealth of detailed data on a small number of individuals (Patton, 1990). Qualitative methods are useful to explore the intricate details of phenomena as complex as health care.

The qualitative study used a Grounded Theory approach (Charmaz, 2006, Corbin and Strauss, 2008) to understand value co-creation from multiple actors' perspectives in the creation of a national Electronic Health Record (EHR) service system: the Portuguese Health Data Platform. Grounded theory allows deriving general, abstract theory that grounded in data. This approach guided the qualitative study phases, data collection, sampling and analysis.

The Portuguese Electronic Health Record (EHR) provides a rich empirical ground for studying value co-creation in many-to-many service contexts. EHR attempts to be a patient centered service system that carries clinical information and is accessible regardless of location or time of health care delivery. The Portuguese Electronic Health Record is supported by the Portuguese Plataforma de Dados de Saúde (PDS) that constitutes the national health record data sharing facility and uses interoperable technologies to link old and new existing applications. PDS provides information through the Citizen Portal and the Professional Portal. Health care is a rich context for the study because of the remarkable complexity of health care systems. The health of citizens depends on a multitude of services and actors, such as physicians, nurses, pharmacists, and family. In particular, the Portuguese Health Data Platform was designed to be more than a mere repository of patient data. It was designed to become a service that enables doctors, nurses, and citizens to access integrated health information

about patients. To attain this goal, it was crucial to understand how value was co-created by the multiple actors, and how the EHR could better support it.

## **Data collection**

To address the research objectives, in-depth interviews and focus groups were undertaken between December 2010 and December 2011. Focus groups and interviews were used in a complementary way since both methodologies have strengths and weakness. While individual interviews enable more in-depth exploration of the subject under study, focus groups have the advantage of group dynamics, which may enrich the data collected.

The first part of the protocol sought to understand the value constellation experience of each actor. Participants were invited to talk about their overall activities during a normal working day, their goals, the artifacts they interact with in performing their work, and the information they exchange with other actors. The second part of the interview addressed the potential advantages and disadvantages of using the EHR, and potential facilitators and inhibitors of EHR adoption by the actors. Interviews and focus groups followed a semi-structured protocol (Fontana and Frey, 2000, Froddy, 1993) and open-ended questions were used to avoid constraining interviewee answers (Froddy, 1993). Interviews lasted from 45 to 100 minutes and focus groups lasted 120 to 150 minutes. The same protocol was used for both individual interviews and focus groups, although with agenda adaptations to make sure all participants had sufficient time to express themselves. All focus groups and interviews were fully and literally transcribed and analyzed using NVivo 9 software.

## **Sample design**

With such a complex network environment, defining and covering a theoretically relevant sample of participants was particularly challenging. As such, the project started with an exploratory study of key actors and informants to design the VNAM (Value Network Actor Map) (Pinho et al., 2013) so priority actors could be identified. The VNAM is a diagram identifying all the actors involved in the service system (individuals and organizations), and their relationship with the citizen, positioned in the centre of the diagram as the most important actor. The map helps visualize the priority actors and how

they relate, their interactions, information exchanged, and value creation for the different actors. The exploratory study involved five semi-structured interviews with the Portuguese EHR project manager, one citizen, one doctor, one nurse and one pharmacist. To systematize and summarize the interviews, interviewees were asked to sort the VNAM and identify the priority entities they relate with, along with the information exchanged and benefits obtained from their interaction with each of those entities (Nielsen, 2004). The results were used to fine-tune the interview protocol for the next stage and to identify the priority actors to be interviewed.

The following stage involved a qualitative study to achieve a deeper understanding of each priority actor's experience and their interactions with other actors. A combination of individual interviews and focus groups was used to understand how value was co-created by the multiple actors, and how the EHR could support it (Krueger, 1994). By combining these two data collection approaches we were able to explore the phenomenon in-depth through interviews and more broadly through focus groups. This study was performed before the EHR was implemented and a brief explanation of the meaning of the EHR was provided at the beginning of each interview. Eight in-depth interviews and four focus groups with citizens, doctors, nurses and pharmacists, were combined using theoretical sampling until saturation of results was reached (Corbin and Strauss, 2008).

A total of 48 different actors (citizens, doctors, nurses and pharmacists) from public and private health care organizations were interviewed (see Table I). This sample covered a diverse set of theoretically relevant organizations, which provided different perspectives of each priority actor in the EHR service (Corbin and Strauss, 2008).

Table I: Sample Design

	Central Hospital	Private Hospital	Primary Care	Citizens/ Organizations
Stage 1 Interviews	1 Doctor 1 Nurse 1 Pharmacist			1 Citizen 1 Member of the Ministry of Health
Stage 2 – Focus Group	5 Doctors	2 Doctors	2 Doctors	8 Citizens
	7 Nurses	3 Nurses	1 Nurse	
	4 Pharmacists	2 Pharmacists	1 Pharmacist	
Stage 2 Interviews	1 Doctor 1 Social Assistant	1 Doctor 1 Nurse	1 Pharmacist 1 Nurse 1 Doctor	1 Citizen

## Data analysis

In the grounded theory approach adopted in this study, theory is developed during the data collection process (Charmaz, 2006, Strauss, 1987). With this method, theory is built from data or grounded in the data. Our research followed more contemporary approaches, where grounded theory is not seen purely as an inductive method – as grounded theory was originally defined - but as an abductive method (Charmaz, 2006, Corbin and Strauss, 1990), that entails construction, which is not totally free of the researcher’s previous knowledge and experience (Charmaz, 2006). Grounded Theory enables data and theory to interact while keeping qualitative research flexible. A moderate review of literature occurred at the beginning and during the study and mainly focused on value co-creation and service systems, as presented in the literature review section. This review was helpful to gain a first understanding of the area and for naming some categories that emerged in the iterative process of data analysis, stimulating theoretical sensitivity (Glaser, 1978). As the process of data analysis evolved, further literature review was undertaken to compare and relate the emergent categories of value-creation factors and value-creation outcomes with previous research. These new rounds of literature review are, therefore, addressed in the discussion section.

Thus, theory was built iteratively (Charmaz, 2006) and simultaneously in data collection and analysis of relevant patterns that provided a guide for future data collection. Through data analysis of interviews, the value creation factors and outcomes were first identified using an open coding process in which phrases and words describing the

phenomena were identified, named, and categorized. Second, using axial coding, the concept categories were related to subcategories and the properties and dimensions specified (Corbin and Strauss, 2008). The objective was finding high-level categories of central value dimensions, which were important to most actors, not just one actor. Figure 1 shows an example of the categorization process that led to the identification of the value co-creation factors and value co-creation outcomes.

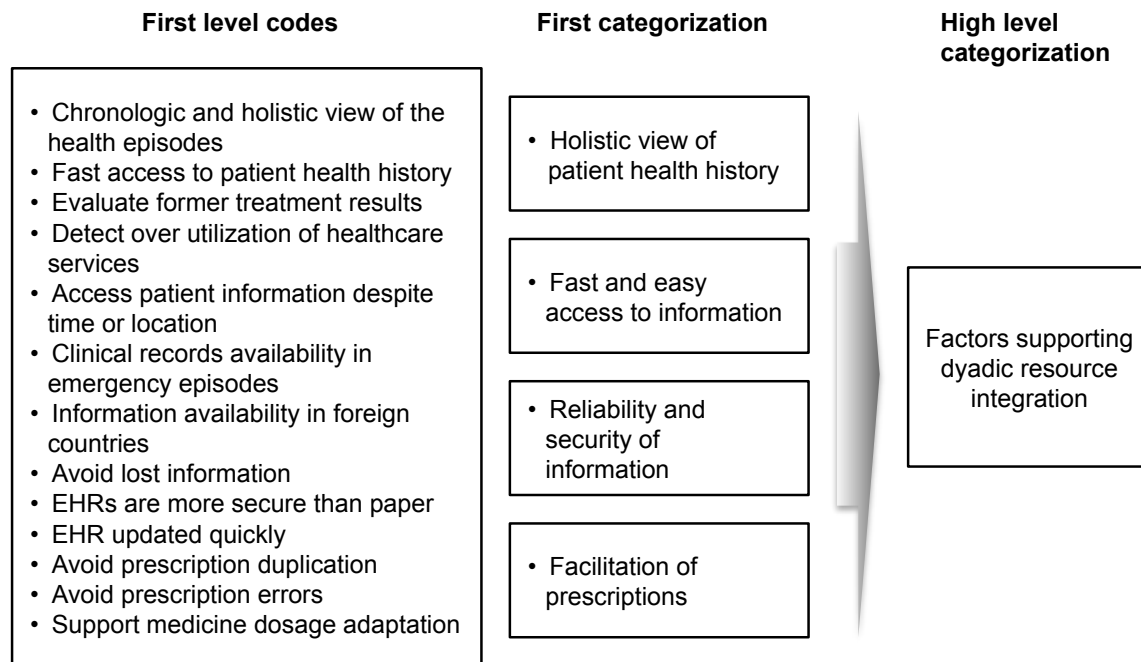


Figure 1: Example categorization leading to the identification of value co-creation factors and outcomes

## RESULTS

The results of this study enable better understanding of how value is co-created by multiple actors in complex environments. More specifically they allow: (1) identifying value co-creation factors and outcomes; (2) understanding how value co-creation factors are interconnected; and (3) understanding how value co-creation for each actor depends on his/her own actions and the actions of other actors.

### Value co-creation in value networks

Data analysis enabled understanding the process of value co-creation by the different actors in the value network with support of the EHR, as presented in Figure 2. The results show that value is co-created in the network when actors integrate resources

through their actions and interactions with each other. Resources may include people, technology, organizations, and shared information (Maglio et al., 2009), and the process of resource integration occurs when an actor incorporates resources of other actors into their experience (Gummesson and Mele, 2010). Furthermore, actor's experiences have a holistic nature with several determinants, which are customer's cognitive, affective, emotional, social and physical responses to the service (Verhoef et al., 2009). In this paper, following existing models of customer experience factors and outcomes (Carreira et al., 2013, Verhoef et al., 2009), the attributes of these resource integration activities were defined as value co-creation factors. Value co-creation factors are related to how resource integration between each actor and the EHR contributes to co-creating value. As shown in Figure 2, the value co-creation factors that emerged from data analysis were structured in two broad categories:

- The first category comprises value co-creation factors related to the dyadic resource integration between the customer and service provider, including classical service attributes such as ease of use and reliability of information.
- The second category comprises value co-creation factors that support many-to-many resource integration among the different actors in the value network. This second category, related to collaboration with other actors supported by the EHR, has not been previously addressed in the literature.

The first four value co-creation factors are related to better quality of information (availability, accessibility, and reliability), and the last three are related to better collaboration among actors (interconnections and dependencies). These value co-creation factors contribute to value co-creation outcomes by generating benefits to the actors in the service network:

- Value co-creation outcomes are the result of the resource integration activities undertaken by the actors and may benefit one actor in particular, several actors, or all actors. Value co-creation outcomes are therefore driven by value co-creation factors.

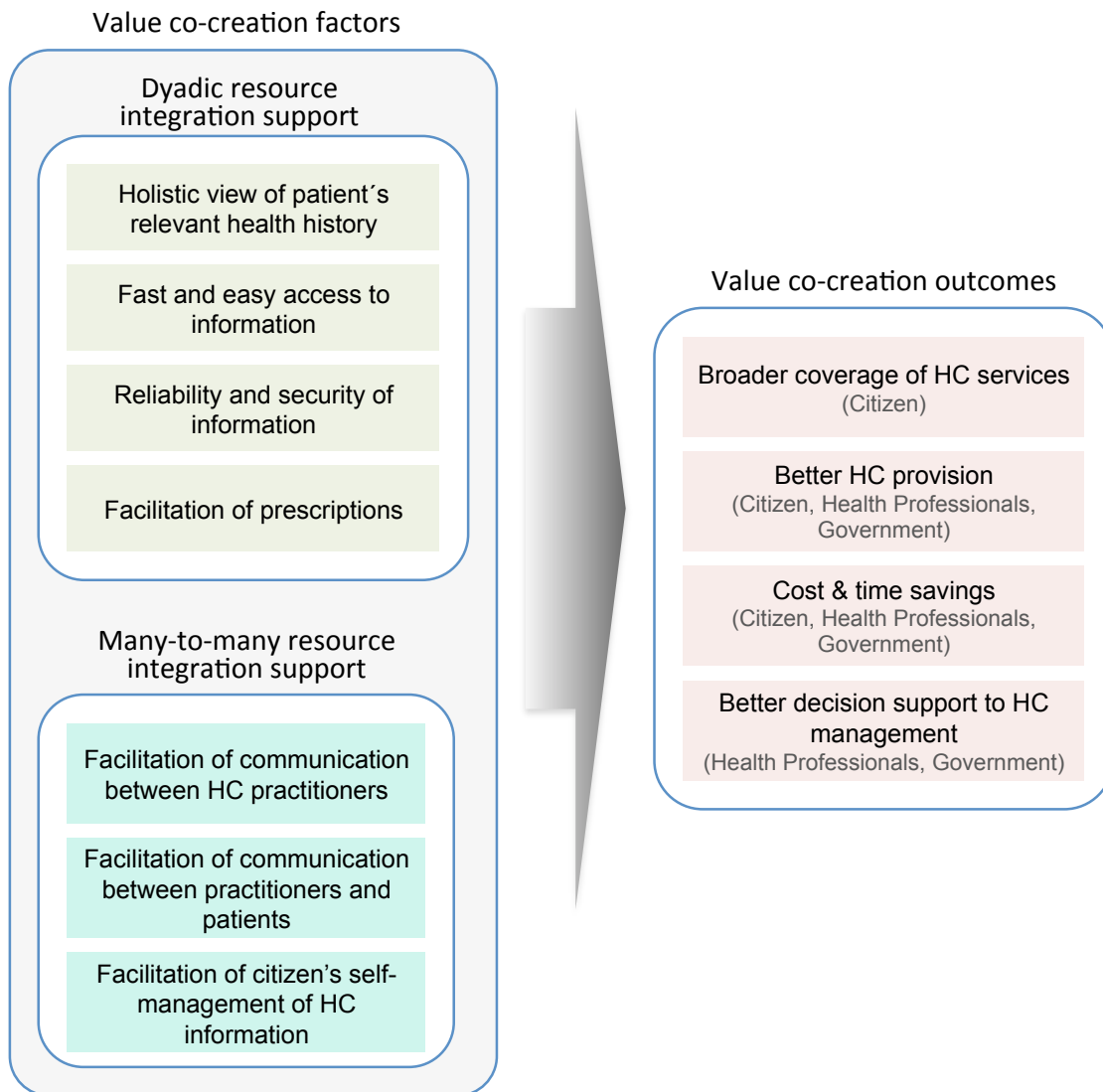


Figure 2: Value co-creating in value networks

## Value co-creation factors

The first set of value co-creation factors is related to how resource integration between each actor and the EHR contributes to co-creating value. These value co-creating factors mostly refer to better quality of patient information and to facilitation of different actor's activities by the EHR. From the interviews, information emerged as a critical resource underlying the value co-creation dimensions. For example, a doctor highlighted some of those requirements, saying: *"It must be simple to use, must be understandable. Information must be structured."* Also, citizens emphasized concerns about privacy, and one said: *"The privacy aspect, I find it extremely important!"* Furthermore, information must be categorized and not be excessive. As stated by a nurse *"we would gain a lot, to*

*have a clinical summary that is fast, efficient and functional”*. This statement highlights some of the value co-creation factors identified in the study.

**Holistic view of patient’s relevant health history.** This factor is related to a complete and chronological view of patients’ health history across time, place and different treatments. This is important to both health professionals and citizens. Several sub-categories emerged from data such as the patient’s complete health history provided by EHR, the evaluation of former treatment results or detection of over utilization of healthcare services. For health professionals, the benefits emerged from having all the relevant health information that would help them make the right diagnosis in a shorter amount of time, as expressed in the following examples:

*[The EHR would allow] to have a view of the patient health history in a short time. (Doctor)*

*What brings the patient here is a pathology. We don’t know exactly if the problem is the pathology or if it is the background of the person that is exacerbating that pathology. (Nurse)*

Also, having all the health history available is essential to health professionals to enable better follow-up of treatments:

*Information is everything, and without information we can’t work. (Pharmacist)*

*Knowing what treatments [the patient] were given and didn’t work would help decide to do another. That would be invaluable! (Doctor)*

Also, it was recognized that some persons overuse the system either by going to different health institutions for the same problem or repeating exams. The EHR allows tracking and preventing such overuse.

**Fast and easy access to information.** This factor is related to accessibility so health professionals can access health information anywhere, anytime, whenever needed. It includes the following sub-dimensions: access to patient information from different sources whenever needed, availability of clinical records in emergency episodes, and accessibility of information about medication. Accessing health information from

different institutions whenever needed is very important to all practitioners, as emphasized by the examples:

*Be accessible at any time! (Nurse)*

*The colleagues from Primary Care should have access to the patient hospitalization information, the procedures, what was done and what was not...and we should also access the same information, to also see what they have done.” (Doctor)*

Fast access to health information is especially important in emergency situations where the patient may arrive in a situation where he or she cannot talk:

*The benefit from accessing information is important to make decisions concerning that patient... Sometimes there is the case where the patient is not conscious and cannot give us information. (Doctor)*

**Reliability and security of information.** From the interviewees’ perspective, information must be secure, reliable, updated, and must not be lost inside the HC organizations or between institutions. Reliability and security comprise three sub-dimensions: lost information prevention inside health system, improved security of EHR when compared with paper, and quickly updated health records. All actors feel it is easy to lose parts of relevant information when paper is used. Actors feel that EHR should aggregate and secure the information dispersed by several health institutions:

*All information is dispersed by several hospitals and primary care units. We have several folders with our exams, the reports and the images, all in CDs and paper, and the information is frequently lost. Lots of information and time is lost in these exchanges. (Citizen)*

*We can’t lose information! It’s a danger to clinical practice. (Doctor)*

Furthermore, it is easier for health practitioners to be updated regarding their patient’s health information by using EHR, and simultaneously facilitate their activities by having all relevant information available whenever necessary.

**Facilitation of prescriptions.** Interviewees mentioned that EHR prescriptions are easier to make and control by the different practitioners, because they have access to previous

prescriptions made by other practitioners. Several sub-categories emerged from the interviews such as prescription error and duplication avoidance and support for fast and efficient medicine dosage adaptations. For example, practitioners believe that patients may take some medicine prescribed by a doctor and then go to a different doctor who may prescribe a similar medicine, leading to duplication. Knowing previous medications helps avoid these errors. A pharmacist pointed this out by saying: *“There are situations in which the patient is taking two overlapping drugs, because he went to a second doctor without mentioning the drugs he was already taking”*. Also, knowing all the medicine that is being taken by patients improves coherence of overall prescriptions as well as better adjustment of dosages and monitoring of medicine interactions.

Whereas the previous factors refer to value co-creation through direct interaction between each actor and the EHR, the second set of value co-creation factors refers to how the EHR supports the interactions and resource integration among actors in the HC system to create value.

