Customer-centric service innovation in health care: findings from a case study[1]

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Abstract

Purpose of the paper: Embracing a service based approach, the present study is aimed at investigating the development of a patient-centred service innovation and its rising in the actors' value networks.

Methodology: A qualitative analysis based on an extreme case study has been performed. The investigation delved on a leading company offering specialized solutions for the treatment of chronic kidney diseases.

Findings: The study shed lights on those factors (e.g. resource openness, resource sharing, resource recombination and institutions generation) that stimulate patients' disposition to identify co-creation opportunities, which effects span from micro, to meso and macro level.

Service innovation spreads its outcomes both for the involved actors and for the well-being of the whole health care service ecosystem.

Research limits: This paper was limited by the analysis of a single health care provider, which did not allow the generalizability of findings. Further research is needed to better understand this intriguing topic, in order to grasp the relationship between actor engagement and service innovation.

Practical implications: The logic underling this study highlighted the importance that patient engagement has at different ecosystem levels and its influence on the resource integration at the roots of service innovation. The understanding of these practices will support health care managers in finding new ways to engage patients in the improvement of personal and collective health services.

Originality of the paper: This work represents one of the first attempts to theoretically and empirically conceptualize health innovation embracing a service ecosystem perspective.

Key words: service innovation; healthcare; service ecosystem; value co-creation; patient engagement

1. Introduction

Innovation in services has paid growing attention to health care (Karniouchina *et al.*, 2014), which is characterized by several challenges such as the ageing of the population, the growth of chronic diseases and

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[1] The work is the result of all the authors' synergistic contribution. However, each author has dealt with some paragraphs more than others. More in detail: Alex Douglas has written paragraph 1, Maria Vincenza Ciasullo has written paragraph 2.1; section 3, 5 and 6; Silvia Cosimato has elaborated paragraphs 2.2, 2.3, and section 4.

changing lifestyles. A service-centred marketing approach is required to respond to these ever-changing social needs. Consequently, health providers should be more focused on finding novel ways to improve the value they offer to society. The literature (Corrigan, 2011) indicates that a personalized approach to medicine could lead to a better understanding of what patients really need. Therefore, the closer the interactions are, the more patients should act as experts to co-produce health-related services (Benzein *et al.*, 2008). To enable this, health organizations should embrace a patient-centred approach (McColl-Kennedy *et al.*, 2012; Kenett and Lavi, 2014) to make health care management open to patient involvement. However, this implies going beyond patient-provider interactions and to involve those multiple entities that populate the complex health care system (Sturmberg *et al.*, 2012). This approach should offer a global service, in which each entity participates to medical services creation and fruition, embracing a service-based view (Barile *et al.*, 2017). Thus, increasing interactions with patients opens up the possibility that health care organizations and other stakeholders' groups can create new opportunities for mutual value creation and foster service innovation integrating and applying their resources in new or different ways (Vargo and Lusch, 2011).

Service Dominant (SD) Logic goes beyond the traditional linear and technological approach to innovation, considering it different from a new offering and aimed at improving actor value co-creation (Michel *et al.*, 2008; Ordanini and Parasuraman, 2011). This perspective approaches innovation as the outcome of behaviours and interactions occurring between individuals and organizations, which cooperate to achieve mutual benefits. Therefore, service innovation should be investigated from a systemic and dynamic perspective, which grasps the complexity of health care service. In this sense, the service ecosystem approach (Vargo *et al.*, 2016) blurred the systems' boundaries, boosting the engagement of several actors in fulfilling customers' needs. A service ecosystem includes different service systems and is characterized by the ability to self-adjust and innovate through shared institutional logics (Vargo *et al.*, 2015).

Actor engagement, resource integration and value co-creation are the main features of service innovation, inextricably linked because resource integration relies on the ongoing combination of resources by actors (resource integrators) in co-creating value. Resource integration, which is at the core of value co-creation, calls for actors' engagement in service exchanges, thus when actors are not engaged resource integration does not occur and value cannot be co-created (Storbacka *et al.*, 2016).

Despite the growing interest in co-creation, the literature calls for better investigations into "What tools and processes enable effective co-creation" (Barczak, 2012; p. 356), encouraging the study of those practices (e.g. activities and interactions) that enhance the collaboration among users to foster service delivery processes. The health care service literature mainly focused on those activities and interactions of resource integration occurring in the patient-physicians dyad (McColl-Kennedy *et al.*, 2012). However, service innovation analysed as an outcome that contributes to the well-being of a health care service ecosystem is still in its infancy (Joiner and Lusch, 2016; Frow *et al.*, 2016); therefore, literature and

empirical evidence are scant. This study aims to fill this gap by investigating the development of a patient-centred service innovation and its rising in the actors' value networks. Three important contributions arouse from the overall study. First, it offers a more granular perspective on co-creation, trying to operationalize it, analysing the factors that stimulate patients' disposition towards the activation of their resources to identify co-creation opportunities. Second, it sheds lights on those mechanisms that foster the co-innovation between different actors. Finally, it highlights the way service innovation contributes to the well-being of actors and the service ecosystem.

