# Conceptualizing service innovation archetypes as antecedents of the healthcare service ecosystem well-being

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## Abstract

This manuscript aims to investigate how service innovation, detected in terms of value co-creation (Helkkula et al., 2018), may support decision-makers in equilibrating resources and challenges during crises (Finsterwalder and Kupplewieser, 2020) to guarantee healthcare service ecosystem well-being (Frow et al., 2019).

A literature review on service innovation and service ecosystem is carried out to integrate these two theoretical frameworks into a unifying research agenda empirically drawn by analyzing an illustration case: RicovAI-19 pilot project.

Service innovation in healthcare may depend on the integration of multiple archetypes: the introduction of a new technology, new ways of providing healthcare services based on data-driven healthcare decisions, personalization, a new shared approach to health system and precision medicine. These archetypes may support an efficient balance of the available resources and Covid-19 challenges and may be considered as possible antecedents of the key characteristics for the healthcare service ecosystem well-being also because they contribute to modify and improve the co-creation factors of value in healthcare.

Health decision-makers can pursue healthcare service ecosystem well-being through a value-centric service innovation, based on the synthesis of four archetypes.

This work proposes an integrated analysis of service innovation and healthcare service ecosystem well-being, by investigating the cause-effect relationships between them.

## Keywords

artificial intelligence; service innovation archetypes; service ecosystem well-being; resources-challenges equilibrium; value co-creation factors

## 1. Introduction

The equilibrium of a system can be disturbed by shock events or critical incidents capable of causing an interruption in the provision of the service and undermining its vitality. The health system the covid-19 pandemic resulted in a critical incident, threatening the collapse of hospital facilities with consequent negative externalities for the community as a whole. To manage these criticalities, systems need to be flexible, agile and fluid, and able to transform and adapt flexibly to the new conditions imposed by the context, generating new conditions of vitality internally through the reconfiguration or new combinations of actors and resources (Kuppelwieser and Finsterwalder, 2016). The motivation for this contribution lies in the need to contribute to the literature on this subject by investigating, in an integrated way, the attributes of service innovation and the characteristics of the service ecosystem well-being to understand if one could enable the other and whether service innovation can be considered as a solution to support healthcare systems in maintaining their viability and being resilient to the adversities caused by the accident.

An attempt was therefore made to answer the following research question:

**R.Q.:** Can the four archetypes of service innovation be considered antecedents of the six well-being characteristics of a service ecosystem?

The paper starts by defining the theoretical framework (par.2), based on value-centric service innovation (Helkkula et al., 2018) and service ecosystem well-being (Beirão et al., 2017; Frow et al., 2019; Finsterwalder and Kuppelwieser, 2020). Next, the healthcare context is described as a service ecosystem and some innovative drivers are identified (par.3). In the fourth paragraph, an illustration case is presented (par.3), the pilot project RicovAI-19, to understand, with an inductive approach and by observing practical evidence, if the elements that may contribute to service innovation, in this case, may be considered as value co-creation enabling factors and antecedents of the key characteristics of service innovation well-being (par.5). Finally, non-conclusive considerations are described (par.6).

The paper contributes to the theoretical advances in the area of service innovation in the context of SES by continuously moving from theory to practice for describing it within the healthcare context. After the theoretical conceptualization of service innovation in this context achieved using the service ecosystem lens, the illustration case helps to understand, in practice, how real situations and conditions effectively confirm the assumptions of scholars and practitioners about institutions and institutional arrangements in the understanding and use of innovation and how innovation may support the health system in pursuing well-being and viability.

## 2. Theoretical framework

A review of the literature on service innovation is carried out, which is deepened by the approach proposed by Helkkula et al. (2018) based on the integration of four archetypes, and on service ecosystem (Vargo and Lusch, 2016), focusing on service ecosystem well-being (Beirão et al., 2017; Frow et al., 2019; Finsterwalder and Kuppelwieser, 2020) and the enabling factors of value co-creation (Beirão et al., 2017), in order to integrate these two theoretical frameworks in a research agenda unifying in the next paragraph.

*2.1 Service ecosystem*

The service ecosystem is a dynamic and changing concept, reconfigurable, emerging thanks to the different ways of integrating resources, aimed at the co-creation of value (Wieland et al.,

2012), pursued by the actors involved (Lusch et al., 2016), which are linked together by value propositions.