**Facilitation of communication between HC practitioners.** This factor is related to how EHR supports collaboration between practitioners through health information exchanges among them. The EHR facilitates the exchange of information within health institutions and with other institutions, which is critical to all health professionals. As a doctor stated, it is important to *“know what happened in the hospital, what the patient did, the colleagues’ opinion.”* For health professionals, the flow of information, the quality of information and how it is treated is critical since it facilitates the interaction among institutions and professionals. Thus, as all actors emphasized, communication is very important and facilitates the provision of health services, and the EHR contributes to value co-creation by supporting this communication:

*Everything is automatic. The doctor prescribes, the pharmacy receives, and sends to us... (Nurse)*

*We have the on-line prescription. [...] Through the information system we can insert the protocols and help the doctors in the medicine prescription. (Pharmacist)*

**Facilitation of communication between HC practitioners and patients.** This factor is related to collaboration and communication among practitioners and patients and how EHR reduces problems, reduces forgotten information, and avoids mistakes. The sub-dimensions are: avoid forgotten information from patients, get correct information when family or patient cannot recall it, avoid communication problems between practitioners and patients, and clarify patient inconsistencies regarding his/her own health. Problems of communication between health professionals and patients can occur because *“sometimes the patient does not know how to talk about his disease”* (doctor). This may happen because patients cannot remember, forget or have difficulties in explaining it. As a citizen pointed out: *“Lots of times we trust our memory and the ability to remember what is really important, and we forget.”* This raises challenges in the interaction with health professionals making it more difficult for them to provide good care. Also, it is important to ensure that the health information is understood and correctly followed by the patient, which is facilitated through EHR. The following examples illustrate the importance of communication and how EHR facilitates it:

*If the patient can't explain, if he brings someone with him who also cannot explain, who does not know what was done in the hospital... sometimes they were at the hospital and do not know why...It is a problem trying to understand!*  
(Nurse)

*The prescription is three times a day, same people took it four or five times, we parameterize [through the electronic prescription] and explain to the patient.*  
(Pharmacist)

**Facilitation of citizen's self-management of HC information.** Citizens can input relevant information into their EHR and this enables patient collaboration with health practitioners and the mutual creation of value. Patients with health problems may insert relevant information in the EHR that may help the practitioner follow up and adjust the care being provided. For example, a nurse mentioned the case of an obese patient with diabetes that could register the weight and insulin values in his personal health record so the values could be controlled more easily. Also, citizens may insert information concerning their health condition such as allergies or chronic diseases, which in an emergency situation may help practitioners provide better care.

The value co-creation factors identified through data analysis show that in a network service environment, classic service attributes such as complete information, reliability and accessibility are still relevant. These dimensions are related to the direct interaction between each actor and the service (EHR). However, study results reveal that another set of attributes become important for value co-creation in a network environment, which are related to the extent to which the service (EHR) supports value co-creating interactions and resource integration among actors. Furthermore, different actors perceive these attributes differently. These results highlight the need to analyze value co-creation, not only in dyadic relationships between customers and service providers, but also in many-to-many environments where supporting interactions among actors become a key component of value co-creation.

### **Value co-creation outcomes**

The factors described above contribute to the co-creation of value by the actors in the value network. Value is therefore the outcome of these value co-creation factors, and involves the set of benefits each actor receives from these interactions and resource integration activities. Data analysis allowed for the identification of four value co-creation outcomes, which are not equally relevant to all actors and are dependent on the interactions and actions of themselves and others in the network.

**Broader coverage of HC services.** This value co-creation outcome is related to the benefit that results from having patient's relevant information available across different health institutions and geographic locations, which will allow a broader coverage of health services. This comprises: citizens feeling more secure by having all data available as necessary, facilitation of continuity of health care, and availability of information in foreign countries. Citizens may feel insecure when going to a different doctor or when moving to a different place because they have to remember their health information. Having all their relevant health information available to practitioners in different locations or even different countries through their EHR would be of great value and would facilitate continuity of care. Citizens showed concern about losing their health information and how EHR would be helpful in managing that information:

*Probably I wouldn't worry so much... if I have a problem, I could go with a card and they [health care professionals] would know what I have and I am taken care of. (Citizen)*

**Better Health Care provision.** This is related to better quality of HC service due to EHR support. This includes the following sub-dimensions of value that result from using EHRs: better clinical decisions, better diagnosis, and better treatment. The EHR provides doctors with a holistic view of patient's health history (i.e. value co-creation factor), which helps doctors provide better patient care (i.e. value co-creation outcome). For health professionals providing good care is important, and for that they need access to all relevant health information as necessary, as exemplified bellow:

*Sometimes the patient is sent to the hospital [from the Primary Care Unit]. I never know for how long he did the treatment, in what way...People think we don't need feedback, but we need it. (Doctor)*

*[Having an EHR would] allow better adequacy of the care and improve the quality of work. (Nurse)*

**Time and cost savings.** This value co-creation outcome is very important to all actors that recognize the value of the EHR in saving both time and money, which in turn allows more efficient use of resources. Several sub-dimensions emerged from the data: fast access to patient health history to avoid wasting time, faster health care procedures, optimization of resources, and cost savings by avoiding duplication and waste of resources. Not wasting time is very important to all practitioners and being able to access all the relevant health information is very important to them, which would translate in faster health care procedures:

*It took me 3 hours to understand who the patient was, what happened to him in the last 2 years; only then was I able to understand what was happening to him at the moment. (Doctor)*

Along with time concerns, avoiding unnecessary costs by duplicating exams or procedures is critical to all actors:

*The patient arrives to the Primary Care Unit and does not have the exams. This is costly to us...it means repeating everything that was done at the hospital.*  
(Nurse)

The EHR allows a more efficient use of resources, benefiting all actors in the HC system.

**Better decision support to HC management.** This value co-creation outcome is especially important to health organizations and the government. EHRs facilitate decision making, improve management of public health, and support health policies. The EHR is a valuable tool in managing institutions and making more informed decisions because it facilitates the control and management of critical resources. The benefits of EHR, were highlighted:

*The EHR will allow statistical analysis about pathologies or other data. What kind of hospital we have, what type of patients we have, it would be very helpful to do that with the program. Not being just a datacenter of clinical information, but also allowing crossing the data to know what patients we have and have more people for that area, for example. Improving the management of resources, that would be important. (Doctor)*

### **Value co-creation interdependencies**

This study allowed better understanding of the interdependencies of value co-creation in network contexts. The results previously presented highlight that value co-creation dimensions go beyond the dyadic relationship between customer and service provider, and that supporting interactions and resource integration among actors are important value co-creation factors. Data analysis also allowed better understanding of how activities, requirements, information and value co-created among actors are all highly interconnected. Table II summarizes the value co-creation factors and value co-creation outcomes previously identified, the actors who referred those factors and their relevance (percentage of times mentioned). All actors consider the interactions and communication between different professionals very important. For example, doctors believe that it is important “to have a good relationship with other professionals such as nurses, which

*helps us a lot and can give us precious information about the patients.*” Nurses share the same point of view and say that doctors, nurses and auxiliary teams need to collaborate.

Table II - Summary of value co-creation factors and outcomes, actors, and relevance

Value co-creation factors and outcomes	%	Definition	Actors
Value co-creation factors			
Holistic view of patient's health history	72	Quick and chronological view of patients health history across time and place	Citizen, Doctor, Nurse, Pharmacist
Fast and easy access to information	88	Information accessible anywhere, anytime, whenever needed	Doctor, Nurse, Pharmacist
Reliability and security of information	63	Information secure, reliable, updated, and must not be lost inside the HC organizations or between institutions	Citizen, Doctor, Nurse, Pharmacist
Facilitation of prescriptions	44	Having previous information about prescriptions makes it easier to prescribe and control	Citizen, Doctor, Nurse, Pharmacist
Facilitation of communication between HC practitioners	52	Practitioners can exchange information about patients health	Doctor, Nurse, Pharmacist
Facilitation of communication between HC practitioners and patients	35	Communication problems and forgotten information is reduced	Citizen, Doctor, Nurse, Pharmacist
Facilitation of citizen's self management of HC information	24	Patients can insert relevant information in their personal health record	Citizen, Nurse, Pharmacist
Value co-creation outcomes			
Broader coverage of HC services	30	EHR allows having patient's relevant information available across different health institutions and geographic locations	Citizen
Better HC provision	56	EHR enables better health service provided to the patient	Citizen, Doctor, Nurse, Pharmacist
Cost and Time savings	70	Time saved in accessing health information and in procedures; Cost saved by avoiding duplication of all resources	Citizen, Doctor, Nurse, Pharmacist

Value co-creation factors and outcomes	%	Definition	Actors
Better decision support to HC management	32	EHR facilitates decisions making, improve the management of public health, and support health policies	Doctor, Nurse,

The amount and type of resources such as information, knowledge, and skills that the actors access and use may vary. Information is a key resource and underlies several of the value co-creating factors identified. All actors require information and produce information. For instance, when the Primary Care doctor and the citizen insert allergy information in the EHR, hospital doctors may use it to make a better diagnosis and for a holistic view of the patient's health history. Also, information inserted by nurses about treatments, which are going to be followed through in the Primary Care Center, helps Primary Care practitioners in continuing the health care. However, study results also indicate that the information provided by the EHR should be different for each type of actor. Citizens feel that "*levels of access*" should be created. Also, a doctor emphasized that: "*Not all should have access to the same type of information. ... Not differentiated by classes, but by the type of service provided to people.*"

Throughout the interviews the interdependencies among actors clearly emerged and their importance to value co-creation for each actor was acknowledged. These results show that value co-creation for one actor depends on the actions of other actors, as well as his or her own actions. Data analysis revealed three types of interdependencies among actors: dynamic role interdependency, temporal interdependency, and self-interdependency. These dependencies are not exclusive and usually occur simultaneously.

The **dynamic role interdependency** means that the value co-creation occurs in an interactive way and actors do not have a fixed role. That is, in one moment an actor may be a creator (service provider) and in another moment a beneficiary (customer). The following example shows the role dynamics:

*In the first consultation, we receive the Primary Care requisition, which is now electronic, and I see the questions the Primary Care doctor had and at the end I always send a letter with a report back to him. I always use the EHR to make the consultation report. (Doctor)*

Thus, when the hospital doctor accesses the EHR before the patient consultation to see the Primary Care doctor requisition he assumes a customer role. At the end, the doctor inserts information in the system, assuming the role of a service provider, which benefits both the Primary Care doctor and the patient. So, the actions are interdependent and the output of one action can turn into a new input of another value co-creation action. Some of the dimensions found specifically address the intricate interconnections among actors. The interactions may occur within the same professional group or with other actors in the network. During citizens' lifetime their health may change, they may visit different health units and consult different practitioners, thus the professionals feel the need to know the previous actions and prescriptions made by other practitioners to follow-up and adjust the treatment if necessary:

*Is important to have the main episodes and diagnostics...It is also important to have all the drug prescriptions and interventions pharmacists made, it is very important to know if a colleague made an adjustment because the patient has a kidney disease. It's always information from pharmacist to pharmacist.  
(Pharmacist)*

These results show that value is co-created through interactions among actors of the network, and not only in dyadic relationships. These results also indicate that a clear and static distinction between customer (benefit receiver) and service provider (benefit provider) may lead to a narrow perspective as it hides the dynamic nature of customer and provider roles, which is important to understand how value is co-created in network environments. Networks are dynamic and evolve over time, thus it is necessary to better understand the changing role of the actors and the dynamics of value co-creation.

**Temporal interdependency** is characterized by the sequence of interactions that usually occur at different points in time. So, the benefit an actor gets today is dependent on what he or she and others did before. For example, when a citizen visits his General Practitioner (GP) because of a health problem (not acute) the GP prescribes a set of exams to help him or her make the diagnosis. After performing the exams, the citizen returns to the health center for an appointment with his GP. The GP diagnoses a specific problem and refers him to a specialist physician. The citizen goes to the hospital looking for the specialist and he tells him or her that the problem is not serious and prescribes a set of drugs that must be administered by a nurse. The citizen then turns again to the

Primary Care unit to carry out the treatment and finally visits the GP to complete the episode. The following examples illustrate the temporal interdependency:

*It is fundamental for us to have diagnosis. For how long has she being treated? Was she hospitalized? Who is her doctor? Because with that we may contact the doctor, if necessary. (Doctor)*

*It's very important for us to be able to see the doctor's diagnosis to provide the best treatment to the patient. (Nurse)*

**Self-interdependency** means that value creation also depends on actors' own actions. That is each actor is also a beneficiary of his or her actions. This is true both for the citizen and the health professionals. The citizen may insert data in his EHR, for example concerning allergies and chronic diseases, which may benefit him or her by allowing practitioners to provide better care. On the other hand, the quality and quantity of data, which health professionals insert in the records may be valuable to them in future consults with the patient. Thus, actor's self actions are very important to them and others:

*I had to do a summary of the clinical file to be able to have easy access. Usually the first step is to read the most important data, my last observations which allows me to know what the patient has, the pathology...the medication. (Doctor)*

These results show that customers play an active role in co-creating the value they will benefit from. Service research has long assumed that customers can actively participate in service delivery (Parasuraman et al., 2005, Wolfenbarger and Gilly, 2003) but studies on perceived value of service have mainly focused on the attributes from the service provider side, and not on the attributes from the customer side, such as the quality and accuracy of information provided by customers. How customer actions contribute to value-creation thus deserves further attention. Service value creation is the result of both service provider actions and customer actions, and services should be designed taking into account how customers may actively contribute to the final result. These results also shed light on the dynamics of value co-creation in many-to-many contexts, showing that actors dynamically change their role as customers or service providers, evolving the

network. Moreover, they show how value is co-created over time, highlighting the interdependencies of resource integration along different steps.

### **A detailed view of value co-creation from citizen's perspective**

Study results also enable a more detailed analysis of value co-creation for each actor. The citizen is the most important actor and as such, we present the results for the citizen in more detail. The health system should be citizen centered and the health professionals acknowledge this:

*Our activity is centered on the patient. He or she is the most important element in all the process...(Doctor)*

The following examples show that citizens want to be able to access and understand their health information:

*It's crucial to be able to access my healthcare information. I want to access my prescriptions, exam reports and be able to share this data with other physicians.*

*It's very difficult for me to understand an exam report or a discharge note. The information should be easy to read and understand even if we are not familiar with clinical terms.*

It is important to account for the possible impacts from citizen's interactions with the different health care providers by looking at the value network from the perspective of the citizen's service network. Citizens may co-create value by integrating resources from their service system and from others actors service systems, such as doctors, nurses, pharmacists, massage therapists, trainers, dieticians, family, in dynamic interactions with those actors. Figure 3 outlines how the citizen co-creates value through the EHR showing the interconnections with other actors (doctors, nurses, pharmacists and central health care system). The citizen was placed in the center of the network with the other actors scattered around. The central part of the figure reflects the citizen value co-creation factors and respective dependencies.

The citizen value co-creating factors (citizen's self-management of HC information, holistic view of patient's relevant health history, fast and easy access to information, reliability and security of information) convert to other value outcomes (broader

coverage of HC services, better HC provision, and cost and time savings) and highlight the importance of interconnections between actors for value co-creation. Thus, citizens co-create value through integration of resources (e.g. information, technology, organizations, health professionals and other people) and dynamic interactions with other actors. Furthermore, the citizen has the primary role as a resource integrator in the co-creation process of their own health care management (McColl-Kennedy et al., 2012).

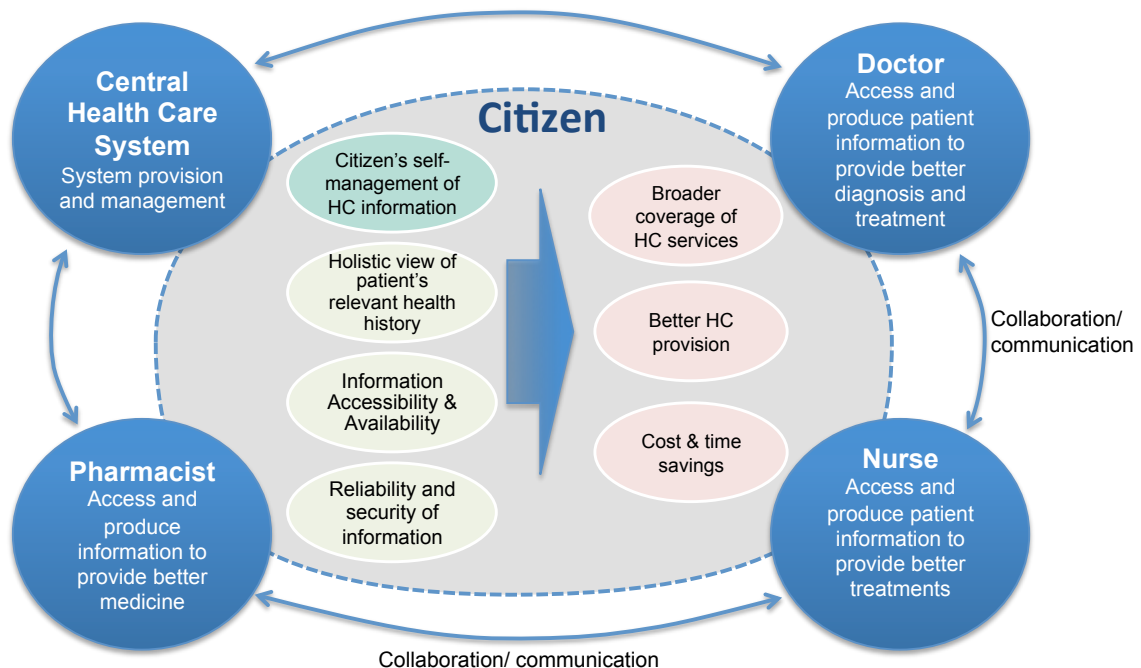


Figure 3: A centered view of value co-creation through electronic health records

Figure 3 also highlights the importance of collaboration and communication among actors and the resulting improvements in the EHR service network. The value of EHR is widely acknowledged by all interviewees. For example, a doctor said, *“it is going to facilitate and improve the quality of my work”*. Also a nurse stated that, *“we are going to improve, improve the care, improve the information...”* Citizens also think that the EHR provides *“efficiencies, benefits, paper savings, time savings, error reduction, increased efficacy and better general health care.”* However, these improvements are dependent on the citizen’s inputs to the personnel health record, as well as the inputs of other actors. It is important to recognize that the actors in the value network are likely to have different views of their role, perform different activities, integrate resources differently and engage differently in interactions with others.

## RESEARCH AND MANAGERIAL IMPLICATIONS

This research responds to the need for empirical studies showing how value is co-created through the resource integration and interactions among multiple actors in a complex service network (Payne et al., 2008, Vargo et al., 2008, Woodruff and Flint, 2006). This study contributes to the exploration of the conceptual domain of value co-creation in multiple actors' settings by identifying its factors and outcomes. Health care was chosen has an instrumental context since is a particularly rich and can therefore provide insights for complex service systems in general. The study findings also provide insights for service managers as they point the need to take into account, not only how the service supports the interactions between customer and service providers, but also the interactions among multiple actors in the network.