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The remainder of the paper is organized as follows. The next section reviews the literature on service innovation and the case for patient engagement. Then, the theoretical model for service innovation used to analyse the selected case study is described. Next, research method and case study findings are presented and discussed. Finally, theoretical and practical implications are highlighted.

2. Theoretical background

2.1 Framing service innovation

The literature traditionally approached service innovation as a firm-centric process (Carlborg *et al.*, 2014) based on dyadic interactions which enable the rise of sequential value from innovation-creating firms to innovation-adopting customers (Akaka *et al.*, 2017). In this approach, firms' activities and results lead innovation towards the development of new products or processes. Most research on innovation set the success of new services at firm level, often focusing on the development of a new service or defining service innovation according to a process-based perspective (Gallouj and Windrum, 2009). Michel *et al.* (2008) approached service innovation as a change of customer role and of value-creation process. A synthesis approach to service innovation considered innovation and value creation not necessarily focused on services or products, technological or non-technological elements, but on how firms deal with customers' participation in a joint creation of value (Gallouj and Windrum, 2009). At the same time, the literature stretched the boundaries of service innovation beyond firms' activities, embracing an open approach based on the ongoing interactions between multiple actors, including customers and end-users (von Hippel 2007). Open innovation (Chesbrough, 2011) covers a range of externally cooperative models, such as value chain innovation (Sundbo and Toivonenn, 2011); user-driven innovation models (Von Hippel, 2007) and service innovation networks (Storbacka *et al.*, 2012). In service innovation networks, the traditional supplier-customer division becomes redundant (Vargo and Lush, 2011) because each actor seeks and provides resources at the same time; thus, all actors are resource integrators and as such, potential innovators. In a similar vein, a web of actors integrates resources in larger constellations through dynamically shaped activities (Gummesson and Mele, 2010). Therefore, innovations

represent the outcome of behaviours and interactions occurring between individuals and organizations (Edvardsson *et al.*, 2011) collaboratively and synergistically able to encourage the creation of new knowledge.

Scholars have paid great attention to ITs' influence in fostering the interaction between users and providers that lead to a better understanding of people's needs (Akaka *et al.*, 2016), highlighting how service innovation does not occur within firms, but in the wider ecosystem to which they belong.

To summarize, the literature underlined that innovation is "the outcome of innovation networks in which different agents cooperate to coproduce a service-based innovation result" whose key insight is "the critical role of a customers' co-creation perspective" (Rubalcaba *et al.*, 2012, p. 699). Scholars (Ordanini and Parasuraman, 2011) considered SD Logic able to grasp the emergence of service innovation combining services and goods in a comprehensive service view (Vargo and Lusch, 2008) consistent with the above-mentioned synthesis approach. In this sense, a service is the application of specialized competences (knowledge, skills, time and expertise) through deeds, processes and performances aimed at benefiting another entity or the entity itself. A relational process of offer-making (e.g. value propositions) sheds lights on customers and the resources they mutually share (Vargo and Lusch, 2008). Hence, the customer is no longer a passive actor, but an active part of the exchange process in which value co-creation occurs through resource integration episodes (Lusch and Vargo, 2006). Firms (or any other actors) cannot deliver value, but they can provide only the value propositions to several socio-economic actors who shape the expectations of value-in-use in a specific social context (Edvarsonn *et al.*, 2011). Therefore, service innovation represents the re-bundling of different resources beneficial to all actors in a given context who are always involved in a net in which the beneficiary is included (Lusch and Nambisan, 2015). The need for a systemic approach to service innovation empatizes the role of direct and indirect service exchanges (Chandler and Vargo, 2011) and institutions' ability to forge resource integration and value co-creation processes (Vargo and Akaka, 2012; Vargo *et al.*, 2016). Vargo *et al.* (2015) defined service ecosystems as dynamic value co-creation configurations of resources (e.g. service systems), including people, organizations, shared information and technology, internally and externally connected to other service systems through value propositions aimed at creating mutual value (Frow *et al.*, 2014). Therefore, service ecosystems represent communities of interacting actors who share and exchange their resources to adapt to the environment and co-evolve, making service ecosystems able to achieve a long-lasting well-being, constantly changing and adapting their structure (Vargo *et al.*, 2008; Baccarani and Cassia, 2017). So the service ecosystem approach lead to grasp its ability to self-adjust, face changes and survive (Lusch *et al.*, 2016) in environments where actors' agencies and institutions interact to create value for themselves and others (Wieland *et al.*, 2012; Taillard *et al.*, 2016). In service ecosystems, embedded social and economic actors are loosely coupled and included in sub-systems nested at three levels: micro, meso and macro. How different actors come together and are engaged in

service exchange contributes to service innovation and, consequently, to their viability and the ecosystem well-being.

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2.2 Patient engagement and resource integration for health service innovation

The shift from the traditional bio-medical model towards a patient-centred approach to care (Bergeson and Dean, 2006) led scholars to focus on patient engagement, putting patients' needs at the core of health services' design and delivery.