The service ecosystem is an autonomous and self-regulating system (Vargo and Lusch, 2016) characterized by a network of interacting actors stratified and nested within three ecosystem levels: micro, meso and macro (Vargo and Lusch, 2016). Actors collaborate and integrate resources according to agreements, sharing mutual interests (Polese et al., 2017a), with the aim of pursuing a collective well-being (Vargo and Lusch, 2017) through the pursuit of the individual well-being of each actor (Kuppelwieser and Finsterwalder, 2016). The purpose of the service eco-system is to pursue a condition of individual well-being that can contribute to the pursuit of general well-being (Vargo and Lusch, 2017).

The functioning of the service ecosystem depends on coordination mechanisms called institutions. Institutions, traditionally understood as sets of rules that convey social interactions between actors, provided that the rules are known and shared by the actors that make up that specific context and assume the characteristics of a constraint, are here understood as emerging social practices that modify behavior. human resources, which regulate and coordinate the behavior of each actor in the process of integrating resources (Vargo and Akaka, 2012).

Institutions are emerging social practices that modify human behavior, not established and pre-established structures to manage human action (Wieland et al., 2016), but tacit rules, symbols, meanings, tacit "rules of the game" (Koskela-Huotari and Vargo, 2016), which regulate the interactions between actors. The set of institutions makes up the institutional agreements, or provisions, that favor coordination between the different levels of the eco-service system (Vargo et al., 2015).

The service ecosystem presupposes a shared intentionality, in fact the development of shared intentions allows the collective agency and it is precisely the sharing of intentions that guides the emergence of the service ecosystem (Polese et al., 2021) through distinct dynamic levels (Taillard et al., 2016).

Actors are attracted to sharing their resources, responding to value propositions that offer potentially more advantageous results. The ecosystem is dynamic because the resources are shared, which allows the players to be able to change their availability and attractiveness. The practices of co-creation in ecosystems allow to shift attention from dyadic interactions to multiple ones, capturing the evolution of the ecosystem and concern the integration of resources, which alters the service ecosystem by impacting on subsequent interactions aimed at resource integration.

In a service ecosystem, the access, the sharing and the recombination of resources together with the monitoring of resources and institutions are considered as value co-creation factors (Beirão et al., 2017).

*2.1.1 Service ecosystem well-being*

The service ecosystem well-being is a dynamic state that occurs when there is a configurational adaptation of resources integration practices (Frow et al., 2019). The more agile, flexible and fluid the service ecosystem is and the greater its transformation capacity, the more easily, in the event of critical incidents, it will adapt, restore, grow and balance challenges with resources to regain balance and allow more fairness between actors and their resources-challenges equilibrium (RCE) (Finsterwalder and Kuppelwieser, 2020).

Each incident, capable of affecting the well-being of a service ecosystem, poses challenges in terms of resources, skills and knowledge. All resource pools between the interconnected levels, as all challenges, require different levels of resource integration and value co-creation.

If the ecosystem can adapt to disturbances and demonstrates integrative properties, the various nested layers support and adapt to each other.

The micro-level of the ecosystem contains the individual actors who interact to co-create value in a sphere of co-creation of value. This sphere represents a space that allows for a cognitively, psychologically, physically and socially safe interaction. The sphere of each actor is his RCE which depends on the increase or decrease of challenges or resources. While each RCE signals individual well-being, the collective well-being of the unity of the two actors is defined (Finsterwalder and Kuppelwieser, 2020). The meso-level affects well-being at the community level (Gallan et al., 2019). The individual well-being of the actors that make up this level is located at the micro level but their individual well-being could be connected to, or influence, the collective well-being of the immediately higher level, and this could require intervention, and use of resources, by the actors placed at the macro level. The macro-level refers to the overall social and public value (Meynhardt et al., 2016) and well-being as well as the well-being of the actors who govern entire ecosystems of services. The well-being of society is facilitated by a government and its agencies that support the well-being of the community and the individual at the meso and micro levels.

A new or substantially improved worldview, which may involve new institutions and resource supplementary practices, is a crucial way to improve the well-being and vitality of a service ecosystem (Frow et al., 2019).

Frow et al. (2019) identify six key characteristics of the service ecosystem well-being:
- the well-being of the ecosystem is improved when the practices reach an aligned configurational adaptation;
- the well-being of the ecosystem is strengthened by institutional agreements deliberately guided by a shared vision of the world;
- the well-being of the ecosystem is supported by ecosystem levels that reinforce, co-evolve and self-regulate iteratively;
- the well-being of the ecosystem is strengthened by the resilience of the ecosystem and the ability to adapt to perturbations;
- the emergency occurs through the adoption of flexible practices by actors who integrate the resources;
- the well-being of the ecosystem is the result of the co-creation of a shared value.