### **Value creation factors and outcomes**

We adopt the McColl-Kennedy et al. (2012) definition of value co-creation as “benefit realized from integration of resources through activities and interactions with collaborators in the customer's service network”, and expand it to a multiple actor value network. The findings allowed identifying the value co-creation dimensions, understanding the different type of interdependencies among the actors, and revealing the resulting value dimensions outcomes.

Two types of value co-creation factors were identified in our study, one representing attributes related to the dyadic value co-creation interactions with the EHR (holistic view of patient's relevant health history, fast and easy access to information, reliability and security of information, and facilitation of prescriptions) and the other representing service attributes that support value co-creation interactions and collaboration among the different actors in the value network (facilitation of communication between HC practitioners, facilitation of communication between HC practitioners and patients, and facilitation of citizen's self-management of HC information). The first type of value co-creation factors is in line with the classic view of service quality, where dimensions related to quality and accuracy of information, efficiency, reliability, security and privacy were identified (Parasuraman et al., 1988, Parasuraman et al., 2005, Wolfinbarger and Gilly, 2003). Our research shows those earlier factors are still relevant. While these prior studies focus only on attributes of the service provider, they

do not explicitly consider the contribution of the customer and of the other actors in the network. This provides an incomplete view of the value co-creation process and the whole network of actors. Notably, the second set of factors, related to supporting interactions among actors has not previously been explicitly considered as value drivers. This is a new contribution for better understanding value co-creation in a value network setting. Interactions have a key role in service provision and offer opportunities to foster value creation (Gummesson and Mele, 2010). The results corroborate and provide empirical evidence for a service logic approach to value co-creation and service management. Four value co-creation outcomes (broader coverage of HC services, better HC provision, cost and time savings, and better decision support to HC management) emerged as consequences (benefits) of the value co-creation factors. The identification of these factors and outcomes contributes to operationalizing value co-creation and to further developing this concept.

This study also shows that different actors perceived the value co-creating dimensions differently. These findings reinforce the need for acknowledging different interests of different actors (Gummesson, 2007), and for going beyond the dyadic view to a network perspective where multiple actors contribute value and expect value in return (Gummesson and Mele, 2010, McColl-Kennedy et al., 2012, Vargo et al., 2008). As such, our study extends the McColl-Kennedy et al. (2012) scope of value co-creation beyond the customer's service network to a value network with multiple actors.

### **Value co-creation interdependencies**

The results highlighted the importance of interactions and interdependencies among actors in the value network. The study identified three types of interdependencies: dynamic role interdependency (actor's role may change from provider to consumer); temporal interdependency (interactions occur sequentially at different times); and self-interdependency (value creation depends on actor's own actions). Understanding the distinctiveness and nature of each interdependence has important managerial implications and points to the need for proactive management and design of customer and other actors' roles in service provision and value co-creation.

In dynamic role interdependency, value actors' roles are not fixed and value is co-created iteratively, which emphasizes the dynamic properties of the value network.

Actors play different roles ranging from being a beneficiary (customer) in a moment to a value creator (provider) in another, which means we must look beyond static two-party customer supplier relationships to a multi-party network view. This has important implications. From a research perspective, this is in line with S-D logic which considers that the roles of producers and consumers are not distinct, thus value is always co-created collaboratively in interactions among providers and beneficiaries (Vargo and Lusch, 2008). However, this raises important research questions regarding the nature, impact and synergistic effects of interactions among actors across the network. From a managerial perspective, this requires deeper understanding of the dynamics of actors' roles and how value is created through their interactions.

Temporal interdependency means the interactions occur sequentially at different points in time, where actors integrate other actor's resources in their value creating process. That is, value is co-created by jointly and reciprocally beneficial relationships (Vargo et al., 2008). From a research perspective this highlights the need to analyze value creation from a relationship and multiple touchpoint context, instead of a transactional context. This corroborates the view that customer experiences are co-created through multiple interactions across time and across multiple partners in the network, requiring a holistic approach (Patrício et al., 2011, Tax et al., 2013).

In self-interdependency, the value creation process is also dependent on an actor's own actions, showing that they play an active role in co-creating the value they will receive. Service research has regularly recognized the active role customers may have in service delivery, but the focus has been on attributes from the service provider side, and not on attributes from the customer side. The study findings corroborate McColl-Kennedy et al. (2012) that showed that customers contribute to value co-creation through their own (self) activities. However, the impact and contribution of customer's actions in value-creation still needs further research. From a managerial perspective, it is important to understand that value creation results from both service provider actions and customer actions. Services should be designed to actively manage the customer role in value co-creation and take into account how customers may actively contribute for their own benefit and for the benefit of others.

Finally, service providers must understand the different nature of the interactions and interdependencies among actors and their contribution to value co-creation. Study results

highlight the changing nature of actors' roles and relationships across time, and their impact on value creation for themselves and other actors. This shows the need to go beyond a dyadic relationship between service providers and customers. Importantly, this study shows the dynamic nature of value networks as actors constantly change their roles and value is co-created in a flow over time. As such, this study responds to Vargo and Lusch (2011) call for investigating value creation from a dynamic, networked, and systems perspective.

### **Value as the result of resource integration and interactions among multiple actors in the value network**

The study empirically shows that a dyadic customer-supplier view is not enough to understand value co-creation in complex value networks. A dynamic network view is needed to be able to comprehend the whole system of service systems, as previously advocated by (Gummesson, 2006, Gummesson and Mele, 2010, Vargo and Lusch, 2011). The study further evolves our knowledge about services provided in many-to-many contexts, showing that a holistic perspective is needed, taking into account that different actors perform different activities and integrate resources differently to co-create their service experience in a dynamic flow over time. This is critical to service managers that have traditionally focused on dyadic relationships with customers and do not acknowledge their role in supporting value co-creation among actors. Thus, this paper offers insights on how companies can enhance their offering by facilitating value co-creation through resource integration among other actors in the value network.

## CONCLUSION

This study shows that value co-creation results from actor's resource integration through complex interactions among actors in the value network. Value co-creation has been thoroughly conceptualized in the service field, but empirical studies are scarce. This study provides empirical support to previous conceptualizations of value-creation in a network of activities involving multiple actors (Gummesson, 2007, Vargo and Lusch, 2008), with iterative and non-linear aspects (Gummesson and Mele, 2010). The qualitative results provide a rich account of the interactions and non-linear relationships

among actors as they co-create value in a complex service setting, using the health care environment.

Health care service systems are essential to modern economies but complex and expensive. This qualitative study provided a deeper understanding of value co-creation from multiple actors' perspectives in the national Electronic Health Record (EHR) service project called the Portuguese Health Data Platform. This setting was chosen due to the richness of interactions among actors and the findings may be useful for other services that share similar levels of complexity and a network context. Nevertheless, further research analyzing value co-creation in complex networks should be applied to other service sectors to expand our understanding of this phenomenon.

This study focused on the four most relevant actors in the complex system, but throughout the interviews other relevant actors emerged. Further research should study a broader set of actors, for a more holistic understanding of complex value networks. For instance, nurses emphasized the importance of teamwork with doctors, nutritionists, dietitians, pharmacists, physiotherapists, and social assistants. Also, throughout the interviews the role and importance of family in health care also emerged. Thus, it is important to further extend the network by incorporating relevant actors.

The study findings may also be useful for other service settings where the value co-created through the interactions among actors is particularly important to the value outcome. The proliferation of social networks, where value emerges from the interactions among members is a particularly rich setting for expanding this research. In the case of Company Social Networks, engaging members is a hard task (Martins and Patrício, 2013) and understanding value co-creation factors and outcomes in this context is crucial.

This study adopted a qualitative approach, which was deemed adequate, as value co-creation in complex networks is still an under-researched area. Building upon the exploration of the conceptual domain of value co-creation, quantitative research can contribute to operationalize and measure this concept. In particular, quantitative studies can shed light into the impact of value co-creation factors on outcomes and how it differs across different actors. Overall, this study contributes to operationalize and further understand the concept of value co-creation. This understanding will hopefully foster empirical research in this area and contribute to a holistic approach to service

design and management, taking into account the complex set of interconnections among actors in value network.

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**PAPER III**



# **Service Design For Value Networks: A New Approach for Designing Complex Service Systems with an Application to Electronic Health Records<sup>2</sup>**

## **ABSTRACT**

Services of all kinds are increasingly provided in value networks. However, existing service design methods do not address the creation of services for multiple interdependent actors in a network context. In complex value networks such as healthcare, holistic and systemic design is necessary to support each actor's activities and to support the value co-creation interactions among actors. This paper presents a new service design approach - Service Design for Value Networks (SD4VN) - with an application to developing a nationwide Electronic Health Record (EHR). This approach starts with an understanding of the value network experience through the Value Network Actor Map (VNAM) and Value Network Relationship Matrix (VNRM). This understanding is then reflected in the design of an integrated service concept at the network level, through Multiple Actor Value Constellations (MAVC). The project was performed in collaboration with the National Ministry of Health and involved over 170 participants at different design stages. The application shows that designing the EHR system requires designing for each actor as well as designing an integrated service concept that interconnects all actors. It also shows how SD4VN can successfully support the creation of integrated services for value networks where multiple actors' service systems develop many-to-many relationships.

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## I. INTRODUCTION

With the rapid expansion of human knowledge and technology, services are now offered through complex service systems and value networks. It is easy to take this complexity for granted when we watch television, travel by jet, or receive a health care test. Such acts seem ordinary to us, and we tend to forget the complex service systems that support them. Value network realities with multiple interdependent actors have become pervasive. In these realities, value is co-created through interactions among a set of interrelated actors, instead of just dyadic relations (Pinho et al. 2014). In this environment, services are increasingly provided, not to individual customers or segments, but to networks of interdependent actors. These actors have different needs that must be satisfied corroborating the importance of balanced centrality (Gummesson 2007), and they need to be supported in their value co-creating interactions.

Healthcare is a critical service sector in every society. According to information from the IBM Institute for Business Value, relative to the world's other major systems, the global healthcare service system "is the least efficient and has the highest potential for improvement" (Korsten and Seider 2010), and is globally affected by systemic inefficiency. In the current context, it is important to improve both efficiency and quality of health services and make them citizen centered. Healthcare is a rich example of a value network of interdependent actors (Vargo and Lusch 2011), involving doctors, nurses, pharmacists, managers and others, who interact and integrate resources so the patient can receive proper healthcare. Only with this perspective can the needs of every actor be fulfilled and the system as a whole be made sustainable.

There are significant efforts taking place to address these challenges, such as eHealth services and Electronic Health Records. The eHealth technology enabled services are initiatives that have the potential to significantly improve the effectiveness of the healthcare sector (Gartner 2009). Electronic Health Records (EHR) are patient data repositories accessible by multiple authorized users (ISO 2004) to support integrated health. EHRs are particular cases of services that are provided to a network of interdependent actors. For example, in order to benefit from better healthcare, patients must be actively engaged, providing accurate information to practitioners and complying with practitioner's recommendations. On the other hand, the doctor can make better diagnoses and provide better treatments if he/she has access to accurate patient history

previously registered by different practitioners during the patient clinical history. Services like national EHRs must be designed to support each actor's individual activities and the value co-creation interactions among actors (Pinho et al. 2014).

Healthcare is an important context for a variety of research priorities (Ostrom et al. 2010) and a fertile field for service research (Berry and Bendapudi 2007). Service Design (SD) can make a key contribution to improving healthcare by bringing new service ideas to life through its human-centered, holistic and iterative approach. However, SD methods and tools have focused on one customer segment at a time. Designing services for value networks of interrelated actors requires designing a set of interconnected service concepts for the different actors involved in a value network, with a special focus on supporting the value co-creation interactions among them. SD tools and approaches should therefore evolve to better address this reality. The application of new service design approaches to interoperable and shared healthcare information systems such as the Portuguese EHR can also positively influence the service of public entities and citizens' wellbeing, while responding to the call for transformative service research (Anderson et al. 2013).

This paper expands service design beyond single customer segments by presenting a method and a set of tools (SD4VN – Service Design for Value Networks) to support the creation of new services in the network context. This paper also presents an application to designing a national EHR that supports the network of citizens and healthcare professionals, which illustrates how the approach can be applied in a real world context.

The project started with a qualitative study of 48 healthcare professionals and citizens. This was followed by two participatory design workshops with 32 and 35 actors respectively, and a set of design meetings with more than 20 different actors: health care professionals, citizens and members of the Portuguese Ministry of Health. This study helped improve healthcare by designing a national EHR service that withstands the challenges of a value network by focusing on broadening patient access, simplifying procedures, and assuring effectiveness in healthcare. A follow-up study involving 37 interviews with healthcare staff was done after the EHR was implemented. This study assessed the performance of the EHR and contributed to validating the SD4VN method.

The next two sections review literature on underpinnings of the SD4VN method: service systems, value networks and service design. The fourth and fifth sections describe the design research approach in the research project and the SD4VN method, which is followed by explanation of its application in designing the Portuguese EHR. Finally, research and managerial implications are discussed in the seventh section.

## II. THE PERVASIVENESS OF VALUE NETWORKS

Service research has increasingly recognized the importance and pervasiveness of value networks. The evolution of the service environment and technology has led to the emergence of complex value networks with multiple actors, where supplier networks interact with customer networks (Gummesson and Mele 2010). According to Service-Dominant logic (Vargo and Lusch 2004), value is co-created through customer interactions with other actors in the value network. Normann and Ramírez (1993) created the concept of value constellations that represent a set of different actors who co-produce value together. To understand this new environment, a systems approach is crucial to take into account the parts of the system and their interconnections, and to enable an analysis at different levels, from the service system at the organizational level, to the system of systems at the value network level (Patrício and Fisk 2013).

A service system can be defined as an arrangement of resources that “includes people, organizations, shared information, and technology, all connected internally and externally to other service systems by value propositions” (Maglio et al. 2009; Spohrer et al. 2007). This definition of service system is more focused on the organizational level, where one service provider develops offerings for its customers. However, customers increasingly co-create value through the combination of service offerings from multiple firms. These constellations of service offerings constitute systems of service systems, where the multiple actors’ service systems develop many-to-many relationships thus forming a value network (Patrício et al. 2011).

In value networks, there is a need to focus on multiple interconnections instead of dyadic relationships, by looking to many-to-many relationships and analyzing the whole context of a complex reality (Gummesson 2007). As such, the focal point should be the interaction between multiple actors. Instead of looking at one customer or at independent segments of customers at a time, a value network perspective allows focusing on any of

its parts without losing sight of the systemic context (Gummesson 2007) and puts an emphasis on the interactions between the multiple parties involved in the service ecosystem (Edvardsson, Enquist and Petros 2007). In the context of a value network, the understanding of value moves from unit output, to one based on processes that integrate resources and different actors (Vargo, Maglio and Akaka 2008) that can influence the overall value of the system. Also, the interactions between actors offer opportunities to facilitate value creation experiences for and with each other (Grönroos 2008; Payne, Storbacka and Frow 2008). The service must support, not only individual customers, but also the value co-creation interactions among interdependent actors.

Taking into account a many-to-many context, achieving balanced centrality (Gummesson 2007) is an important challenge, since all actors have the right to satisfaction of their needs and wants. The focus should be on the whole context of the value network and not only the benefits provided for each specific actor in isolation. Thus, value in the network is generated through complex dynamic exchanges between several actors (Vargo, Maglio and Akaka 2008). This value can be measured for each actor in terms of a “system’s adaptiveness or ability to fit in its environment” (Vargo, Maglio and Akaka 2008), p. 149), and depends on the capabilities the system has to accomplish different goals and support the different needs and wants of each actor. In the example above, the value outcome from the patient’s perspective can be the healing of the problem that lead to the surgery. From the hospital’s perspective the value outcome can be the efficient and effective recovery of the patient, without relapses and with controlled costs. Finally, from the family’s perspective, the value outcome can be defined as the ability of the patient to have better quality of life after the surgery.

A reductionist approach to designing a service in the context of value networks suggests breaking the system into small parts that reduce its complexity. However, by splitting the service into subsystems, there is the risk of local optimization, while losing sight of the larger systemic context (Gummesson 2007). In a value network approach, the service concept must consider all subsystems associated with the service that is being designed, and take into account that they have dynamic configurations that can suffer mutations. Patricio et al. (2011) have already proposed that the service concept should be defined taking into account the perspectives of different actors that interact directly with the service. However, they still focus on one customer segment. Designing for value

networks requires designing different but integrated service concepts that take into account the interdependencies among actors.

Understanding value networks is a service research priority (Ostrom et al. 2010). Some approaches (Normann and Ramírez 1993; Patrício et al. 2011; Tax, Mccutcheon and Wilkinson 2013) already address such complex realities, but they still focus on designing a service for a specific customer or customer segment. New approaches are needed that take into account the active role of each actor in value co-creation and their interactions with other actors.

### III. DESIGNING FOR VALUE NETWORKS

Service Design (SD) is a human-centered process based on a deep understanding of users and their contexts, service providers, market strategies and social practices (Holmlid and Evenson 2006). SD is a discipline that blends business, marketing, engineering, and design for a multidisciplinary approach to the introduction and sustainability of services (Saco and Goncalves 2008). As a growing field, SD methods and tools have been developed in different disciplines over almost 30 years. Following design thinking approach (Brown 2008; Stickdorn and Schneider 2010) the service design process involves three steps (see Fig. 1) from inspiration (understanding the customer experience), ideation and reflection (designing the service offering and reflecting through prototyping and testing), and implementation. This process requires orchestrating a set of service elements through different levels, from the in-depth understanding of the customer experience to the specific design of the service solution (Patrício and Fisk 2013). Service design methods and tools can bridge the gap between research results and new service concepts (Dubberly, Evenson and Robinson 2008).