Embracing a service ecosystem view, the engagement of patients - which assumes different traits at each ecosystem level - acts as a motivational construct fundamental to value co-creation and to resource integration essential for service innovation (Storbacka *et al.*, 2016). The micro level is characterized by interactions between physicians and patients, who act as resource integrators combining operant (e.g. knowledge, skills) and operand resources (e.g. equipment, medicine, facilities, financial resources, etc.). These resources come from those health providers, public sources and social networks in which patients are embedded, from patients' personal knowledge, experience, and skills (Vargo and Lusch, 2011) or even from private sources, such as families, informal caregivers and friends. Patients are individually engaged in resources integration through specific co-created activities such as cooperating, sharing information, combining complementary therapies and co-learning (McColl-Kennedy *et al.*, 2012). Thus, individual and organizational health literacy, the willingness and desire to participate as well as well-trained professionals foster patients' engagement, improving their experiences, emotional and physical well-being (Coulter, 2012; Palumbo *et al.*, 2016). To summarize, at the micro level the engagement of patients is rooted in their contribution to enhance or renewing service encounters to improve service outcomes (e.g. experiences of care, enhanced service quality, satisfaction with care, motivation to adhere, trust in the clinicians and system, self-efficacy).

At the meso level, service innovation benefits come from those activities of resources integration which involve organizations (e.g. hospitals, clinics, hospital emergency units, care home, etc.) participating in wider networks and held together by their willingness to align their goals. These interactions also involve specific groups of the target population (e.g. patients' associations, families' associations, etc.), characterized by similar needs and demands. At this level, the engagement depends on their contribution in evaluating the design of new or renewed services in order to make them compliant with peoples' needs and able to offer better health outcomes (Cantù and Tzannis, 2016). However, institutions (e.g. shared rules, norms, values and beliefs, shared language) and institutional arrangements (e.g. sets of interdependent institutions) occurring at the meso level are fundamental to exploit the outcome achieved at micro level and to institutionalize service innovations at macro level (Storbacka *et al.*, 2016). Institutions as "socially embedded systems of rules" (Hodgson, 2006, p. 8) offer a structure for resource integration and value co-creation in service ecosystems (Vargo and Akaka, 2012). Therefore, institutions and institutional arrangements lead actors to a shared view of the environment

in which they interact. The above-mentioned social mechanisms foster resource integration that at the meso level can change the extant resources configuration to co-produce solutions able to make generic and specific health care services more efficient and effective.

At the macro level, complex networks of relationships arise, aimed at shaping a viable co-creating environment in which state health authorities and other organizations contribute to spread in the market and in society's new services. Here too, patients acting as engaged citizens offer insights that public institutions can use to frame new practices. At this level, patient engagement can occur through the involvement of societal institutions or organization, such as the ethical committee, which is called upon to pronounce about the ethical or non-ethical orientation of an innovation. Patients' engagement occurring at all ecosystem levels led to re-conceptualize the patient-provider relationship, making the patient a real co-creating actor.

Finally, literature suggests that patient engagement is boosted by ICTs, which facilitate actors' interactions, fostering open information sharing able to reduce the information asymmetry that traditionally affects patient-provider interactions (Barile *et al.*, 2014).

2.3 A framework for service innovation

Dealing with service innovation, Lusch and Nambisan (2015) developed a theoretical framework based on *service platform, value co-creation processes and service ecosystem.*

Organizations should design their offerings as service platforms that foster daily service exchange and the emergence of new scalable solutions. In this way, service platforms promote the capture of value-in-use experienced by customers. Thus, rebuilding value propositions and making them compliant with ever-changing customer's needs implies knowing customers' value-in-use.

A service platform is layered, modular and based on multiple actors' interactions intended to share tangible and intangible resources. It is built upon those service encounters that occur at the micro level. In this sense, service platform, firstly, enhances resource liquefaction as the opportunity to extract knowledge from its primary source (e.g. customer value experienced) and to recombine it with other resources to create innovation opportunities. Secondly, they enhance resource density or "the degree to which mobilization of resources for a 'time/space/actor' unit can take place" (Normann, 2001, p. 27). The highest resource density occurs when at a given place and time "an actor provides and integrates all the resources necessary to co-create the best value in that context" (Lusch *et al.*, 2010, p. 23). Customers can assume different roles in the development of a service platform. They can perform as "correspondent", providing information that often contributes to the development of new ideas and solutions or to improve the existing service (Edvardsson *et al.*, 2011), or as "ideator", adding to firm knowledge about their contextual needs and integrating it with knowledge about how they use existing market offerings to envision new services (Lusch and Nambisan, 2015).

Value co-creation processes describe the complex interconnected activities that lead to a supportive resource integration in a wide actors' network settled at the meso level of a service ecosystem. The activities at the core of value co-creation focus on actors' different roles and responsibilities which sustain the understanding of a service context. Consequently, they should be built upon a cross-sectorial collaboration based on shared rules, norms of reciprocity, trust, empathy and mutual beneficial interactions occurring in the actors' value network. Customers can play different roles such as "correspondent, tester, and dreamer" (Edvardsson *et al.*, 2011) or even "reflective practitioner" (Lusch and Nambisan, 2015).