However, in service ecosystems value co-creation can be understood as a lever to improve the well-being of the system and can be assessed based on its adaptability (Vargo et al., 2008). For this reason, Beirão et al. (2017) identify value co-creation factors, such as access to resources, resource sharing, resource recombination, resource monitoring, and governance/institution generation, and believe they enable actors to integrate resources into multiple dynamic interactions favoring the density of resources, facilitating the coordination and co-evolution of the ecosystem, contributing to the well-being and vitality of the ecosystem as a whole.

*2.2 Service innovation*
The scientific debate on innovation begins with the studies of Schumpeter (1934) who understood innovation as a combination of new and existing knowledge suitable for the development of new useful ideas to be proposed to the market (Suroso and Azis, 2015), distinguishing it from the concept of invention, which may be intended as an idea, a projection to improve a product or service. Tuominen and Toivonen (2011) defined service innovation as a new service, capable of renewing an existing one, which offers advantages to the organization that developed it. Skålén et al. (2015) extend the definition of service innovation to include the development and implementation of results as well. Today innovation is increasingly associated with the function of encouraging companies in pursuing and maintaining their survival, through the achievement of a competitive advantage (Damanpour, 2010).

From a traditional perspective, the only possible source of innovation was the company and innovation was characterized by its internal processes.

Coombs and Miles (2000) have provided an important contribution aimed at identifying the differences in the basic hypotheses on service innovation, in three research perspectives: assimilation, distinction and synthesis. Bryson and Monnoyer (2004) called it a technological approach, assuming that innovation in the service sector is fundamentally similar to the innovation of manufacturing and technology-based firms (Gummesson et al., 2014). Service companies are considered passive recipients of innovations from other sectors (Witell et al., 2016), services are not considered innovative, but the innovation is closely linked to the adoption of new technologies. Researchers investigating the concept of distinction have focused attention on the peculiarities of service output and processes underlying the intangible nature of services and the need to conceptualize innovation models specifically designed for services (Nijssen et al., 2006).

The synthesis perspective, on the other hand, refers to an integrated perspective, which is not limited to technological innovations only, starting to emphasize the importance of defining new combinations of more accessible resources. and strategic compared to previous solutions. This emphasizes the multidimensional nature of service innovation. A convergence between goods and services is beginning, in production as well as in consumption. Innovation, in this perspective, can refer to both technological innovation and non-technological innovation that involves, for example, a change in the organizational model (Bon and Mustafa, 2013). Innovation in organizational terms, for example, implies that the decision maker is always able to analyze his own context of reference, in order to be able to seize opportunities (Yeh-Yun Lin and Yi-Ching Chen, 2007) and establish, with it, economically viable relationships (Tidd and Bessant, 2018).

According to this approach, in fact, service innovation is achieved through a fruitful combination of technological elements, social relations, organizational adjustments and commercial interactions, based on a human-centered perspective (Yu and Sangiorgi, 2018).

The synthesis perspective of innovation lays the foundations for understanding innovation according to Service-Dominant Logic: service innovation refers to a networked approach to innovation (Vargo et al., 2015), according to which innovation can no longer be considered as the result of a dyadic perspective, referred to the supplier-customer relationship (Lusch and Nambisan, 2015), does not take place through a linear sequence of actions, with single actors incorporated in an integrated path of activities but in a broader perspective, through a process of practical recombination of resources, where existing value propositions are modified through a process of integrating existing resources or by inventing new resources (Åkesson et al., 2016). The integration of resources between actors is understood as the main activity that allows the emergence of innovation (Colurcio et al., 2017). Innovation requires openness on the part of companies and continuous collaborations with their own context in order to expand the density of resources (Caridà et al., 2017), functional for the integration of resources, through cooperative practices, fundamental foundations for co-creating value and co-innovating.

Taivonen and Kijima (2019) argue that innovation involves the creation, renewal and transformation of pre-existing knowledge in a process that allows the design or even re-definition of value propositions.

Koskela-Huotari et al. (2016) state that innovation does not manifest itself when a new product is introduced into a market or a new service provided (traditional perspective) but when its introduction determines new practices and institutionalized solutions to co-create value among the players. Institutionalization, understood as maintenance, disintegration, change of institution, is the process underlying innovation (Vargo et al., 2015), useful for solving problems, developing new forms of knowledge and also implementing new and more effective ones. technological components starting from value co-creation processes (Akaka et al., 2017).