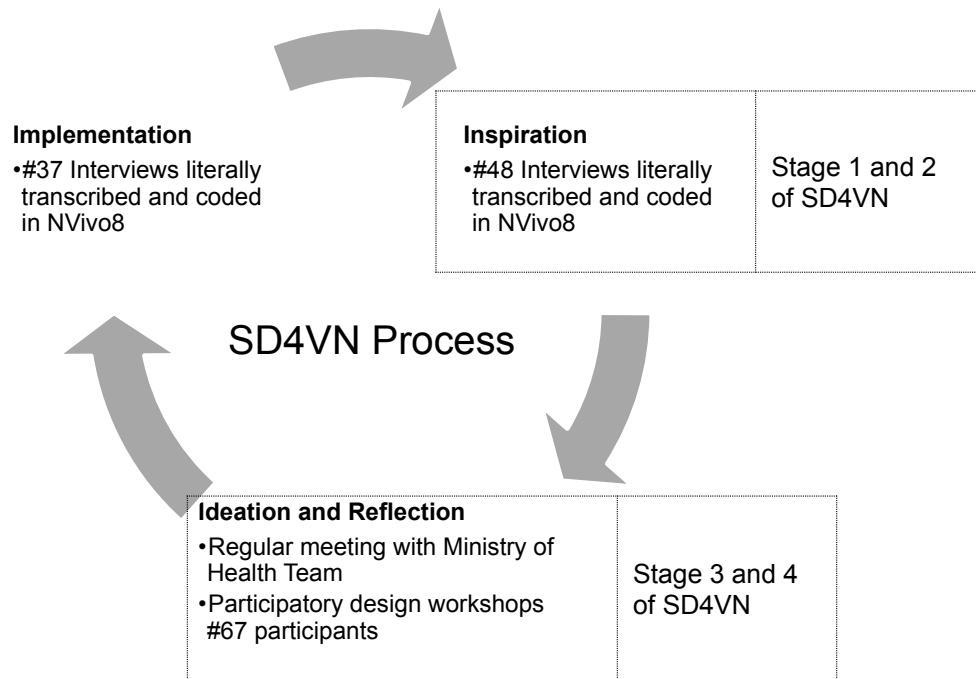


Fig. 1 – Service design process of SD4VN approach

Different SD methods and tools have particular characteristics that help designers tackle specific problems (Alves and Nunes 2013; Moritz 2005; Saco and Goncalves 2008). Although there are many tools available to support the service design process stages and address some aspects of value networks, they are not well integrated. Patrício et al. (2011) created the Multilevel Service Design (MSD) method, which provides a holistic and interdisciplinary approach that enables integrated design of service offerings at three hierarchical levels with a strong focus on the customer experience: designing the service concept in the customer value constellation; designing the service system; and designing each service encounter. MSD offers an integrated view, from the service concept level, to the multi-interface service system level, and to the service encounter level, but is still focused on one customer or segment.

Current service design methods and tools view the value network mostly as context, and not as design space. Designing services for the value network requires a change of perspective where the service is provided to the value network as a whole and its interdependent actors. To address these gaps, this paper proposes an evolution of current SD methods into a new approach - SD4VN - that is based on MSD principles and guidelines, but integrates other SD tools and a new design level - the network level. To

this end, the next subsections review existing service design methods and tools, which served as foundations for SD4VN.

## **A. Designing the Service at the Network Level**

### **1) Mapping the Value Network**

Identifying all the actors in the value network is a vital step in the process of designing a service. In service design, actors are sometimes also referred to as stakeholders. Following an S-D Logic perspective (Vargo and Lusch 2008), we use the term actor instead of stakeholder to emphasize the interactive nature of value co-creation among actors in value networks. However, many times the task of identifying actors is made on an ad-hoc basis (Reed et al. 2009). The consequences can be forgetting an important group of actors, giving too much attention to others, or simply forming a biased vision of the service network. Various methods and approaches have been developed, leading to confusion over the concept and practice of stakeholder analysis (Varvasovszky and Brugha 2000). Reed et al. (2009) define the stakeholder analysis as (1) the process of identification of individuals, groups and organizations who are affected by or can affect the service to be designed and (2) the prioritization of these individuals and groups as the focus for involvement in future interaction processes, in this case, the service design process. The last step is particularly important in designing services in multi-actor environments given its complex nature.

The Actor Network Mapping tool (Morelli and Tollestrup 2007) provides an overall picture of the network of actors in the service system and allows the identification of different groups and their relationships. The grouping aspect of the technique organizes the actors by their function and influence on others, for example, individuals versus organizations. Or in the EHR case, those that directly interact with the citizen versus those that do not.

Service ecology (Moggridge 2006) and Value Network Analysis (Allee 2008) also provide a systemic view of the value network and the context the service will operate within. In other words, these tools provide a holistic visualization of the service system where all the environmental factors are gathered and visualized: politics, the economy, employees, law, societal trends, and technological development. By analyzing service

ecology maps, it is possible to identify opportunities for new actors to join the network and form new relationships with the actors.

Mapping the value network's actors and its most important dimensions is one of the challenges designers address when designing services for multi-actor environments. Stakeholder Maps, Actor Network Mapping and Service Ecology provide an overall picture of the actors in the system, but they only represent a designer's perspective of the value network. To fill this gap we propose evolving existing tools, such as Actor Network Mapping into a Value Network Mapping Tool, which will be described in detail as part of the SD4VN method.

Actor Network Mapping and Value Network Analysis provide visualization tools to represent value network actors and their relationships (e.g. information, activities). However, for complex networks such as healthcare, these representations do not allow a detailed analysis of the established interrelations. To fill this gap we propose using a complementary tool. Value Network Relationship Matrix that will also be described as part of the SD4VN method.

## **2) Understanding the Multi-Actor Experience**

Understanding the customer experience is a crucial step for human-centered service design. However, in value network contexts, after identifying the relevant actors it is important to understand their overall experience and how they are interrelated. This is the starting point for discovering new opportunities for value co-creation with the actors and between them by responding to their needs and aspirations.

Customer experience is co-created through customer interactions with service elements such as the physical environment, people (customers, employees and other actors), and service delivery process (Vargo and Lusch 2004). Service design orchestrates these elements to help customers co-create their desired experiences in a human-centered design process (Evenson 2008) that entails a deep understanding of the customers and other actors in their contexts. Specific customer experiences cannot be designed because exact reactions people have in specific situations cannot be predicted. People are influenced by a multitude of factors such as their past experiences, other actors, or even the social environment (Verhoef et al. 2009). Instead, designers can aim to design

situations that support customers in co-creating their desired experiences (Forlizzi and Ford 2000). Customer experiences cannot be designed by an organization, but services can be designed for the customer experience (Patrício et al. 2011).

Many tools and techniques can be used to understand and map the customer experience of all the actors involved in the service (Berry, Carbone and Haeckel 2002). The customer journey tool represents a series of touchpoints, involving all activities and events related to the delivery of the service from the customer perspective (Zomerdiik and Voss 2010). However, the customer journey tool does not offer an overall view of the value network or an integrated approach to the different levels of service design. Customer experience modeling (Teixeira et al. 2012) provides a more comprehensive approach by systematizing all experience information to support service design. It examines the customer journey through the different levels and also represents the rich contextual environment underlying customer experience, such as physical artifacts, actors and systems. Existing tools already provide a holistic and systematized view of the customer experience. However, they do not examine how the customer experiences of different interdependent actors of the value network are interrelated.

### **3) Designing the Service at the Network Level**

Literature on designing services for the value network is scarce. Several tools enable mapping the value network as a context for service design, but not as something to be designed. Designing for interrelated actors at the network level requires designing an integrated service concept for the value network as a whole, and then drilling down to each actor without losing the overall perspective. However, existing methods and tools do not address service design at this level. The tools previously presented for defining the value network such as Service Ecology (Moggridge 2006) and Actor Network Mapping (Morelli and Tollestrup 2007) enable characterizing the value network as a context but not as a design space.

Other approaches such as designing the service concept with the Customer Value Constellation (CVC) (Patrício et al. 2011) already take into account the value network to design the service concept for a focal customer. However, the CVC still focuses on designing one service concept for one customer segment, and not for multiple interrelated actors. In the value network context, different actors may have different goals and expectations, and as such, an integrated design of the service concept for

multiple actors is needed to ensure balanced response to the actors' needs, avoiding local optimizations that could hamper the overall objectives of the network.

## **B. Designing the service at the actor level**

After designing the service at the value network level, it is important to drill down to designing the service for each actor, taking into account the value network perspective. Most of the service design tools are applicable at the actor level (Zomerdijk and Voss 2010). Patrício et al. (2011) proposed MSD method to design services at the actor level that organized and integrated these tools at three hierarchical levels: designing the organization's service concept; designing the organization's service system; and designing each service encounter. Designing the service at the actor level involves understanding the customer experience and designing the customer value constellation (CVC), characterizing the organization's service concept. The service concept is the set of benefits the service offer to its customer (Edvardsson et al. 2000) or segment of customers. According to Patrício et al. (2011), the value constellation experience is co-created during the interaction between the different stakeholders (individual or organizations) needed to perform a given activity and the CVC "represents the set of service offerings and respective interrelationships that enable customers to co-create their value constellation experience for the activity" (Patrício et al. 2011), p. 185).

Designing the service at the organization's service system level involves the definition of the service operations that lead to the value co-creation. This step is based on a deep understanding of the customer experience (artifacts, technology, process and people). The MSD method uses Service System Architecture (SSA) and Service System Navigation (SSN) to design the Service System. With these tools the design team can map different customer journeys for the desired service, compare them with the ones used to define the customer experience and analyze their implications for backstage processes and technologies, thereby enabling a clearer understanding of service system design possibilities (Patrício and Fisk 2013).

The third hierarchical level of MSD designs the service encounter through the service experience blueprint (SEB) (Patrício, Cunha and Fisk 2009). The service encounter (Bitner, Brown and Meuter 2000), or touchpoint (Zomerdijk and Voss 2010) is the moment of interaction and value co-creation between an actor and the service provider.

At this level, service designers need to define the interaction setting, interaction process, and the role of each participant, based on the definitions of the higher MSD hierarchical levels. Tools such as SSA, SSN and SEB are adequate for designing the service at the actor level and are applied based on the CVC in the context of a customer segment. However, to design for value networks, this approach should be complemented with a network view, that enables designing an integrated service concept for the multiple interdependent actors.

Although several tools and methods address the service design at the actor level, designing services for value networks requires further research to integrate service design at the network level with service design at the actor level to achieve balanced centrality (for example, enhancing the service experience for one actor may hinder the service experience of other interdependent actor). This paper proposes the SD4VN (Service Design for Value Networks) method to fulfill this gap, which enables understanding and designing integrated service concepts for the value network as a whole by taking into account the interdependencies among actors.

#### IV. METHODOLOGY

Design research has been evolving in two strands: interaction design and design-science. Interaction design research has its basis in the design field and advances knowledge in three main directions: Design Practice, Design Exploration, and Design Studies. From this point of view, knowledge creation arises from the interaction between practical applications and design studies. This interactive dialogue leads to the evolution of design methodology (Fallman 2008). Design-science research is based in the information systems field (Hevner et al. 2004). This approach has in common with interaction design research the constant dialogue and interaction between practical application and conceptual development, but it is more structured by following a process with several stages of development and validation. This research project built upon the two approaches, but given the complexity of this research project, a design-science approach was adopted since it provided step-by-step guidance to evolve and validate the research process.

In design-science research, knowledge and understanding of the design context and the development of the proposed solutions are achieved in developing applications of the

designed artifact (Aken 2004; Hevner et al. 2004). This research project extended service design methods (the artifact) to the creation of services provided to multiple interdependent actors in a value network. As such, a design research approach was considered adequate to develop and validate these new approaches.

Following Hevner's (2004) guidelines, design-science research requires the creation of a purposeful new artifact, being a construct, model, or method. In this case, we developed a new service design method – Service Design for Value Networks (SD4VN) for contexts with multiple interdependent actors in value networks. The development and evaluation of the method first required a qualitative approach (Corbin and Strauss 2008) to gain an in-depth understanding of the value co-creation experience in complex services with many actors. Then, based on the study results and literature review, the method was iteratively developed through the application to designing the Portuguese Electronic Health Record.

Taking into account Hevner's (2004) guidelines, the SD4VN method is innovative in that it supports service design for entire value networks rather than one organization or a customer segment. The value co-creation experience studies and the method application to designing the Portuguese EHR enabled an iterative dialogue between conceptual development and empirical validation. Moreover, the Portuguese EHR service was actually implemented by the Portuguese the Ministry of Health, and the positive feedback obtained from the follow-up study shows that the SD4VN method can be successfully applied. The SD4VN method and its application will be detailed in the following sections.

## V. SERVICE DESIGN FOR VALUE NETWORKS (SD4VN) METHOD

In complex value networks, a holistic design approach is necessary to create an integrated service for different actors that co-create value with each other. SD4VN enables designing services at the network level, which then impacts the design of the service at the actor level (see Fig. 2). This approach enables the design an integrated service concept at the network level that interrelates the different service concepts for each actor, by taking into account the dynamic configuration of the network of actors, their needs and resources.

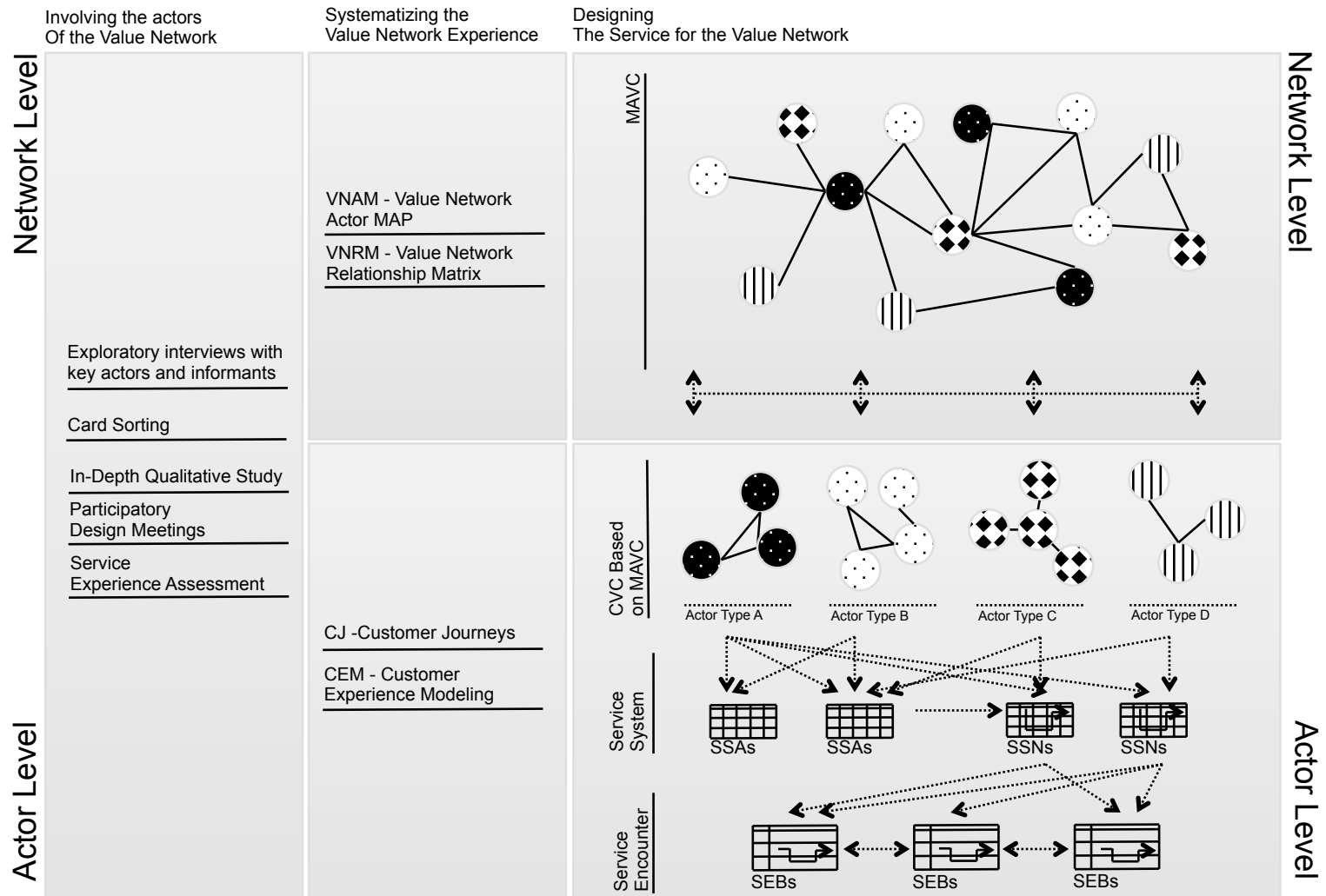


Fig. 2 - Service Design for Value Networks

The SD4VN method follows iterative design thinking (Brown 2008; Stickdorn and Schneider 2010), Multilevel Service Design (MSD) (Patrício et al. 2011), and a systems perspective (Spohrer et al. 2007; Vargo and Lusch 2011). First, design thinking is reflected in an iterative process of understanding the customer experience, designing new concepts and testing them. Second, MSD is reflected in the idea that service requires orchestrating a set of service elements down through different levels, from the deep understanding of the customer experience at the value constellation level, to the design of the service solution at different levels. The systems perspective is reflected in considering all subsystems related to the service being designed, and takes into account that they have dynamic and mutable configurations. SD4VN makes contributions beyond existing methods by addressing a new value network level and by designing services for multiple actors in an integrated way. In other words, SD4VN is a human centered design process, which starts by understanding the Value Network experience and translates this understanding into an integrated service concept for the value network of interdependent actors.

The SD4VN process involves four steps, as shown in Table 1. Step 1 maps the value network, identifying all relevant actors and their relationships through the Value Network Actor Mapping (the different types of actors, and the identification of priority actors) and Value Network Relationship Matrix (actors' interactions, information exchanged, value creation, and other relevant exchanges). This first step is crucial to defining the boundaries of the value network to be studied.

Step 2 uses Customer Experience Modeling (Teixeira et al. 2012) and involves understanding and mapping each priority actor's experience in the context of human centered design: map their daily activities through customer journeys; identify the artifacts used; describe their experience requirements and information needs. Customer Experience Modeling was further evolved by applying a deeper analysis of the relationships and influence between multiple actors and focusing on the overall service value (the value network perspective, instead of the individual actor perspective).

Step 3 is the design of the service offering at the network level. Through an iterative process of participatory design (Edvardsson et al. 2006), ideas that may lead to the service solution are generated and tested with the design team and key actors. This

ensures the design of an integrated concept for the value network of actors. Modeling the Multiple Actor Value Constellation (MAVC) becomes fundamental, as it reveals the interactions between the different actors and the conflicts generated by the integration of the different service solutions. After the design at the network level, Customer Value Constellations (Patrício et al. 2011) for each actor are designed based on MAVC. The interplay between the two models is important to highlight the interconnections between the design of the integrated concept at the value network level, and the design of each service concept for each actor.

Finally, Step 4 focuses on designing the service concept at the actor level and entails iterative cycles of participatory design and prototyping of the previously created service concepts for each actor with regular meetings with the design team and workshops with groups of actors. Following MSD, at this stage the design also drills down to design the Service System Architectures and map the most important Service Experience Blueprints (SEBs) (Patrício, Fisk and Cunha 2008) for the priority actors. Instead of designing the service concept, service system and service encounter for each actor in isolation, the value network service concept in this third stage provides an integrated view, which enables the design team to take into account the value co-creation interactions among actors. These activities are followed by the definition of use cases (Pender 2003) and system requirements for the development of the service system interfaces and prototypes.