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A service ecosystem puts emphasis on common principles intended as shared institutional logics which facilitate resource integration, the re-bundling between all the involved actors and the enhancement of ecosystem well-being. According to Chandler and Vargo (2011) "the notion of service ecosystem is a fundamental aspect of value co-creation because it acknowledges how large-scale social structures and institutions evolve relative to the individual service efforts of actors, dyads, triads, and complex networks" (p.10). Moreover, to support the maintenance of those shared institutional logics that act as coordination mechanisms in actors' behaviours (Barile *et al.*, 2016) the authors advocated the co-construction of a common mind-set. This approach takes the systemic view of innovation, grasping the influence of the micro, meso and macro levels of interaction and institutions in value creation (Vargo and Lusch, 2016). This emphasizes that the flexibility and the adaptability, typical of service ecosystems, allow the engagement of different configurations of actors, who proactively create innovation opportunities.

3. Research objectives and methodology

This study aims at investigating the development of a patient-centred service innovation and its rising in the actors' value networks. Therefore, the main questions this study points to answer are:

RQ1: How can patients engage in improving health care services?
RQ2: How can health care organizations integrate actors' specific resources with their own resources to design new medical solutions?
RQ3: How can service innovations enhance ecosystems' well-being?

To this end, a case study was implemented (Yin, 2003). This qualitative methodology was chosen because of its suitability for practice-oriented research and for answering the "how" research questions (Baxter and Jack, 2008); thus, it fosters a better understanding of complex social phenomena such as the multi-actor contribution to service innovation in healthcare. To deal with the complex reality of management studies, qualitative methodologies are superior to quantitative (Gummesson, 2006). Using a non-probabilistic technique (Newman, 2000) and choosing a purposing case, Fresenius Medical Care was selected, because of its long-standing patient-centric innovative approach to dialysis services.

3.1 The Case Company

Fresenius Medical Care started in Germany in 1912 as a pharmaceutical manufacturer. In the 1960s, as haemodialysis was beginning to be adopted, it developed the infusion solutions for dialysis treatment. Fresenius became the world's largest producer of dialysis equipment due to ongoing R&D activities'. The success of the company came from its ability to develop value-added solutions, offering integrated services aimed at improving the overall quality of care. Although Fresenius is still a main provider of dialysis machines, about 75% of its revenues come from the services it provides. Currently, the company is active in more than 120 countries, served through a global network consisting of about 110,000 employees (medical and non-medical staff) and an actors' network characterized by interdisciplinary skills including biotechnology, ICTs and engineering. The case company, building on its strategy of a patient-centred approach to care, developed a broad collaboration network of international public/private organizations for the treatment of renal diseases.

3.2 Data Collection

Several data collection methods were combined according to Eisenhardt's (1989) suggestions. In particular, our analysis performed both a desktop study and a field analysis. Drawing on Dul and Hak's (2008) insights, multiple techniques were used to collect empirical data. A desktop analysis of documentation was performed, including corporate reports, handbooks, brochures and scientific papers provided by the case company or accessed via its corporate web site and social networks.

The sources of the empirical findings were 20 semi-structured interviews conducted to obtain a deeper understanding of the observed phenomenon. Interviewees included managers from Fresenius and from partner companies, medical and non-medical staff, patients and peers (family members, friends, colleagues). The interviews were administered through a set of questions and conducted on the interviewees' premises. Initially, the company executives (general manager, human resources manager, marketing manager, service manager, R&D manager) were interviewed to get a general perspective on the company's strategic orientation towards innovation. Then, actors embedded in Fresenius value network were interviewed (service manager, innovation manager, R&D manager). To obtain information about the way innovation was built, implemented and experienced, some medical and non-medical staff as well as patient representatives were approached. Open questions were used to encourage the interviewees to participate in an open dialogue with the interviewers. The interviews lasted, on average, 45 minutes, the data was captured on tape and then transcribed. Before starting data collection, a research protocol was prepared to organize data into digital worksheets and allow the authors individually and independently to analyse them.

3.3 Data Analysis

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The case study was analysed adapting the Lusch and Nambisan (2015) conceptual framework of service innovation (see Tab.1).

An iterative coding process and theoretical categories were implemented. The categories, used to classify data, were derived from Lusch and Nambisan's (2015) key themes to improve their comparability. However, initial codes resulting from the above-mentioned conceptual framework were progressively defined according to the data obtained during the interviews. To ensure research reliability, data were triangulated; thus, the coding process was iterative, being based on the classification, testing and redefining of gathered data through a critical and mutual debate between the authors. All collected data and information were critically examined and a research report was written. Finally, specific categories were derived from the overall coding process as showed in the next section.