Technology, therefore, does not appear important as a tool, but as an operant resource (Akaka and Vargo, 2014) which, acting with other resources, is able to provide new knowledge and new solutions, therefore the moment in which a new idea is proposed, but when the practices of generation, supply and use of this new idea become common and shared, then when, in order to pursue the co-creation of value between actors, new practices and solutions become institutionalized (Koskela- Huotari et al., 2016) and allow the realization of new value propositions and new SES (Kaartemo et al., 2018).

According to traditional literature, on the subject of innovation, there were specific distinct roles to be considered in the innovation process: the innovative entrepreneur opposed the adopting or non-adopting consumer (Laukkanen, 2016). According to the SD logic, all actors are equal in that they are all co-creators of value and integrators of resources (Vargo and Lusch, 2008) and the same principle of co-creation of value applies, it is not possible to understand the two actors as isolated and solely influenced by the counterpart of the exchange, but it is necessary to intend, also for innovation, a multi-part and multi-form contribution.

The focus is therefore on the end user (Helkkula et al., 2018), recipient of the value proposition: the recognition by the customer of proposals considered innovative, as effective new ways of satisfying individual needs, means the offer, in innovative power, proposed by the company, is effectively recognized as such and adopted by the consumer (Flint, 2006). Consumers effectively become co-innovators.

In general, the value of technology depends on the perception of the individual actors called to use it and therefore, as well as for value, its effectiveness also depends on the resources they already hold (Wieland et al., 2018). Indeed, people can assign different meanings to technology, based on the resources they hold, based on personal, social and contextual perceptions (Edvardsson et al., 2018).

*2.2.1 Service innovation archetypes*

Helkkula et al., (2018) describe the four archetypes of value-centric service innovation: output-based archetype, process-based archetype; experiential archetype; systemic archetype.

The archetypes of service innovation based on output and processes are based on the traditional approach of describing innovation and market logic.

According to the output-based archetype, service innovation is a measurable output, a new service or new product, acquired by customers with effects in terms of value-in-exchange.

Similarly, the process-based archetype assimilates service innovation to a new way of delivering output to the customer, with effects in terms of value-in-use.

Drawing on the transition from a GD logic to an SD logic, the nature of service innovation has shaped two further emerging archetypes: experiential and systemic.

Experiential archetype derives from the idea that experience is something differently and subjectively perceived and understood by individuals. Each actor is subjectively engaged in service innovation, experiencing and co-creating value according to his experience, and service innovation is considered as an improvement in a single value-in-experience.

Lastly, the systemic archetype focuses on the integration of resources by actors in service ecosystems. service innovation is the result of the development of a new value proposition and new institutionalized solutions, with effects in terms of value-in-context.

**3 Healthcare service ecosystem well-being and service innovation**

The national healthcare system (NHS) can be understood as a service ecosystem (Polese and Carrubbo, 2016) as it embeds a set of interrelated actors (e.g. patients, families, scientific

communities, doctors, hospitals, Ministries, Drug agencies, Hospitals, Health Residences, etc.) who interact, according to their specific tasks and the activities they perform, from diagnosis to treatment, to rehabilitation, with the ultimate goal of protecting public health; it is a set of resources such as skills, knowledge, tools, technologies, regulations, connected by value propositions in a network of relationships (Frow et al., 2016). In this ecosystem, the patient is at the center of a network of relationships between interconnected actors through value propositions based on the integration of resources, and information flows linked to the various health services (Polese et al., 2018).

Healthcare actors are nested on each level and they can access different resources at each level. The various levels are linked by value propositions, which offer the actors access to resources that contribute to the service ecosystem well-being and the well-being of each possibly related ecosystem.

In recent years there has been an increasing complexity, given by new ways of interaction between multiple actors and unexpected negative events (such as Covid-19). This complexity forced healthcare decision-makers to seek new solutions (Badr et al., 2021) that could balance resources and challenges during crises (Finsterwalder and Kuppelwieser, 2020).

This has led to the start of a health system restructuring process, to satisfy the need to effectively allocate scarce resources (Castellana, 2012), driven by a contextual health system digitization process. The need for data is increasingly strong. The healthcare system is today increasingly centred on the patient (Lapão, 2019) and aimed at implementing predictive governance models based on decision-making processes more increasingly data-driven thanks to real-time information. Data, if correctly interpreted, provide knowledge (Troisi et al., 2020) and allow health decision-makers to understand the behavior of individuals (Barile et al., 2017), favoring a more effective interaction with them (Breidbach and Maglio, 2016), with consequent patient engagement and empowerment due to the personalization of health services.