Table 1 - The Process of Service Design for Value Networks (SD4VN)

<b>Design Level</b>	<b>Stage / Step</b>	<b>Service Design process and actors involvement</b>	<b>Service design models and tools</b>
Designing the service at the network level	1. Mapping The Value Network	Exploratory study with key actors and informants with open-ended questionnaires and Card Sorting	Design the value network actor map and relationship matrix with all the entities involved in the service: <ul style="list-style-type: none"> <li>- VNAM – Value Network Actor Map Identification of priority actors.</li> <li>- Identification of the different types of actors (individuals and organizations);</li> <li>- VNRM – Value Network Relationship Matrix</li> <li>- Actors;</li> </ul>

Design Level	Stage / Step	Service Design process and actors involvement	Service design models and tools
			<ul style="list-style-type: none"> <li>- Interactions (Information exchanged and Value propositions);</li> </ul>
	2. Understanding multi-actor experience	In-depth study of actor network experience (understanding the customer experience in the value network taking into account multi-actor relationships)	Mapping the experience for each priority actor in the context of human-centered design: <ul style="list-style-type: none"> <li>- Customer Experience Modeling</li> <li>- Design their daily Activities and map them as customer journeys;</li> <li>- Identify the artifacts used;</li> <li>- Describe the experience requirements and information needs;</li> </ul>
	3. Designing the service at the network level	Iterative cycles of participatory design comprising conceptualization, service concept mapping (at the network level) and participatory workshops with different actors	Designing the service concept with the MAVC (Multiple Actor Value Constellation) for the network Drawing the implications for the service concepts of each actor;
Designing the service at the actor level	4. Designing the service at the actor level	In-depth study of actor experience (understanding the customer experience)  Iterative cycles of participatory design comprising conceptualization and mapping of each actor CVC, SSA (Service System Architecture), and participatory workshops with different actors, mapping the most important SEBs (Service Experience Blueprints) for each actor	Designing the service concept for each actor with the Customer Value Constellation (CVC); Designing the SSA and the most important SEBs for each actor; Definition of use cases and system requirements for the development of the service system interfaces and prototypes; <ul style="list-style-type: none"> <li>- Service System Architecture (SSA)</li> <li>- Service Experience Blueprint (SEB)</li> <li>- Use Cases</li> </ul>

## **A. Step 1 - Mapping the Value Network**

A Service System is dynamic and involves mutable configurations of resources such people, organizations and information (Spohrer et al. 2007). Combining tools such Stakeholder Map and Actor Network Mapping (ANM) allows the service designer to have first contact with the service value network. This step is very important in the design of multi-actor environments and must take into account the different perspectives of each actor.

ANM is useful to represent the actors of an existing system or to generate models of a new system (Morelli and Tollestrup 2007). By focusing on one segment of service customers, an actor network map can visualize the nature of the interaction between customers and other actors, although it does not provide enough detail about the interactions. However, when designing a service for multiple interrelated actors, considering the different actors' points of view can originate different maps. In fact, before defining a final actor network map for the service system, it is important to ask the different actors what is their perspective about the more relevant stakeholders, their influence and interaction with each other. "Hit-Maps" using card sorting techniques (Nielsen 2004) can be produced in a exploratory approach to represent each perspective of the Actor Network Map (Morelli and Tollestrup 2007).

Building upon ANM, Step 1 of SD4VN starts with an exploratory study of key actors and informants to design the VNAM (Value Network Actor Map). VNAM provides a systematic process using card-sorting techniques to map each actor's perspective of the value network map. Moreover, VNAM includes the different views of each priority stakeholder into a single diagram – the value network (see Fig. 2) – that represents all the important actors of the service to be designed, grouped into similar characteristics (individuals or organizations, public or private, etc.). The diagram also allows identifying the priority stakeholders and the entities that are related to them. In this case, the different actor's perspectives and interactions can be mapped to represent different configurations of the new system and to analyze the interaction between the actors in each configuration. We call this tool VNAM to emphasize that this is the integrated view based on multiple actors' perspectives.

Using Actor Network Mapping or Value Network Analysis to represent the detail of each interaction is not feasible in complex realities with many-to-many relationships between the actors, because it generates a very complex diagram. In fact, being able to define the value network and its most important dimensions is one of the challenges designers face when designing services for multi-actor environments. To address this gap, VNAM was complemented with Value Network Relationship Matrix (VNRM) tool.

The VNRM tool was developed to help designers understand the value network they are designing for. Besides understanding who are the actors involved in the service, they also need to understand how actors interact, the information exchanged, the artifacts used, and their value propositions. In other words, designers need to understand the different dimensions of the value network (Spohrer et al. 2007). VNRM is a three-dimensional matrix where the X & Y axes represent the list of actors (in the same order), and the Z-axis represent the service system dimension to be characterized. The interception cell details the different dimensions of the value network (value proposition, information exchanged, artifacts used, etc.). Colors can be used to highlight dimension details of a specific group mapped in VNAM, for example the priority actors, or the actors that relate directly with a specific stakeholder (See Fig. 3). Combining the VNRM tool with VNAM enables a more complete view of the value network and its dimensions.

## **B. Step 2 - Understanding the Multi-Actor Experience**

In complex networks with many actors, it is important to map not only each actor's experience with the service system being designed, but also to understand how the different actors co-create value with each other, entailing new collaboration and social experience dimensions (Pinho et al. 2014). Step 2 applies Customer Experience Modeling's tools and techniques, but it takes a broader approach in understanding the actor's experience in a value network of many-to-many actors: (1) identifying value co-creation factors and outcomes that support many-to-many resource integration among the different actors in the value network; (2) understanding how value co-creation factors are interconnected by going beyond the dyadic relationship between customer and service provider and supporting interactions and resource integration among actors;

and (3) understanding how value co-creation for each actor depends on his/her own actions and the actions of other actors (Pinho et al. 2014).

To apply Customer Experience Modeling, Step 2 involves an in-depth study of the customer experience at different levels. SD4VN uses qualitative methods (Corbin and Strauss 2008) to gather a comprehensive understanding of the actors experience in the value network. This stage involves data collection techniques such as observation (Neuman 2006), in-depth interviews (Froddy 1993) and focus groups (Krueger 1994). This qualitative study enables mapping the overall customer journeys of each priority actor, their daily activities and service related tasks, and the elements of their surrounding context.

### **C. Step 3 - Designing the Service at the Network Level**

When designing for value networks, it is important to identify the actors the service is designed for. In multi-actor environments there is not only one customer value constellation around the focal actor's activity, but a Multiple Actor Value Constellation (MAVC) that integrates the different customer value constellations designed for the different relevant actors.

In MSD, the Customer Value Constellation (CVC) puts the customer activity that is being supported at the center of the value network, and builds the CVC analyzing the service offerings that respond to customer overall needs. However, when addressing a complex multi-actor environment, the overall service should support, not one but a set of interrelated activities performed by the different interdependent actors, such as patients taking care of their health and doctors providing health care services. In this context, successful service design and implementation must address the concept of balanced centrality (Gummesson 2007), which argues that all actors have the right to satisfaction of their needs and wants. In complex value networks this becomes more relevant, because each actor's actions have impact on the others, thus influencing the value perceived by them. Designers must assure the service attends to the interdependent needs of different actors at the same time.

To this end, in Step 3 the service is designed at the network level through Multiple Actor Value Constellation (MAVC). SD4VN evolves the MSD method by adding a network level, through both the understanding of the multi-actor experience and the design of the

value network integrated service concept. The MAVC depicts a set of CVC for the different actors, showing how they are interrelated. The MAVC therefore maps the interplay among multiple actors and resources used to co-create value and support the different interrelated activities such as taking care of health for the patient, and providing health care for the doctor. This helps the design team find opportunities to reconfigure this network of relationships to create more value for all actors in the service system and not just for one actor in isolation. This perspective opens new forms of service innovation through enabling new value co-creation interactions among actors. The MAVC may reveal the opportunity to design a new service that, not only co-creates value through a dyadic interactions between the service provider and the customer, but also enables new forms of value co-creating interactions between actors in the value network. This approach is particularly suited to services provided to the network, such as EHR, because a significant part of the value created by the service results from the system ability to enable patients and health care professionals to exchange information and interact with each other.

#### **D. Step 4 - Designing the service concept at the actor level**

Following the integrated design at the value network level, Step 4 designs the service at the actor level. In MSD, the Service System Architecture and the Service System Network are used to operationalize the value proposition for each actor based on the Customer Value Constellation. However, in SD4VN, the design of the service system for each relevant actor takes into account the customer experience of the different actors, the different artifacts they use, the different information they require and the different service benefits and functionalities they require, by taking the MAVC into account. As such, although SSAs and SSNs are focused on one actor, they take into account the interconnections with other actors. Based on the resulting SSAs and taking into account the relationships between actors, Step 4 of SD4VN maps each service encounter and designs it through service experience blueprints for each actor.

In summary, Step 4 follows the three levels of MSD for each actor taking into account the MAVC. This approach therefore improves the application of MSD for each actor by taking into account the value network. The next section presents the application of SD4VN in the context of designing the national Portuguese Electronic Health Record.

## VI. APPLICATION OF SD4VN TO DESIGNING THE PORTUGUESE ELECTRONIC HEALTH RECORD

Electronic Health Records (EHR) are repositories of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users (ISO 2004). They contain retrospective, concurrent, and prospective information and their primary purpose is to support continuing, efficient and quality integrated health (Hayrinena, Sarantoa and Nykanen 2008). The Portuguese EHR aims to be a patient centered service system that carries clinical information and is accessible regardless of location or time of health care delivery. The Portuguese Electronic Health Record is supported by the Portuguese “Plataforma de Dados de Saúde” (PDS) that constitutes the national health record data sharing facility and uses interoperable technologies to link existing applications. By this means, information is provided through different portals/areas to different actors: (Citizen Portal, Professional Portal, and Institutional Portal).

The Portuguese EHR fits the definition of a complex service system that “includes people, organizations, shared information, and technology, all connected internally and externally to other service systems by value propositions” (Maglio et al. 2009; Spohrer et al. 2007). In healthcare, the complexity of the value network is very evident, making the EHR a rich empirical context to study service design in multi-actor environments. In this environment, actors frequently play the role of both client and service provider, which transforms the system into a complex reality of many to many relationships. For example, when a doctor accesses an EHR during a patient consultation, he/she plays the role of EHR service customer at the beginning (when searching for patient historical clinical information), and plays the role of EHR service provider at the end of the consultation (when he/she provides the EHR service with the report of the consultation or information about drugs he prescribed to the patient). In such complex service systems, holistic design is necessary to create a service for different actors with different needs, who are all interconnected and co-creating value with each other.

This research project for the design of the Portuguese EHR entailed three main objectives: (1) Supporting the design of EHR as a service with a focus on the service experience and creating value for the different healthcare actors; (2) Creating a service that would contribute to improve the national health care service as a whole and that would be flexible enough to withstand the challenges of providing a complex and

universal service; and (3) Supporting the research and development of a new method to design complex services with multiple actors. As such, this project was considered a rich empirical field for the study and design of services for value networks (see Fig. 3).

The project involved a multi-disciplinary team that included the members of the Ministry of Health responsible for the implementation of the EHR, information system engineers responsible for the development and implementation of the EHR, and the research team who were responsible for the PDS Service Design and for supporting the development and implementation stages. The project also included Citizens, Doctors, Nurses, Pharmacists and other healthcare professionals from public and private healthcare organizations that were involved in different stages of the design process as service users. The application of the SD4VN method resulted in the design of the Portuguese Electronic Health Record Service at its different levels (Service design at the network level and Service design at the actor level).

Involving the actors  
Of the Value Network

Systematizing the  
Value Network Experience

Designing  
The Service for the Value Network

**Network Level**

Exploratory interviews with key actors and informants #5

Card Sorting #5

In-Depth Qualitative Study #43

Participatory Design Meetings #87

Service Experience Assessment #37

**Actor Level**

#Number of Interviews/Participants literally transcribed and coded in NVivo8.

VNAM – Value Network Actor Map

VNRM - Value Network Relationship Matrix

Each cell contains detail about every relationship dimension

Value Dimension

Information Dimension

2 Dimensions

CJ -Customer Journeys

Healthcare for 2012

CEM – Customer Experience Modeling

Daily Activities

Artifacts

Information

Doctor Information

**MAVC**

**Network Level**

**Actor Level**

**Service System**

**Service Encounter**

**Doctor**

**Citizen**

**Actor Level**

Fig. 3 – Application of SD4VN

## **A. Step 1 – Mapping the Value Network**

The first two steps of SD4VN were part of the inspiration stage (see Fig. 1) of the service design process (Patricio and Fisk 2013), which entails the study of the actors involved in the project their experience, behavior and context. Following the steps of the SD4VN, the project started with an exploratory study of key actors and informants to Design the VNAM (Value Network Actor Map) and define the value network borders. The exploratory study involved five semi-structured interviews with the EHR national project manager, one Citizen, one Doctor, one Nurse and one Pharmacist. In order to systematize the interviews, card sorting (Nielsen 2004; Nielsen and Landauer 1993) was used through which interviewees were asked to sort the VNAM, identify the priority actors they related with, along with the information exchanged and benefits gained from their interaction with each one of those entities. The results obtained were used to: fine-tune the interview protocol for Stage 2; identify the priority actors; and design the VNAM (see Fig. 4). The diagram helped to identify all the actors involved in the value network (individuals and organizations), and their relationships with the citizen, which was positioned in the center of the diagram as the focal actor. VNAM also helped visualize the priority actors and their relationships. Figure 4 combines the different views of each priority actor into a single diagram as a result of the application of the card sorting technique with the different types of actors, and not just the designer perspective of the value network. In the EHR application, the VNAM showed that more than 100 types of actors (both individual and organizational) could be found in the health care ecosystem, and how they were related.

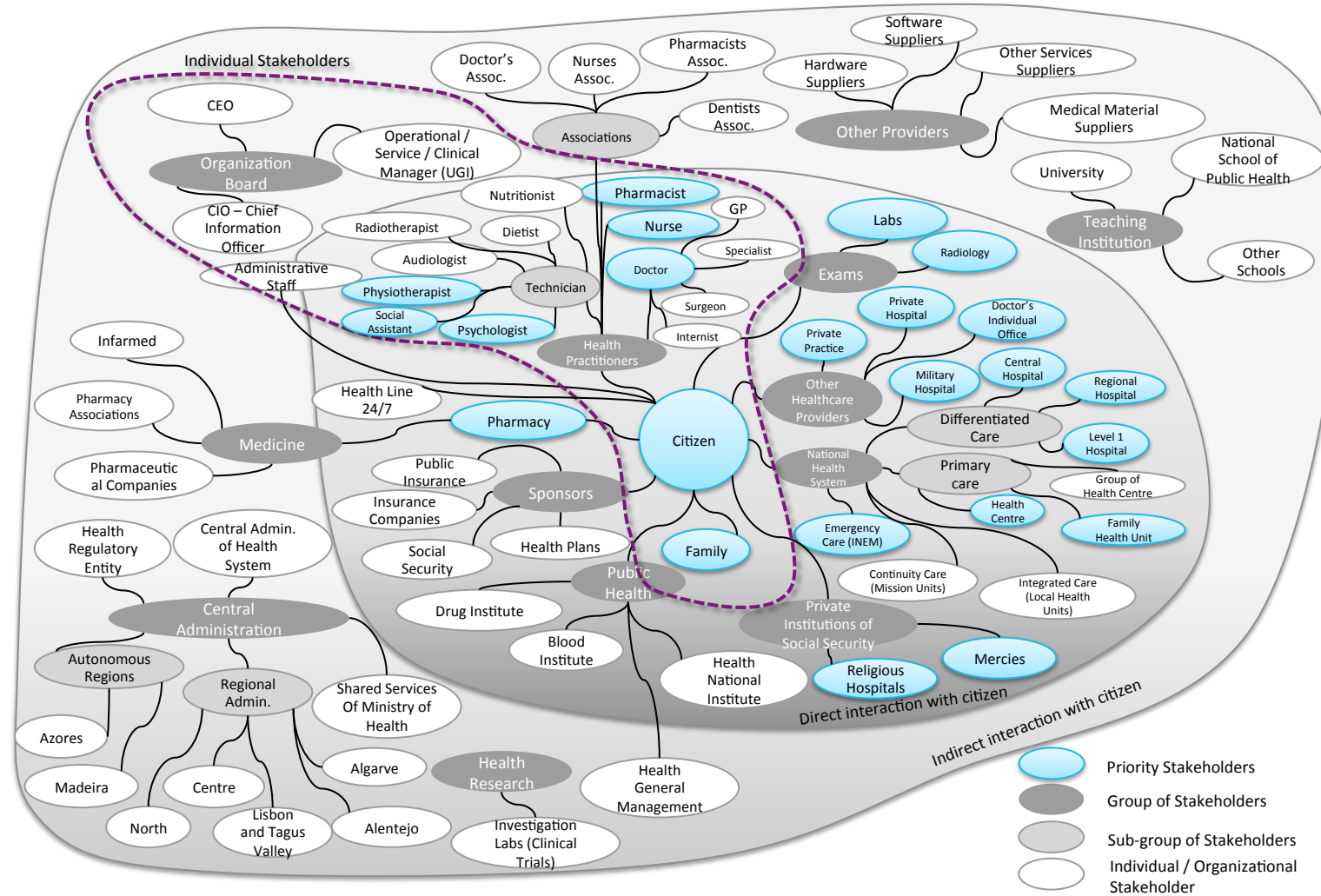


Fig. 4 - Value Network Actor Map

VNAM was then combined with a Value Network Relationship Matrix (VNRM) (see Fig. 5) where the x and y axes are composed by listing actors, and the z axis details the different dimensions we need to understand (value propositions, information exchanged, and artifacts used) to characterize the service system (Spohrer et al. 2007). For example, the diagram helped the team understand that in the EHR project, having an in-depth understanding of the experience of some healthcare technicians (psychologists, audio-therapists, and others) was not a priority, as they would not provide or access direct information from the national EHR service. Moreover, the VNRM also helped identify the strongest relationships and interdependencies between the actors (information exchanged, precedent activities, value propositions, etc.). For example, to securely prescribe a certain medicine, it is important that the doctor be aware of patient's allergies. The patient could communicate this information, or the nurse could identify an allergic reaction after applying a specific treatment. In this case, even the pharmacist could help the doctor and the nurse to adapt the patient medication, by providing additional information about alternative medicine. Overall, whereas the VNAM enabled the identification of the most important actors, the VNRM allowed understanding the more important relationships among those actors. Based on this analysis and discussions with the design team and the Ministry of Health, four priority stakeholders were identified for the first stage of the EHR: citizens, doctors, nurses and pharmacists. These four groups were the ones that used the health information the most.