Tab. 1: The key themes of patient-centered service innovation

Key Themes	Aims and Actions	Ecosystem level
Service platforms - Tangible and intangible resources - Rules/protocols for enhancing resource exchange in the service encounter - Emerging value proposition	*Strategic aim to enable customer engagement*	Micro level
Service processes - Mechanisms for enhancing resource integration in the service value network - Actors' roles and responsibilities - Knowledge transparency - Adapting processes/activities	*Strategic aim to enable actor value network engagement*	Meso level
Service ecosystem - Structural flexibility and integrity - Institutional logic (e.g. rules, norms, laws, regulations, meanings, etc.) - Systemic service culture and management	*Strategic aim to enhance a common mindset based on mutual value creation processes*	Macro level

Source: adapted from Lusch and Nambisan, 2015.

4. Findings

4.1 The rise of patient-centred service innovation

The service platform

The case company developed a strategic approach to the ongoing renewal of its offering to improve the well-being of kidney patients. To do that Fresenius based its approach to innovation on a real and ongoing dialogue and cooperation among its medical staff, patients and peers. A network of patients was engaged not only in a physical but also in an online environment thanks to a digital platform. In particular, it fostered

resources exchanges among medical and non-medical staff, patients and their families, enabling them to share traditional anamnestic information (e.g. the history of vascular access, clinical tests and analyses, the hospitalization history, the drugs therapies, etc.) and those related to social and psychological responses to treatments. The platform is layered on three main channels: 1) the "social channel", enabled by digital tools that allows physicians, patients and peers to communicate and share information about medical and non-medical experiences; 2) the "informative channel", enabled by and integrated information system offering data relevant to the everyday life of patients and peers; 3) the "operative channel", characterized by digital records able to report and manage each step of care path and some ancillary functions (e.g. scheduled time, appointments management, etc.) to customize dialysis treatments.

The discussions about everyday exchange among medical and non-medical staff, patients and peers revealed that emotions, trust and assurance influenced patients and their caregivers' experiences. A young girl reported:

"I know I'm ill, but since my first time at the clinic I feel somewhat better, less lonely and sad. I think it is because of my doctors. They're great guys. I can always talk to them, also staying at home. I can ring them and ask for some advice, but I can also chat with them. I really feel that they are there for me".

Another patient declared:

"Since I started the dialysis my life turned bad. I feel constrained in too many of my daily activities. I have to be careful about the diet, the pressure, to not push too hard. But I just wish to go out for a dinner with my wife or do sport. Could someone give me some advices? Which sport should I do?"

Physical and psychological experiences led some patients to share, via online chat and forum, feelings like pain, uncertainty, fear, hope and even happiness felt during the treatments. One patient reported:

"I wrote a post on the forum telling how I felt during my dialyses. I have to say that it was very hard for me to lie down on the bed. I felt powerless, bored and lonely. It was horrible. I think that the comfort of the clinic environment should be improved, allowing us to sit on a couch, use our mobiles or tablets, read a book or talk to our caregivers. What about it?"

The wife of another patient put it this way:

"We found that dialysis infusions and drugs smelt very bad. This terrible smell followed my husband and me in the clinic and even at home. I thought I smelled it everywhere. I tried to support my husband, but he felt sick and exhausted. He told me he can't resist, but there was nothing that I could do for him. It was a horrible day. I felt helpless and useless".

On the other hand, a nurse said:

"It was very hard to support a suffering adolescent. He said 'I hate this hospital; because I can't do my things, chat with my friend'. He felt like he was stuck in bed. What struck me was that the boy considered the dialysis room

an 'alien spacecraft'. I think we should strive to find solution to relieve both physical and psychological symptoms".

Service Processes

Experiences occurred at the micro level led the case company to critically think about them and evaluate the need for new medical solutions. Drawing on the experiences of physicians, patients and peers, Fresenius general management decided to revise their haemodiafiltration therapy. To do this the active participation of some business organizations belonging to different industries (e.g. biotechnology, medical engineering, ICTs) and some other non-business organizations (e.g. nephrologists' association and kidney patients and families' associations) was necessary.

The coordination and collaboration with value network actors were fostered by regular open dialogues, meetings and by assembling coordination teams. Moreover, the digital platform represented the environment in which all the actors exchanged and shared information enhancing resource integration. In this way, the prototype of the new haemodiafiltration service was co-designed. The Fresenius R&D manager reported:

> *"The integration of patients' needs in our research activities led us to rethink the whole haemodiafiltration service. The desire to give our patients a normal life, led us to seek a solution able to make their kidneys as close as possible to natural functioning ones. Therefore, we rethought the haemodiafiltration service in order to enable it to remove a higher rate of fluids, lowering the cardiovascular risks. This idea arising from patients' requirements called for the contribution of different competences that we were, fortunately, capable of sharing with our partners. The result of our long-lasting collaborative efforts was the haemodiafiltration online".*

Two main components characterized the innovation; the first related to the technical and medical dimension and the second to the psychological and social dimension. The first one was developed due to knowledge sharing among biotech, medical engineering and ICTs companies, who co-designed the new service through ongoing experiments. The innovation manager of a medical engineering company stated:

> *"We daily worked together with several practitioners to rethink the haemodiafiltration and developed the haemodiafiltration online. The innovation arose from our knowledge sharing, competences and skills that performed better in terms not only of uremic molecules removal, but also of machine design, which completely removed the risk of accidental torsions or knots in hematic lines. In this way, we improved the overall safety of dialysis treatment".*

Supporting the previous statement, the R&D manager of the biotech company said:

> *"We designed and developed more effective middle molecules removal, reproducing high-flux membranes. We supported the technological advancement of dialysis machines, enhancing the structure of the membranes used for blood filtration, making their layers and the support region wider*

as well as making them much more bio-friendly. We developed a next-gen membrane, the Helixone, whose innovation lies in its ability to retain the good molecules such as the albumin. Finally, we worked on the smell of the dialysis fluids; thus, we made them better, correcting their typically acrid smell".

The second dimension of the haemodiafiltration online was co-designed due to the contribution of the network of kidney clinics, public hospitals, nephrologists' association and kidney patients and families' associations. The ICT company supported them in co-designing new ancillary activities aimed at offering physical and psychological support during the treatment. ICT's service manager reported:

"Reading the patients' and careers' posts on the forum and sharing my impression with other researchers, we understood that patients' needs and anxieties are often related to their emotional state and to the way they 'feel' the treatment. In fact, they complained of feeling that the clinic was a place of suffering and that they were passive targets of unknown treatments and tools. To reduce the stress level that negatively affects patients' response to treatments, we designed a system for their ongoing monitoring based on sensors connected to the haemodiafiltration machine and to the digital platform. These sensors measure and record patients' stress levels during the treatment, in order to reduce it".

Software engineers updated the management software of the haemodiafiltration machines. This new software release connected patients to the digital platform through touch screen monitors and tablets, enabling real-time medical and non-medical data recording. Some nephrologists belonging to their professional association tested the software; one of them stated:

"When I used the tablet and the touch screen monitor I understood that all my wishes had come true. I could monitor fluids infusion and filtration parameters as well as those related to the patient's physic and psychological response to the treatment. I felt very relieved, because these devices let me choose to manually or automatically start the machine, reducing the possible complications, included the most dangerous cardiovascular ones".

All the activities that led to the development of haemodiafiltration online actively involved both physicians and patients in designing the innovation. Indeed, they agreed to test each component of the service concept step by step, offering suggestions for the development of new ideas. A member of the kidney patients' association pointed out:

"I found the couch for my treatment uncomfortable. I think doctors should use more ergonomic couches or armchairs and, if possible, with a specific support for the arm with the vascular access in order to make the treatment less hard and invasive".

In a similar manner, a female patient stated:

"I found the couch not so bad, but what I need is a support for my mobile, laptop and iPad. Yes, I always have them all with me. Just another

little thing, please, I'd like to listen to some music during my three hours of treatment".

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The psychological and social component of the haemodiafiltration online was enhanced reassembled the medical team. In fact, some psychologists were added to assist emotionally fragile patients. Fresenius general manager stated:

"Patients' experience is deeply influenced by their psychological state, so I understood that the solution was offering our weakest patients constant and emphatic support, thanks to the action of a psychologist, who will assist them during the treatment".

Finally, a systemic mind-set inspired the case company to tighten partnerships with other service providers to offer a more effective daily well-being to patients. Some collaborative agreements were defined with companies active in tourism and hospitality sector. These actors (hotels, resorts, B&B, restaurants, etc.) shared Fresenius' mind-set and dedicated some of their internal areas to haemodiafiltration online machines.

Service Ecosystem

The conjoint efforts that occurred at the micro and the meso level influenced the wider societal level. Institutional actors such as the Ministry of National Health and the State Medical Board approved Fresenius' innovation, finding it compliant with the current sector-specific standards and regulations. The Regional director of the State Medical Board stated:

"Analysing the new dialysis service, we found it very interesting that patients were actively involved in the whole process of innovation. We have also positively evaluated the rethinking of the medical staff, which now involves a psychologist for supporting patients better. Thus, our positive judgement is based on the previous considerations and the new service complying with current regulations".

At the macro level, actors' engagement, their alignment towards shared goals and the deep collaboration that occurred at the micro and meso levels led to develop a new care protocol, then implemented by several other public and private health providers. For example, in Italy, the Bolognini hospital currently runs the dialysis service according to this protocol. In summary, the service innovation fostered the market success of the case company and its partners who developed new competences and skills in their own businesses and in the treatment of kidney diseases.

5. Discussions

The case study findings offered some additional insights on how resources are recombined at the various eco-system levels, shaping the social context that enables service innovation (See tab.2). At the micro level, findings highlighted a growing self-disclosure among patients' networks and their disposition to share sensitive health information. This

was possible due to non-planned processes enabled by the digital platform, which activated patients' silent resources on a physical, psychological, emotional and relational level. Thus, using its dynamic functions, patients and peers could share information about medical and personal experiences, which fostered cooperation between them and health professionals negating space, time and/or social status constrains.