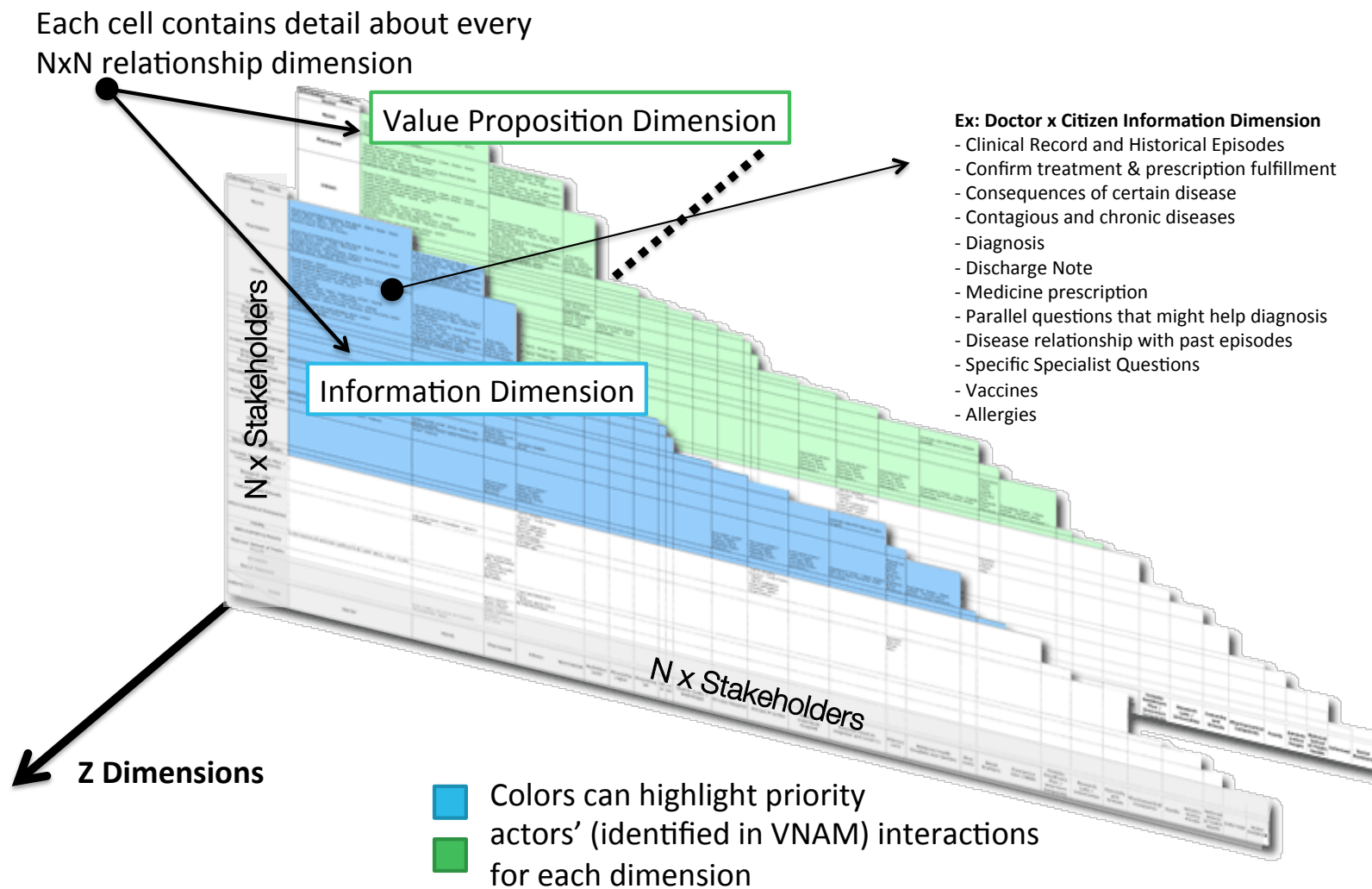


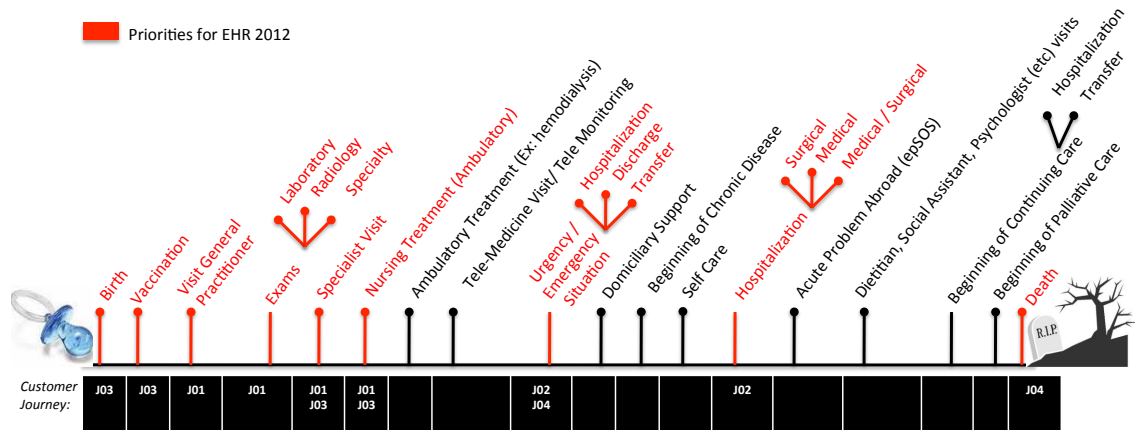
Fig. 5 - Value Network Relationship Matrix

## **B. Step 2 – Understanding Multi-actor experience**

The second stage of the project involved a qualitative study to get a deeper understanding of the experience of the four priority actors (citizens, doctors, nurses and pharmacists), their interactions and interdependencies. In this step, a combination of individual interviews and focus groups were used to understand the value constellation experience for the priority actors (activities, goals, artifacts, information and interactions with other actors) and to expand the knowledge regarding the EHR Service System. We combined in-depth interviews with focus groups (Krueger 1994) using theoretical sampling until saturation of results was reached (Corbin and Strauss 2008). The project involved 48 participants (Citizens, Doctors, Nurses and Pharmacists) from public and private health care organizations (see Table 2 of Appendix 1). This sample covered a diverse set of individuals and organizations with theoretical relevance, which provided different perspectives of each priority actor on the EHR service. All interviews were literally transcribed and coded in NVivo 8. Data analysis followed grounded theory methodology. We built the theory iteratively (Charmaz 2006) by being involved simultaneously in data collection and analysis in search of relevant patterns that provided a guide for future data collection. The results of the qualitative study allowed for mapping each priority actor's experience in the context of human centered design: (1) mapping their daily activities into customer journeys (see Fig. 6); (2) identifying the artifacts used; (3) describing their experience requirements, and (4) identifying their information needs.

The customer journeys were also analyzed in more detail. Fig. 6 shows a lifetime timeline of possible citizen interactions with the healthcare value network, and highlights in red the ones related to the EHR service. The detail of the customer journey is provided in the last table of Fig. 6 and helps the design team to understand the interactions and experience of the citizen and the doctor (in this case) with the value network and the EHR service. In this example, it became clear that the EHR service could provide value to the patient (secure care) and to healthcare practitioners (a technology repository with the patient healthcare data accessible by every professional involved in the patient treatment). The detailed description added to the customer journey also highlighted the interdependencies between actors (the diagnosis was dependent on the exam results, and the nursing treatment was dependent on the doctor

prescription). After the study of the multi-actor experience, it was decided to address only on the more direct and critical health care actors and as such, the following stage focused on patients, doctors and nurses.



Customer Journey	Title	Selected Episodes
J01	Citizen visits a General Practitioner (GP) and he forwards him to a Specialist	<ul style="list-style-type: none"> <li>- Visit to GP</li> <li>- Exams</li> <li>- Visit to Specialist</li> <li>- Nursing Treatment (Ambulatory)</li> </ul>
Stakeholders	Citizen, General Practitioner, Specialist Physician, Nurse, Lab. Physician, Pharmacist, Health Center (Primary Care), Hospital, Exams Lab.	
Summary of Citizen's Perspective	A citizen visits his General Practitioner (GP) because of a health problem (not acute). The GP prescribes a set of exams to help him make the diagnosis. After performing the exams, the citizen returns to the health center for an appointment with his GP. The GP diagnoses a specific problem and forwards him to a specialist physician. The citizen goes to the hospital looking for the specialist and he tells him that the problem is not serious and prescribes a set of drugs that must be administered by a nurse. The citizen then turns again to the health center to carry out the treatment and finally visits the GP to complete the episode.	
Summary of Doctor's Perspective	<p>The GP receives a patient in his office for a previously scheduled appointment. He asks the patient the motive of the appointment and access the patient electronic health record to help them diagnose the problem. Having doubts, the GP prescribes a set of exams and schedule a new appointment. When the patient comes for the next appointment with the GP, he access the exam results and forwards him to a specialist with a consultation and exams report.</p> <p>After the specialist consultation with the patient, the specialist defines a diagnosis that will be accessible by the GP.</p>	

Fig. 6 - Customer Journey for individual actor - Citizen

### C. Step 3 – Designing the Service at the Network Level

According to Brown (2008), this stage could be described as part of the ideation and reflection stages (see Fig. 1), where the design team creates and tests the service

offering. At this stage the application involved iterative cycles of participatory design sessions and meetings to generate and test new EHR service concepts. Participatory design (Schuler and Namioka 1993) involves the inclusion of the different service actors in the design team (Edvardsson et al. 2006) and assumes they are the true experts in their domains such as living, learning or working (Sanders 2008). By using engaged involvement and pluralistic techniques, participatory design helps operationalize the needs and desires of the different actors (Holmlid 2009). Patrício and Fisk (2013) also advocate a participatory design approach, as it can enrich the study of the customer experience (Stage 2 of SD4VN) by involving the actors as participants in key moments of service concept design and testing, thereby incorporating their perspectives in the creation of actor oriented services. In a value network with many-to-many actors, this becomes ever more important because it requires a holistic understanding of different actors' experiences, their interactions, priorities and conflicts of interest.

Weekly meetings with the Ministry of Health were organized between January and July 2012 with more than 20 different actors involved in the design team (see Table 3 of Appendix 1). The result of the first meetings was a draft of the Multiple Actor Value Constellation (MAVC) which integrated all priority actors' perspectives (see Fig. 7) as well as the Customer Value Constellation (CVC) for each actor (see Fig. 8). To iteratively develop and test these new concepts, two participatory service design workshops were undertaken with 32 and 35 different actors respectively: health care professionals, citizens and members of the design team and the Portuguese Ministry of Health discussed, evolved and validated the service concepts initially presented. Each of the two workshops tested and evolved the service at both the network and actor levels.

### **1) Designing the Multiple Actor Value Constellation (MAVC)**

Based on the results of the customer experience study and the participatory design workshops, a final version of the aggregated Customer Value Constellation of the EHR Service was developed, which originated the MAVC diagram (see Fig. 7), mapping the network of services needed for the different actors to manage and access complete and relevant health care information. The final result showed that what was an individual concern of one actor, sometimes was not so important for other actors, or was even conflicting. For example, access to clinical data was segmented to the different actors

who access it, for confidentiality reasons and ease of access. The surgery records are important for different actors, but only the surgery discharge note was considered relevant to share with nurses or the patient (too much information is often unnecessarily distracting). Another example was the information that should be part of the patient summary. After vivid discussions, Healthcare Professionals and the Citizens agreed on the minimal dataset that should be included, which is reflected in Figure 7. More than just the end result, the MAVC allowed for the different actors to visualize and communicate, structure, and prioritize the services offered by the EHR together. For example, the discussion highlighted the relevance of the patient summary, as complete information may sometimes lead to overload, especially for doctors in consultation. The discussion with citizens and health care professionals also emphasized the need for a robust access control and auditing system, to ensure the privacy of health care information.

As demonstrated in the resultant MAVC diagram, the main services and functionalities of the National EHR are significantly different from the doctor's individual CVC (see Fig. 8). In the MAVC diagram (see Fig. 7), more importance was given to the citizen's perspectives, security issues, and specific information needs of other healthcare professionals. In this sense, there is an important iterative process in the design of the service at the strategic level, because individual actor's CVC influence the design of the MAVC and the MAVC also influences the design of the individual actor's CVC's. It was interesting to see that MAVC results were reflected on the implemented system through an integrated platform (PDS): currently, there are three different national portals dedicated to different types of actors (Citizen Portal; Health Professional Portal; and Institutional Portal), corroborating the importance of balanced centrality (Gummesson 2007) in designing the EHR service differently for each actor in an integrated and interoperable manner. Moreover, the Portuguese Ministry of Health implemented service functionalities such as the Patient Summary, the Personal Health Record, and the information access management (highlighted in the MAVC as priority service components) in the first phase.



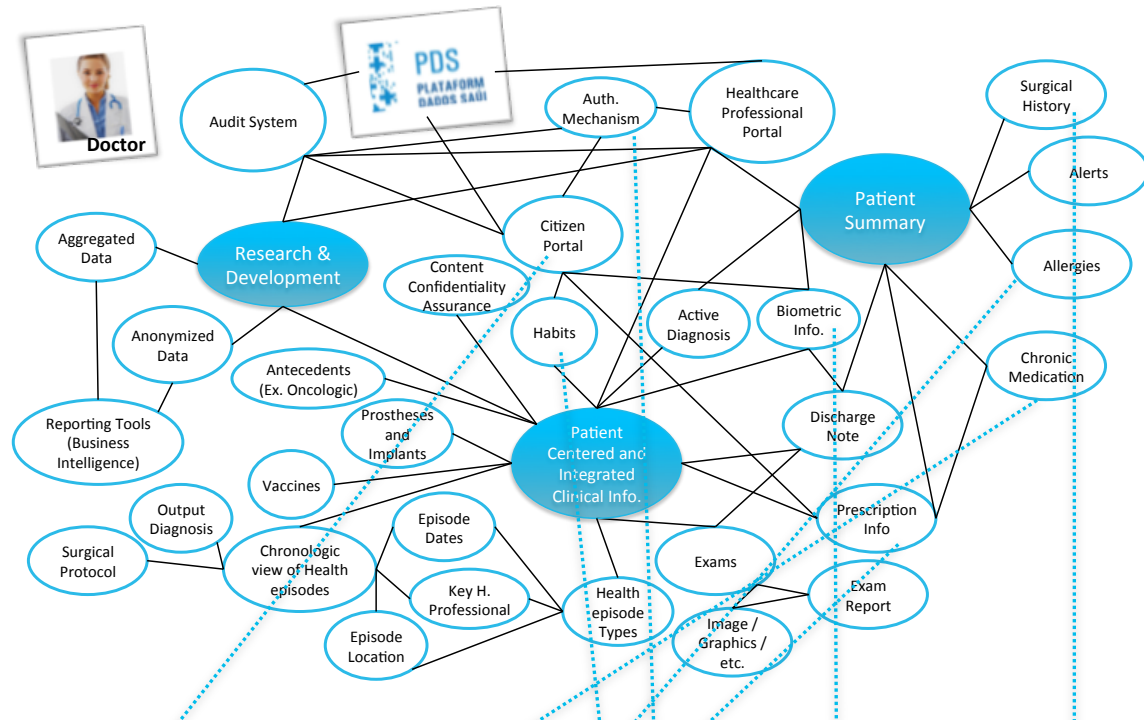


Fig. 8 - EHR-Customer Value Constellation – Example of Doctor’s Perspective

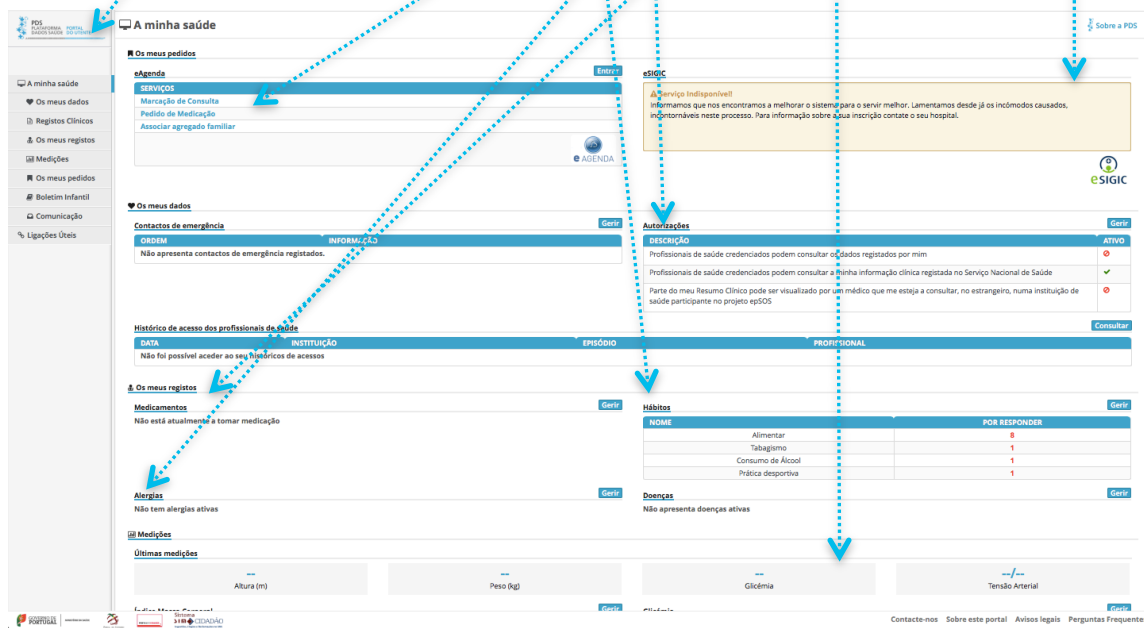


Fig. 9 – Screen Shot of a set of functionalities of the Portuguese Patient Portal

Figure 9 presents a screen shot of a sub-set of functionalities of the Portuguese patient portal, linking the services identified in the MACV with the functionalities presented in the professional portal. This picture highlights the relationship between the designed CVC for the doctor (see Fig. 8), taking into account the MAVC (see Fig. 7), and the

resultant functionalities of the service for the patient (see Fig. 9). This corroborates the balanced centrality characteristic of SD4VN, making sure that the service is provided differently for the different actors (for example the patient portal for the citizen and the professional portal for the doctor), but taking into account their relationships and interdependencies (for example, the common information accessible and provided through both professional and patient portal, such as allergies or prescriptions).

#### **D. Step 4 – Designing the service concept at the actor level**

Involving the same multidisciplinary design team from Step 3, the second part of two participatory design workshops supported the design of the EHR service offering at the actor level. Following the MSD approach (Patrício et al. 2011), this stage comprises the design of the service concept, the service system and the service encounters for each actor.

##### **1) Designing the service concept for each actor with the Customer Value Constellation (CVC)**

Based on the results of the qualitative study of the customer experience, the regular meetings and the participatory design workshops, the Customer Value Constellation for each priority actor was designed, in tight interconnection with the design of the MAVC (see Fig. 7). Figure 8 illustrates the EHR CVC from the doctor's perspective. The most important services are represented in the center of the diagram highlighted in dark blue. In this case, they represent the relevance doctors give to the patient summary. More than having the ability to drill down in their patient's detailed clinical information, they want to have short summaries of the key information they should be aware of when they are examining a patient for the first time (or after several months without any contact). In this example, the relevant information provided in the patient summary was the result of MAVC. To enable doctors' access to more information about the patient allergies, an allergy information field was added to the patient portal. With this functionality, the patient can now provide personal allergy information to healthcare practitioners, such as the date that a specific allergy started, or an allergy never detected before by any practitioner. This information is integrated through PDS and accessible by the Professional Portal.