Tab. 2: The emergence of patient-centered service innovation

Key Themes	Aims and Actions	Ecosystem level
Service platforms - Co-experience in service encounter - Rules/protocols for enhancing resource exchanges in service encounters - Emerging value propositions	*Re-conceptualize the patient role to explore value proposition considering patient as a co-ideator* - Activation of silent resources - Non planned process	Micro level
Service processes - Mechanisms for enhancing resource integration in the service value network - Actors' roles and responsibilities - Knowledge transparency - Adapting processes/activities	*Re-defining the critical interfaces supporting actors' interaction to develop value propositions considering patient as a co-innovator* - Integrate information system that acts as interface to share knowledge in the network - Patient centricity - Ongoing experiment to co-innovate in a reflective, experiential and systemic way	Meso level
Service ecosystem - Structural flexibility and integrity - Institutional logic (e.g. rules, norms, laws, regulations, meanings, etc.) - Systemic service culture and management	*Institutionalizing in the market and society the co-developed value propositions* - Open regional group - Sector-specific laws, regulations and standards perceived as guide - Common and systemic service culture spread across the whole value network through cooperation and co-development experiments	Macro level

Source: Our elaboration

Information sharing fostered by the digital platform also supported medical professionals, who could learn about patients and peers' feelings (e.g. sadness, loneliness, powerlessness, etc.) perceptions (e.g. side effects from a medication), emotions and attitudes toward medical services (Ugolini *et al.*, 2014). Therefore, at the micro level the co-experience (Prahalad and Ramaswamy, 2004) in the service encounter was shared in patients and peers' networks and, contextually, learned by health professionals (Nambisan and Nambisan, 2009), paving the way for creating innovation in service. This led to change patients' roles, as they become co-ideators of new services, sharing their experiences to create new knowledge. Thus, knowledge-for-knowledge exchanges boosted new or more effective responses to the demands of actors involved in the service

encounter (Osei-Frimpong and Owusu-Frimpong, 2015). However, service innovation arises in complex value networks, which at the meso level are characterized by the interaction between service systems characterized by different skills and core competences that in health care are fundamental to generate innovations (Jaakkola and Jakanen, 2013). Findings showed that the cooperation between different actors - e.g. biotechnology, medical engineering, ICT companies, nephrologists' associations and kidney patients and families associations - supported the case company in co-designing the haemodiafiltration online.

The interactions between these actors were supported by an easy access to resources that made them capable at synergistically integrating biomedical, technological and psychological skills. The easy access to resources was a fundamental driver of their disposition to be engaged. Actor engagement was also fostered by their common mind-set. In a real and virtual environment, the exchange and combination of actors' knowledge, experience and expertise fostered the bundling of new and superior resources. Resource integration was promoted by regular open dialogues, meetings and by the implementation of coordination teams. Therefore, the digital platform allowed resource liquefaction, enabling the intertwining of virtual and physical layers of communication in order to support the shaping of new social connections that opened up to innovation opportunities. In fact, the functionalities of the digital platform led actors to co-design the prototype of the new haemodiafiltration service, making the dialysis patient-oriented. With the shared purpose of improving patient well-being in terms of physical and psychological state, the actors' network co-developed the new dialysis treatment. In summary, learning from the physical and social context in which patients lived, they developed an innovation complying with personal and collective interests (Fisher and Smith, 2011). The new treatment was focused not only on patients, but also on the physical and social context they belonged in order to improve the quality of life of the whole community.

The interfaces rethinking supported actors' interactions enabling the conjoint development of the new value proposition. These interfaces sustained also the co-design of the new service, enabling patients to act as co-innovators (Mele *et al.*, 2014). Indeed, patients and physicians, acted as "testers", using their experience to evaluate the obtained results, simulating several situations and the related contexts of use (Edvardsson *et al.*, 2011). In this way, ongoing experiments enabled knowledge sharing between patients, physicians and all actors involved in the value network, co-innovating in a systemic manner.

Finally, at the macro level, the results of activities and interactions occurring at the previous levels have been institutionalized in the new care protocol for the treatment of kidney diseases. In fact, this innovation became a current medical practice and is now adopted by other public and private health providers. State organizations and authorities performed as innovation intermediaries (Lusch and Nambisan, 2015), acting as "carriers" (Lappalainen *et al.*, 2012) and supporting the spread of the new haemodiafiltration service into the health service ecosystem.

6. Conclusions and further remarks

This study supported a deeper understanding of the ongoing transformation of patient-centric service innovation in actors' networks according to an institutional logic. Together with service research in the health care context and Lusch and Nambisan (2015) conceptual framework on service innovation, empirical research led to discuss and contextualize it in dialysis service. This has advanced the understanding of the systemic and non-deterministic nature of innovation, which lies upon actors' disposition towards resource integration (Pinho *et al.*, 2014) and the way actors' activities are coordinated and adapted to each other. In this direction, the digital platform has mediated social space, supporting the rising of connection opportunities between all the involved actors. More in depth, the platform fosters an open communication between the actors, making them capable at better generating value-in-use, facilitating resource openness, resource sharing, resource recombination and, finally, institutions generation between and within the intertwined ecosystem levels.

Patients' disposition to co-create rises from a path of community identification, which led members to felt gradually themselves as an integral part of it, gaining social legitimacy, emotional support, help and friendliness.

All these factors are nourished by a feeling of safety reinforced by those social relationships that make community members active participants willing to share their experiences and discuss about their health status. The sharing of these experiences led patients' network to a self-disclosure towards the health service, which led them to assume a more conscious behaviour and to self-manage their illness, care and daily life. All these factors nourished members' willingness, making them even more knowledgeable, skilled and self-efficient. In other words, this process was at the core not only of the emergence of social benefits, but also of a valuable knowhow that make individuals open to share their knowledge and expertise. From the health professionals' side, the platform made them able to join patients, families and peers in an ongoing learning process, supported by a deeper individualized knowledge of patient behaviours and a high medical and non-medical staff commitment with the service. This implied their attitude to be informative and empathic with patients, creating a tie that goes beyond the mere professional relationship, enabled their agency.

Resources recombination, pointing to create new and higher level ones, required the involvement of actors' network in closer collaborations fostered by the easy access to resources that the digital platform enhance. An integrated information system acted as a specific interface to share and create new knowledge in the actors' network through ongoing experiments aiming to co-innovate in a reflective, experiential and systemic way (Witell *et al.*, 2015). The patients' network was actively engaged through specific interfaces that facilitated the sharing of their experiences and their participation in the co-design, co-development and co-delivery of the new service. The engagement of the patients' network led them to be partners

of multi-disciplinary teams, paving the way for a shared decision-making. Therefore, they were considered as real co-creating actors, performing as experts that together with the service providers offered ideas and insights to rethink and renewing health service. According to an institutional logic and embracing a service ecosystem orientation, service innovation relies on a systemic service culture, intended as a fundamental informal mechanism, which makes that social change launched by the innovation meaningful. The co-developed value proposition was institutionalized in the market and in society becoming an effective innovation.

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Customer-centric service innovation in health care: findings from a case study

The main findings let to consider service innovation as rising from the interplay between micro, meso and macro ecosystem level, which mutually influence each other. This influence is evident from micro to meso and macro as well as downwards from macro to meso and micro. Thus, the study, thanks to an empirical explication, contributes to a better understanding of the antecedents for service innovation in healthcare, offering a more granular vision of value co-creation practices (activities and interactions). Therefore, service innovation arises from service networks including not only the dyad health provider-patient, but also other service systems both private (e.g. families, peers, biotechnology, medical engineering companies, etc.) and public (e.g. nephrologists' association, Ministry of National Health, etc.). In this way, the interactions occurring among and within the intertwined levels contributed to the emergence of the service innovation, which is the outcome of value co-creation practices and contributed to each actor's well-being and at the same time to ecosystem viability, nourished by the generation of new institutions.

Previous research explored the conceptual domain of this topic, but empirical studies are still lacking (Beirao *et al.*, 2017). This led to a main theoretical implication according to which this qualitative study adds to the development of midrange theories (Brodie *et al.*, 2011; Vargo and Lusch, 2017; Vargo *et al.*, 2017) linking the high-level SD Logic conceptual perspective with specific empirical findings in health care context. More specifically, the study empirically advances service theory, further developing the practice to better understand the empirical features of value co-creation operationalizing it. In particular, the study sheds lights on the involved actors, resource exchanged and social mechanisms that supported by technology foster the co-innovation process. This led to consider technology as the outcome of social practices and at the same time the input for their renewal (Vargo and Lusch, 2016).

From a managerial point of view, findings can support health service managers in fostering patients' engagement in service outcomes' improvement. In particular, service managers might be inspired from the analysed findings grasping those factors which boost patients' empowerment in order to encourage value co-creation activities and, in this way, achieve patient satisfaction. Digital platforms pave the way for service innovation opportunities, so this implies that service managers should integrate, people, technologies, process and information (Maglio *et al.*, 2009). Understanding how service innovation influences the different actors involved and the whole ecosystem is important. Therefore, service managers should zoom in to understand and enhance, at each ecosystem

level, resource integration activities and zoom out to grasp the way each level boost and shape the others. More in detail, health service organizations should grasp the importance of resource integration occurring within and across levels and the way it might be improved. Last but not least, the understanding of the enablers for service innovation can support managers to better elaborate relational strategies for stimulating actor's engagement and for establishing meaningful relationships to challenge the complexity of health care service.

Despite the contributions outlined above, this study is somewhat limited by the investigation of a single case study referred to a chronic disease. Therefore, additional research should investigate the factors that stimulate the engagement of patients' service networks in non-chronic illnesses, as in the case of acute diseases. Finally, even though the results of this paper support the current use of technologies (e.g. ITCs platforms) to increase the opportunities for service innovation, further research is needed to better understand organizational, social, legal and ethical barriers that affect the complex health care service system. In this direction, some open questions emerge. How to involve patients (e.g. elder, ethnic minorities or patients' simply reluctant) that are unwilling to use health technologies? How to limit technologies' intrusiveness in patients' life? How health professionals should protect personal and sensitive information? What are the main ethical implications that health professional should consider approaching service innovation?

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