## 2) Designing the Service System

Based on understanding each actor service experience, SD4VN used the SSA (Service System Architecture) and SSN (Service System Navigation) from MSD to operationalize the value proposition. However, since the service is co-created by multiple actors at the same time and each actor's actions impact other actors, there was a need to design the SSAs and SSNs separately for each actor but taking into account the MAVC and the CVC of each actor that derived from it. Fig. 10 represents an example of the doctor's SSA based on the most important activities related to the EHR service, performed in their daily experience (information derived from Step 2 – understanding the multi-actor experience). Combining this diagram with the doctor CVC and the MAVC, the interdependency of activities such as Consult or 'Manage patient summary', or 'Manage patient information' with other actors becomes evident.

This tool also allowed the design team to draw the impacts of each actor's actions on the PDS platform (the technological platform that supports the EHR service) as the PDS Interface row is also depicted in the SSA. Several dimensions were analyzed such as: authentication mechanisms (needed by the doctor to access or post information into the patient EHR), semantic norms (for doctors to understand what is written unambiguously in the Patient Summary), or service accessibility (when doctors need to consult patient exams posted by other healthcare practitioners in the PDS). This analysis gave the design team the capacity to focus on different solutions through specialized resources, which contributes to providing each actor a better service experience. In the mentioned dimensions, the design team of the Ministry of Health had to involve the National Commission of Data Protection, to validate the security and storage architecture (regarding legal requirements), as well as different groups of experts in health semantics to define which standards would be used in the PDS interoperability mechanisms.

## Doctor's EHR Service System Architecture

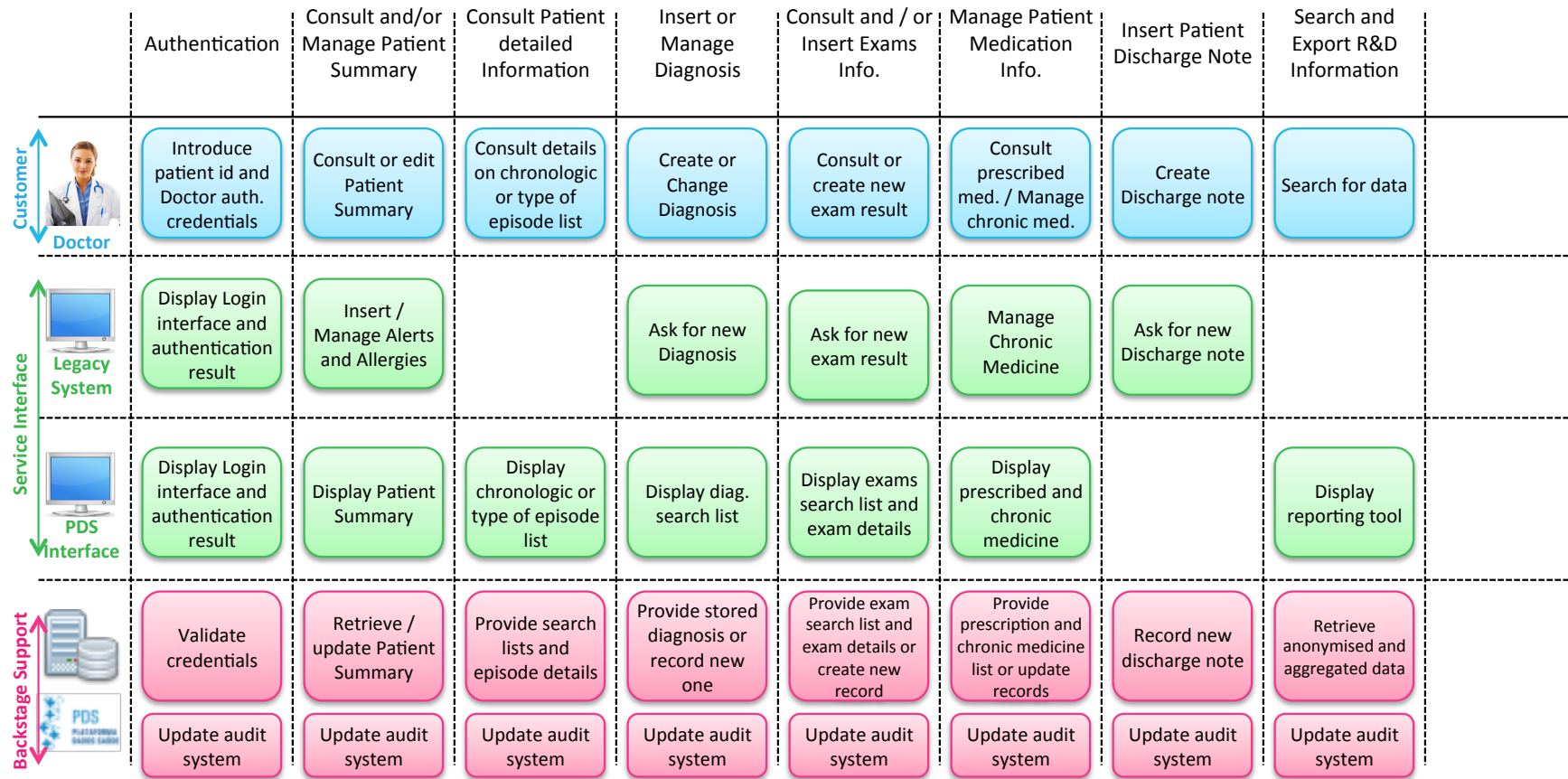


Fig. 10 - Service System Architecture – Example of Doctor's Perspective

### 3) Designing the Service Encounter

In the context of the EHR service, the service encounter (Bitner, Brown and Meuter 2000), or touchpoint (Zomerdijk and Voss 2010) is the moment of interaction and value co-creation between actors (citizen, doctor, nurse, etc.) and the EHR Service through a specific service interface. Drilling down from the SSA and SSN to the design of each service encounter, the Service Experience Blueprint (Patrício, Fisk and Cunha 2008) provides a diagrammatic tool for designing the service provision.

In Step 4 of SD4VN, the process of designing the EHR service encounters started with identifying the most important EHR service interfaces to be designed. The decision to design the Patient Summary was influenced by the PDS roadmap, but also by the importance given by all actors during the customer experience study and workshops. Based on the previous stages, a Patient Summary interfaces document was developed. The document contained: the purpose of the Patient Summary; the identification of all related actors and their specific roles; the functional and experience requirements of the service; security concerns about information access, management and segmentation; and the definition of the minimum data set to be included (information type, standard used, etc.). After validating the initial document with the team of the Ministry of Health, Patient Summary SEBs for each actor were developed and evolved through weekly meetings with the design team. The different needs and requirements identified during the customer experience study were taken into account in designing the different service interfaces. Fig. 11 illustrates a Patient Summary SEB for the doctor.

During the development of SEBs, the interdependence of the multiple backstage systems was evident, enhancing the fact that they need to be interoperable (technically and semantically). For example, patient allergies are part of the minimum data set of the patient summary. Allergies can be associated with a patient record by both healthcare practitioners and the patient himself. For this to be possible, the healthcare organization systems, the patient portal and the patient summary repository must be interconnected through an interoperable platform such as PDS. Also, semantic concerns must be taken into account, and the list of allergies must be the same in every system. This is an example that fostered the Ministry of Health to develop a unique allergy coding system to be adopted by all healthcare applications in Portugal.

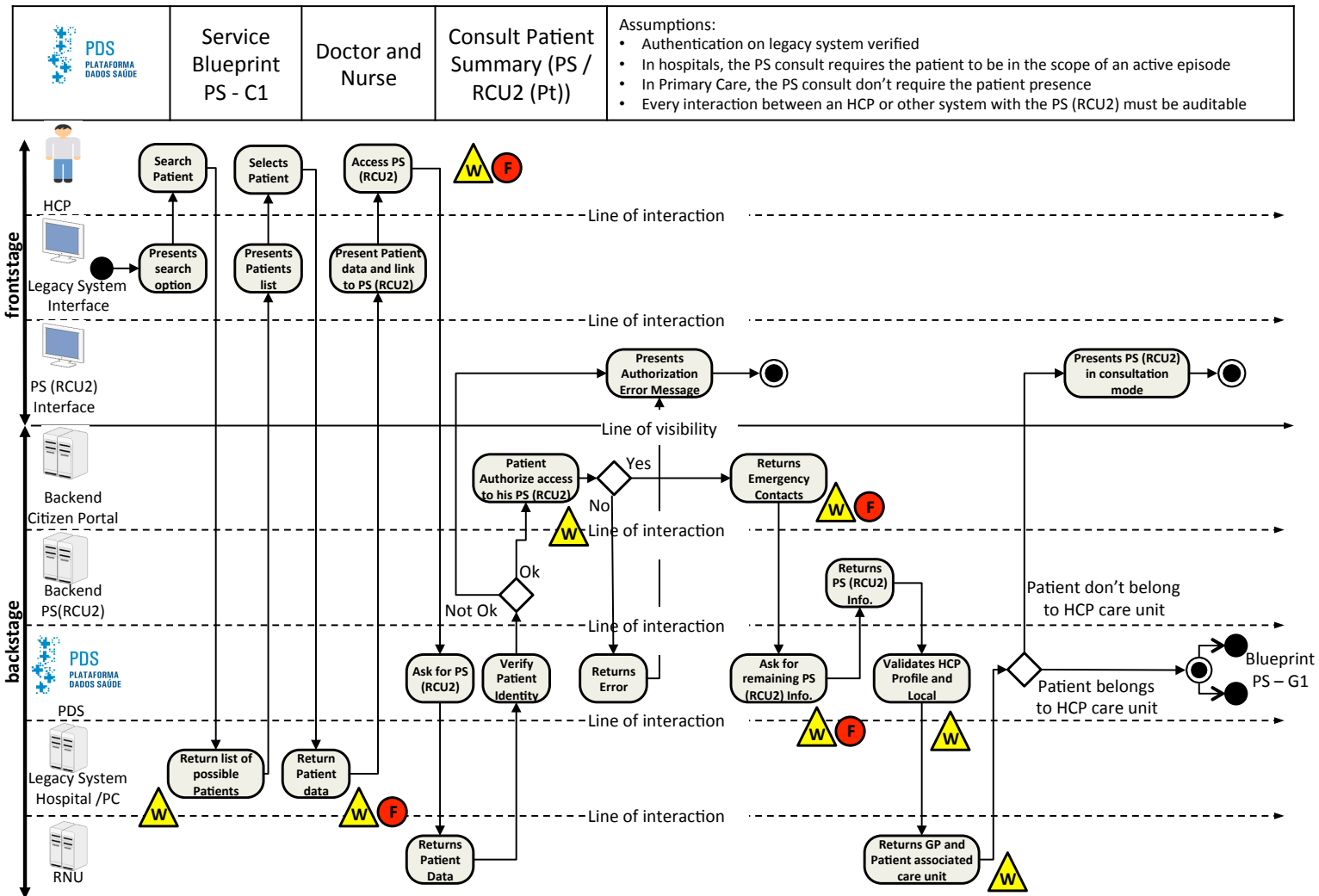


Fig. 11 - Consult Patient Summary SEB – Example of Doctor’s Perspective

Designing the service encounter using SEBs helped bridge the gap between the PDS service design and the PDS information system design. This tool also allowed PDS technical teams to identify the use cases (see Fig. 11) and build the data model for the PDS information System. For example, the Patient Summary's minimum data set (emergency contacts, allergies, vaccination, chronic medication, surgery discharge notes, etc.) was clearly identified (fields, data origin, data type) in the Patient Summary Interfaces document. Finally, this step helped identify the physical evidence that the PDS information system interfaces should provide to enhance the actor's PDS service experience. In the Patient Summary interfaces document, there is a section dedicated to the experience requirements of the different stakeholders. For example, the doctors always mentioned they would like to have direct information (or at least direct links) to the patient summary information, in the context of the usage of their current information systems.

## VII. RESEARCH AND MANAGERIAL IMPLICATIONS

The SD4VN method enables an integrated approach to designing complex services for value networks. SD4VN provides researchers and practitioners a method that allows understanding the value network with many-to-many relationships and translating this knowledge into new service concepts. The method contributes new design tools and integrated perspectives applied in complex service systems. Its application to designing the Portuguese EHR also contributes to establishing an integrated healthcare service system, with significant impact on the quality of health care.

### **A. Complex Services: From Characterization Tools to Design Tools**

There are several different tools and models that address the challenges of designing service systems in a multi-actor perspective, such as defining the value network (e.g., Stakeholder Mapping or Actor Network Mapping), understanding the actors experience (e.g., Customer Journeys, Customer experience modeling), designing the service at the actor level (e.g., Customer Value Constellation, Service System Architecture and Navigation, Service Experience Blueprints). However, literature is still scarce regarding tools and methods that address multi-actor network services (Ostrom et al. 2010), and current methods adopt the value network as a context and not a design space. SD4VN fills this gap by providing tools and concepts that can be operationalized in designing

services for value networks with interdependent actors. This method enables the definition of the value network (VNAM and VNRM) by comprehending the different views of each priority actor into a single diagram and detailing the interconnections between them. Then, based on this understanding it designs the service concept at the network level (MAVC) and the actor level (CVCs, interconnected SSAs, SSNs and SEBs, based on MAVC). All of these models take into account that the service is simultaneously co-created by multiple actors.

## **B. New Perspectives on Value Network Actor's Experiences**

This study also shows that different actors perceive the value co-creating dimensions differently (Pinho et al. 2014). These findings reinforce the need for acknowledging different interests of different actors (Gummesson 2007), going beyond the dyadic view to a network perspective where multiple actors contribute value and expect value in return (Gummesson and Mele 2010; McColl-Kennedy et al. 2012; Vargo and Lusch 2008). As such, the in-depth understanding of the value network actor's experience (in Step 2 of SD4VN) extends the McColl-Kennedy et al. (2012) scope of value co-creation beyond the customer's service network to a value network of multiple actors. The results of the qualitative study highlight the dynamic and mutable configuration of actors' roles and relationships across time, and their impact on value creation for themselves and other actors. As such, this study responds to the Vargo and Lusch (2011) call for investigating value creation from a dynamic, networked, and systems perspective, necessary to design a service for value networks.

## **C. Integrated design of the service concept at the network and actor level**

Traditional approaches to designing complex services break the system into small parts that reduce its complexity. By splitting the service into subsystems, designers and actors lose sight of the larger systemic context (Gummesson 2007). In a systemic approach, the service concept of the value network must consider all subsystems associated with the service being designed, and take into account that they have dynamic configurations that can suffer mutations. The service concept should describe the value that the service should provide to its clients (Patrício et al. 2011) and detail the different perspectives of

different actors that interact directly with the service, while taking into account their different needs and wants. Current service design methodologies do not fully address this level of complexity and still assume that there is a clear distinction between client (recipient) and the service provider, not taking into account the interrelationships between the different actors. Designing in such a complex environment requires a many-to-many perspective. This paper presents an evolution of current service design methods to address multi-actor environments at the network level, by considering the service concepts of each actor involved in a given activity, and designing a Customer Value Constellation for each one of them without losing the holistic view of the complete value constellation - Multiple Actor Value Constellation (MAVC).

#### **D. Improving Healthcare for societal well-being**

From a managerial perspective, this research enables improving healthcare by designing a national EHR service system that allows broadening patient access and improving personal health via PDS Citizen Portal. The Portuguese EHR simplifies healthcare practitioners' procedures by assuring integrated access to patients' healthcare information regardless of the time or locale of healthcare delivery (via PDS Professional Portal). The successful application of SD4VN to a large-scale project provided a rich understanding of the challenges of managing the service design process and indicates that SD4VN may be applied to other complex contexts. It is now possible for 41,000 healthcare practitioners (PDS 2014) to access accurate and meaningful information through the patient summary record provided by PDS. This EHR system is a foundation for huge improvements in patient safety, treatment effectiveness and sustainable healthcare. As such, this research shows how a service perspective and service design approaches can be applied to key sectors such as healthcare and how it can contribute to improve societal wellbeing.

### **VIII. CONCLUSION AND FUTURE RESEARCH**

This study adopted a design-science research approach to develop new methods for designing for complex service networks. Building upon the exploration of this conceptual domain, design-science research offered guidance for the iterative process of development and testing of the SD4VN method. Overall, this study designed and operationalized complex service systems. We hope the SD4VN method fosters empirical

research in this area and contributes to holistic service design and management approaches by taking into account the complex set of interconnections among actors in value networks.

This SD4VN research project establishes a foundation for understanding how new service design approaches can be successfully applied to designing value networks. The study findings may also be helpful for other service settings where complexity and many to many relationships are evident, such as social networks or logistics systems. The proliferation of complex service systems, where value emerges from the interactions among network members is a particularly rich setting for expanding this research.

This paper shows how a service perspective can make a key contribution to the evolution of healthcare information systems. Unlike other information systems, which are commonly considered successful if they meet a set of technical specifications and requirements, any healthcare service system can only be considered successful if it creates value for its users and providers. To be considered a successful service, a technology-based service such as an EHR must be used, well accepted and valued by its users. Metrics for evaluating a successful technology-based service should be based on the value created by the service, not just the success of its technical implementation. The human-centered and value co-creation focus of SD4VN were important for the successful adoption and use of the Portuguese EHR, and shows how a service approach can contribute to the successful development of information systems. We hope these results foster closer and fruitful collaboration between information systems and service research.

The EHR Service Design provided a holistic vision for what the EHR service should be globally and for each actor (Doctor, Nurse and Citizen) from the value network to the service encounter. As such, balanced centricity is put into practice through SD4VN. This avoids local optimizations and captures the whole healthcare value network perspective for designing an EHR information system, which is patient centric but does not forget the needs of the healthcare practitioners and the public organizations. From a transformative service research (TSR) perspective, this paper advances healthcare service research by providing a new method for designing complex services in a key TSR sector such healthcare. The Portuguese EHR contributes to a patient centered vision

and supports patient centered health care. For example, it is now possible for patients and healthcare professionals to access accurate and meaningful information through the patient summary record provided by PDS. This can foster improvements in patient safety, effectiveness and sustainability in healthcare. By improving health cares and ensuring balanced centricity, the SD4VN helps improve citizens' wellbeing.

This paper presents the development of the SD4VN approach as a system for designing services for complex value networks. However, many challenges remain in both health care and value networks. First, electronic health records can make a structural contribution to improve health care services and make them more patient centered, but health care challenges go well beyond that. Future research can explore how a service design approach can contribute to other areas of health care. Second, although health care is a fertile ground for studying complex service systems and value networks, it is not the only service sector facing these challenges. New studies can explore how the SD4VN approach can be applied to other service sectors functioning in value networks. Third, although the SD4VN approach addresses a new level of complexity – the value network – many organizations already devise their strategies taking into account whole ecosystems and try to play the keystone role. Future research can explore how service design can support the creation of service platforms for entire ecosystems. Overall, this paper represents a step towards tackling the increasing complexity of service systems and value networks, applied to the key health care sector. We hope this paper provides a foundation for further service research at the intersection of the key areas of service design, technology and healthcare perspectives that can have a powerful impact on societal wellbeing.

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## APENDIX 1

Table 2 - Qualitative Study Sample Description

Sample Design	Central Hospital	Private Hospital	Primary Care	Citizens/Organizations
Interviews	1 Doctor (CHVNG) 1 Nurse (CHVNG) 1 Pharmacist (CHVNG)			1 Citizen from Porto 1 Member of the Ministry of Health
Focus Groups	5 Doctors (CHLO)	2 Doctors (José Mello, Personal Office)	2 Doctors (Health Centers from ARS LVT)	
	7 Nurses (CHLO, CHLN)	3 Nurses (MAC)	1 Nurse (Health Center from ARS LVT)	
	4 Pharmacists (CHLO, FX, CHLO - EM, HGH)	2 Pharmacists (CUF - IS, CUF - Descobertas)	1 Pharmacist (Communitary - Lisbon)	
				8 Citizens from Lisbon
Interviews	1 Doctor (CHVNG) 1 Social Assistant (CHVNG)	1 Doctor (ML) 1 Nurse (ETG)	1 Pharmacist (Viseu) 1 Nurse (Viseu) 1 Doctor (Viseu)	1 Citizen (Viseu)

Table 3 - Participatory Design Sample Description

Sample Design	Doctors	Nurses	Citizens	Organizations	Total
Participatory Design Meetings	2 Doctors from Porto 1 Doctor from Lisbon	2 Nurses from Porto 1 Nurse from Madeira	3 Citizens from Porto	5 Members of University of Porto 6 Members of the Ministry of Health	20 Participants
Service Design Workshop - 1	2 Doctors from Porto 2 Doctor from Viseu 2 Doctor from Santarém	4 Nurses from Porto 1 Nurse from Madeira 3 Nurses from Lisbon	4 Citizens from Porto 1 Citizens from Vila Real 2 Citizens from Lisbon	5 Members of University of Porto 6 Members of the Ministry of Health	32 Participants
Service Design Workshop - 2	2 Doctors from Porto 2 Doctors from Viseu 2 Doctors from Santarém 1 Doctor from Lisbon	4 Nurses from Porto 1 Nurse from Madeira 3 Nurses from Lisbon	5 Citizens from Porto 1 Citizens from Vila Real 3 Citizens from Lisbon	5 Members of University of Porto 6 Members of the Ministry of Health	35 Participants

Table 4 – Follow-Up study Sample Description

Sample Design	Doctors	Nurses	Total
Interviews	7 Doctors from the Emergencies 1 Surgeon 2 Pediatricians 2 Urologists 3 internal medicine doctors 12 Primary care doctors	10 primary care nurses	37 Participants



## 5 Discussion and research contributions

The rapid expansion of human knowledge and the constant need of evolution led humanity to a point that in many situations cannot control or even measure their actions' impacts on the future. The world is complex and technology based services emerged as a tool to help humans address its complexity and satisfy their needs. However, most of the services have been developed to one or more customer segments, disregarding the impacts other actors may have on the service, or may be affected by that service. This ignores the premise of sustainability to avoid compromising the ability of future generations to meet their needs. The service community had defined sustainability, transformative services, and complex value network contexts as research priorities (Ostrom et al. 2010).

Based on both dissertation challenges and research objectives presented in Chapter 1, this thesis contributes to a better understanding of sustainability and its application to services and service design processes. Based on an in-depth understanding of value co-creation in complex services with many actors, the thesis also contributes to the development on a new method for designing services in value network contexts.

Extant sustainability and value co-creation research in the context of complex service systems is mostly conceptual, and literature on service design at the value network level is very limited. Many of the dissertation contributions are therefore related to the in-depth understanding of sustainability and value co-creation in empirical contexts. Conversely, overall research is scarce in what concerns the incorporation of this understanding in structured methods for designing services in value network contexts, and more specifically, in the application of these methods to complex environments such the Portuguese Electronic Health Record (EHR) service offering.

The healthcare context emerged as motivation during Stage 1 of the research, and the design of the Portuguese EHR was adopted as the empirical setting for Stages 2 and 3 that focused on value networks with multiple interrelated actors. The following subsections discuss the research contributions in more detail.

## **5.1 Understanding of Sustainability and its incorporation into services**

The design community has been aware of the need for designing sustainable services for a long time (Crul and Diehl 2006; Edvardsson and Enquist 2009). However, there is no consensus about how to incorporate sustainability into services. Stage 1 of the dissertation contributes an in-depth study of what service organizations mean by sustainability, their practices regarding sustainable service design and how they incorporate sustainability into their services.

Study results show that sustainability has become an important organizational concern. Organizations already incorporate sustainability in their mission and values, backstage operations, and in the creation of new services by transforming behaviors throughout the value network. However, the study reveals that these organizations lack methods for systematically incorporating sustainability into service design.

Stage 1 also contributes with a reference model to systematize the incorporation of sustainability in services at three levels: (1) internal backstage processes that promote sustainability but do not have a direct impact on the customer experience and the value network; (2) new service offerings, that decrease harmful impacts or create positive ones through service delivery processes or service support processes; and (3) value network initiatives that change behaviors beyond consumption of the services, promoting sustainability through organization's employees, their clients, suppliers and other stakeholders.

Results show that most of the organizations base their actions on the Triple Bottom Line principle (Elkington 2001; Elkington 1997), both in the "meaning, importance and drivers of sustainability" as well as in the sustainable initiatives. Stage 1 of the dissertation contributes to demonstrate that organizations which are part of complex service domains (such as healthcare, transports, and government) recognize the importance of acting as units integrated within a complex system and whose actions impact other units, and the importance of the dissemination of sustainability throughout the value network. At this point, the healthcare sector emerged as the motivational context for the research dissertation, where the social and economic pillars of sustainability were considered the most important.

Some authors propose incorporating sustainability into organizations' service ecosystems (Vargo and Lusch 2010) through values (in the sense of ideals), supporting long-term perspectives and the emergence of a more collaborative society and economy through transformative services and transformation design (Sangiorgi 2011). However, they do not provide specific guidelines regarding the concrete impact on new service development (NSD) (Edvardsson and Enquist 2009; Edvardsson, Enquist and Petros 2007). The qualitative study employed in Stage 1 provides service researchers new insights on sustainability meanings and practices. This can foster further research on developing new service design methods that lead to creating transformative services, aiming at promoting sustainable behaviors in organizations, their customers, and the entire value network.

## **5.2 Understanding value co-creation in complex services with many actors**

Designing services for complex value networks such as healthcare requires studying value co-creation phenomena. Although there are thorough conceptualizations of value co-creation in the service field, empirical applications showing the relationship and interaction phenomena from a multiple actor perspectives are scarce (Payne, Storbacka and Frow 2008; Woodruff and Flint 2006). This dissertation contributes an in-depth understanding of the value co-creation concept in complex environments with multiple actors, allowing (1) the operationalization of the value co-creation concept by identifying its factors and outcomes; and (2) comprehending how value co-creation for each actor depends on his/her own actions and the actions of other actors, in a complex set of interactions and interdependencies.

### **5.2.1 Value creation factors and outcomes**

Two types of value co-creation factors were identified in the study: one (classic view) representing attributes related to the dyadic value co-creation interactions with the service (Portuguese EHR), and the other representing service attributes that support value co-creation interactions and collaboration among the different actors in the value network (e.g. citizens, doctors, nurses). Classic value co-creation factors, such as availability, accessibility, and reliability (Parasuraman, Zeithaml and Berry 1988;

Parasuraman, Zeithaml and Malhotra 2005; Wolfinbarger and Gilly 2003) represent a limited perspective because they do not explicitly consider the contribution of the customer and the other actors involved in the network. Stage 2 of the dissertation provides empirical evidence of the second set of factors related to supporting interactions among actors (e.g. Facilitation of communication between healthcare practitioners, or Fast and easy access to information inside and across institutions). This brings new insights into value co-creation in network settings, corroborating that interactions have a key role in service provision and offer opportunities to foster value creation (Gummesson and Mele 2010).

Responding to the need for operationalizing the value co-creation concept in dynamic, networked and systems context (Vargo and Lusch 2011), benefits emerged (e.g. better healthcare provision, better diagnosis, increased patient safety, better decision support to healthcare management) as outcomes (consequences) of the value co-creation factors that take into account the interaction among the different actors and their interactions. For example, different healthcare professionals contribute for the patient EHR overtime. In a consultation episode, the doctor relies not only on the patient symptoms' description to make a diagnosis hypothesis, but also relies on the patient healthcare history he can access through the EHR service. Moreover, he can discuss the case with other doctors and prescribe more efficient treatments, contributing to increase patient safety. This constituted an empirical demonstration of the dynamic nature of value networks as actors constantly change their roles (may change from provider to consumer) and value is co-created in a flow over time. The identification of these factors and outcomes contributed to operationalizing value co-creation in value network contexts and to further developing this concept.

### **5.2.2 Value creation interdependencies**

Stage 2 of the dissertation empirically demonstrates the importance given by all actors in the EHR value network to the interactions and communication between different professionals and with the citizen. Building upon the new set of value co-creation factors that support the interaction among actors, study results highlighted the different nature of interdependencies among actors, meaning that value co-creation for one actor depends on the actions of other actors, as well as his or her own actions.

Three types of value co-creation interdependencies were identified: First, the dynamic role interdependency where the actor's role may change from value creator (e.g. when registering data to EHR) to beneficiary (e.g. when consulting the EHR). Second, the temporal interdependency where the benefit an actor gets today is dependent on what other actors did before (e.g. if a diagnosis requires an exam, the radiologist have to execute and insert the results in the system before the doctor can confirm the diagnosis). Finally, self-interdependency, meaning that value creation also depends on each actor's own actions. In other words, each actor plays an active role in co-creating the value they will benefit from (e.g. when a patient provides allergic information in his personal health record, which is accessible by the doctor, he is avoiding prescriptions that might provoke him an allergic reaction).

The study demonstrated the changing nature of actors' roles and relationships across time, and their impact on value creation for themselves and other actors, highlighting that value co-creation in value networks goes beyond the dyadic relationships between service providers and customers.

Overall, Stage 2 of the dissertation adopts a rich value network empirical environment such as healthcare, contributing to support previous conceptualizations of value-creation in a network of activities involving multiple actors (Gummesson 2007; Vargo and Lusch 2008). Overall, this stage contributed to operationalize and evolve current understanding of the concept of value co-creation supporting the development of a new method for designing services for value networks.

### **5.3 A new method for designing complex services in value network contexts**

Stage 3 of the dissertation contributes to service research with a new service design method - SD4VN - that allows understanding the value network with many-to-many relationships and translating this knowledge into new service concepts using new tools and models, in an integrated vision of designing the service concept at the network and actor level.

### **5.3.1 New tools for designing complex services**

Literature is scarce regarding tools and methods that address multi-actor network services (Ostrom et al. 2010). Several of these tools and methods address the challenges of designing service systems in a multi-actor perspective, such as defining the value network (Morelli and Tollestrup 2007; Reed et al. 2009), understanding the actors experience (Tax, Mccutcheon and Wilkinson 2013; Teixeira et al. 2012), or designing the service at the actor level (Patrício et al. 2011). However, they all assume the value network as a context and not a design space. Stage 3 of the dissertation fills this gap, providing researchers and practitioners a method (SD4VN) that allows understanding the value network with many-to-many relationships and translating this knowledge into new service concepts.

Compared with other service design methods, SD4VN enables the definition of the value network through Value Network Actor Mapping and Value Network Relationship Matrix, by integrating the different views of each priority actor into a single diagram and detailing the interconnections between them. Then, based on this understanding, SD4VN allows designing the service concept at the network level through Multiple Actor Value Constellation (MAVC) and at the actor level through a multi-level service design perspective (Patrício et al. 2011) based on MAVC and taking into account that the service is simultaneously co-created by multiple actors.

### **5.3.2 Integrated design of the service concept at the network level and actor level**

Traditional approaches to designing complex services break the system into small parts that reduce its complexity. By splitting the service into subsystems, designers and actors lose sight of the larger systemic context (Gummesson 2007). In a systemic approach, the service concept of the value network must consider all subsystems associated with the service being designed, and take into account the different perspectives of different actors that interact directly with the service, while taking into account their different needs and wants (assuring balanced centrality). Current service design methodologies do not fully address this level of complexity and still assume a dyadic perspective between client and the service provider, not taking into account the interrelationships between the different actors.

Stage 3 of the dissertation provides a key contribution for integrated design of service concepts both at the network and actor level, because SD4VN addresses complex value network environments considering the service concepts of each actor involved in a given activity, and designing a Customer Value Constellation for each one of them without losing the holistic view of the complete value constellation - Multiple Actor Value Constellation (MAVC). Overall, Stage 3 contributes to service research with new design tools and an integrated perspective (SD4VN ) applied to complex service systems and value networks.

## **5.4 Managerial Implications**

From a managerial perspective, Stage 1 of the research project provided organizations insights to incorporate sustainability in their services. The qualitative study discussion employed in Stage 2, allowed the different actors involved in the Portuguese EHR (Managers, Doctors, Citizens, Nurses, Pharmacists) better comprehend the value co-creation between them and the impact of each other actions in other actors and in the EHR service itself. This supported the application of the SD4VN method (Stage 3) in the context of the national EHR where consensus were needed (concerning requirements prioritization and requirements conflict management), to design the service concept at the network level. The following sub-sections detail the most relevant managerial contributions of each research stage.

### **5.4.1 Values resonance as a driver to sustainability**

The incorporation of the ethical dimension in new business models can foster values resonance (Edvardsson and Enquist 2009), which occurs when the values of customers and other stakeholders are in accordance with the core organizational values, the social and environmental values. The higher the congruence between customer's values and the service provider's values, the higher the customer loyalty (Mascarenhas, Kesavan and Bernacchi 2006). Stage 1 results provide managerial insights on the importance of defining and adopting strong sustainability values as drivers of resonance with their customers, supporting companies in pursuing their own values and fostering customer loyalty.

### **5.4.2 Value as a result of a dynamic view of value networks**

The qualitative study employed in Stage 2 has implications for service managers seeking to understand how actors participating in the network integrate resources and interact to co-create value. The study further evolves our knowledge about services provided in value network contexts, showing that instead of focusing on dyadic relationships with customers, companies should adopt a holistic perspective, taking into account that different actors perform different activities and integrate resources differently to co-create their service experience in a dynamic flow over time. These results also reinforce that companies, besides promoting value co-creation through direct interactions with their customers, should pay particular attention to how they can develop services as enablers for their customers to co-create value with other actors. Thus, Stage 2 offers insights on how companies can enhance their offering by facilitating value co-creation through resource integration among other actors in the value network.

### **5.4.3 Application of SD4VN in organizations' value network contexts**

Service design in the context of value networks is an under researched area and there is a lack of replicable methods to design services for multiple interconnected actors. Organizations in sectors such as healthcare, transportation or public administration, lack tools to help them face this level of complexity in a concrete manner. From a managerial perspective, stage 3 of this research dissertation, provides managers with a structured method (SD4VN) that can be used by organizations to expand their service portfolio in the context of value networks. SD4VN comprehends a set of integrated tools and models that are organized in a well defined process and have the potential to be applied by organizations operating in every sector that addresses value network realities.

## 6 Conclusions and future research

Sustainability has long become an important concern for humanity (United-Nations 1987) and in particular, the service research community (Ostrom et al. 2010). This dissertation started showing that organizations lack methods for systematically incorporating sustainability into service design, and provided insights to foster sustainability incorporation into services. The study also revealed that services provided in a value network context should be sustainable, and the complex systems nature of sustainability emerged as an important issue. This constituted the motivation for understanding value co-creation in value network contexts and developing a new method for designing services in this context.

Building upon the exploration of this conceptual domain, design science research offered guidance for the iterative process of development and testing of the Service Design for Value Networks (SD4VN) method. Overall, this stage of the dissertation designed and operationalized complex service systems in the context of the Portuguese Electronic Health Record. This dissertation, and in particular, SD4VN research project, contributes to holistic service design and management approaches, establishing a foundation for understanding how new service design approaches can be successfully applied to designing value networks, taking into account the complex set of interconnections among actors that must have their needs satisfied in a balanced centrality perspective (Gummesson 2007). It represents a step towards tackling the increasing complexity of service systems and value networks, applied to the key health care sector.

Despite the dissertation research contributions on the incorporation of sustainability in services, value co-creation in value network contexts, and an innovative approach to design services for value networks (SD4VN method); these contributions have some limitations and many challenges remain unaddressed.

First, the method was only applied in one context for a specific service sector (the design of a national Electronic Health Record), and it should be applied in other value network contexts in different service settings where complexity and many-to-many relationships are evident, such as social networks (Martins and Patrício 2013) or logistics systems.

The proliferation of complex service systems, where value emerges from the interactions among network members is a particularly rich setting for expanding this research.

Second, although the SD4VN approach addresses a new level of complexity – the value network – many organizations already formulate their strategies taking into account whole ecosystems and try to play the central role. According to Martins and Patricio (2013) companies capture value through different strategies involving provision platforms where customers co-create value sharing and getting information, selling and buying products and services and socializing with other actors. Future research can explore how service design can support the creation of service platforms for entire ecosystems, and not only for the healthcare sector.

Third, during the in-depth study of value co-creation from multiple actors' perspectives in the Portuguese EHR, the research focused on the four most relevant actors in the complex system (citizens, doctors, nurses and pharmacists), but throughout the interviews other relevant actors emerged, such as many different healthcare technicians, regulation agencies, or managers responsible for IT infrastructures. Further research should study and involve a broader set of actors, for a more holistic understanding of complex value networks in the healthcare context. This would allow leveraging balanced centrality among the actors and facilitating the service implementation.

Fourth, the Portuguese EHR contributed to improve health care services and make them more citizen centered. Still, many challenges remain unaddressed. Health care realities are changing around the world, due to various factors such as an aging population, demographic changes, the increase in chronic diseases (diabetes, hypertension or obesity), economic and political instability or the evolution of health technologies. Further research can contribute in this field to improve systems interoperability, promote more involvement of healthcare professionals in healthcare information projects, explore new big-data services taking advantage of the huge amount of information generated in both primary-care and hospital services, or create new technology enabled services that incentivize citizens to better take care of their health.

Finally, value networks are composed by complex and interconnected sub-systems of people, organizations, resources, regulations, and information, mostly supported by technology (Spohrer et al. 2007). The problem is that technology *per se* does not create value. In a traditional computer science perspective, an information system is considered

successful when they meet a set of technical specifications and requirements, and are installed and ready to be used. As future research, computer science must be complemented with a services perspective transforming technology in a value co-creation enabler, in tune with the service science movement (Spohrer and Maglio 2010). In other words, an information system can only be considered successful if it is used, well accepted and provide benefits for all the actors in the value network.

This research thesis demonstrates that is possible to integrate multi-disciplinary areas such as service design, computer science, sustainability and healthcare in, a unique perspective focused on providing powerful impacts in the health care sector, making it citizen centered, helping healthcare professionals' providing better diagnosis, and improving its sustainability. We hope this dissertation provides a foundation for further service research at the intersection of key multi-disciplinary areas, focusing on societal wellbeing and societal sustainability.



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