Consistent with the modern market and marketing logic, according to which consumers are no longer understood as passive recipients of an offer (Payne et al., 2008), patients, as consumers, may be considered integrators of resources and value co-creators, for example, the successful management of chronic diseases is closely related to the collaboration between doctor and patient (Berry and Bendapudi, 2007). Patient engagement and empowerment can stimulate co-creative events in healthcare through fruitful cooperation and a doctor/patient co-learning process (McColl-Kennedy et al., 2012). This positive interaction depends on an effective exchange of information and information depends on data. Patient data can provide healthcare facilities with valuable information as doctors, who are called upon to make analytical and sophisticated decisions, can exploit it to intervene in an increasingly timely manner (Sakr and Elgammal, 2016). Data collection and analysis can improve overall performance (Manogaran et al., 2018) and response times (Dautov et al., 2019), but specific skills are required, a combination of different smart information systems (Pramanik et al., 2017), and a better design of a shared database, data storage, extraction data, data processing, to favor of a more functional, versatile, scalable and contextual health system (Frow et al., 2016) and potentially viable (Polese et al., 2017b).

However, as previously clarified, service innovation does not occur simply through the introduction of a new technology or a new digitalization process, but it occurs when new solutions or resource integration practices become institutionalized (Koskela-Huotari et al., 2016).

Helkkula et al. (2018) propose a value-centric service innovation perspective and argue that service innovation is not reducible to output, process, experience or system (each archetype) but takes place through an integration of these four archetypes with effects in terms of improving the potential for co-creation of value.

Service innovation, in healthcare, may depend on the integration of multiple archetypes and different factors, as shown in the Figure 1.

**Figure 1. Service innovation path in healthcare context**

| | Output-Based Archetype | Process-Based Archetype | Experiential Archetype | Systemic Archetype |
|---|---|---|---|---|
| | Product innovation management | New service development, operations management | Phenomenological (experientially determined) value | Social systems, living systems |
| Focus | Attributes of the service innovation (e.g., new technology) | The service innovation process; architectural elements (phases) of the customer's service consumption | Actors' experiences while using the service and in the wider phenomenological context, extending beyond a specific service innovation | Resource integration by actors engaged in the service ecosystem |
| Description of service innovation in healthcare context | The adoption of new technological solutions to design an offering not previously available | A change in the service creation: new ways of designing healthcare based on data-driven healthcare decisions | The personalization of the care that can improve the experience of the consumer/patient | A reconfiguration of resources, actors and institutional structures to enable service innovation also through a new shared approach to the healthcare system and precision medicine |

*Source: authors' elaboration from Helkkula et al., 2018*

The introduction of new technological solutions (output-based archetype) upgrades the healthcare offer by introducing new digital elements and new necessary skills applied both for the provision of the healthcare service and for access, with effects in terms of value-in-exchange. A change in the service provision process is instead determined by new ways of providing healthcare services, based on data-driven decisions (process-based archetype), with implications in terms of value-in-use. The new ways of providing health services based on data mean that health services can be increasingly personalized, thus favoring the involvement and empowerment of the patient, who is increasingly informed and aware of his or her state of health (experiential archetype), with effects in terms of value-in-experience, laying the foundations for the realization of precision medicine. But, for this to be fully realized, it is necessary to attract resources from multiple ecosystem levels to reconfigure resourceness, actors and institutional structures, through a multi-part, multi-actor and multi-level contribution, possible only under a shared new vision of health (systemic archetype) with implications in terms of value-in-context.

## 4 Illustration case: RicovAI-19

RicovAI-19 is a pilot project proposed by Almawave, a leading Italian company in Artificial Intelligence (AI), natural language analysis and Big Data services, in collaboration with Ancona Ospedali Riuniti, Marche University Polytechnic, ASUR Marche, and the companies Vivisol and Aditech. With RicovAI-19 they propose a feasibility study, interventional and non-pharmacological, and clinical experimentation, to understand how Artificial Intelligence can concretely support the heterogeneous series of healthcare actors, from patients to doctors, to hospitals, placed on more ecosystem levels, in the complex challenge of fighting the Covid-19 pandemic.

RicovAI-19 is a potentially innovative system, capable of perfectly integrating technological and scientific evolutions with local health needs and laying the foundations for medicine of tomorrow in which diagnostics, artificial intelligence, advanced prognostics, remote assistance, are integrated to put forward a new vision of medicine and health in general.

A sensor detects a series of symptomatic patient data, which are then conveyed to a dedicated app:
- body temperature;
- blood pressure;
- oxygen saturation;
- breath frequency.

The artificial intelligence engine interprets all data and information acquired in real-time which are then evaluated based on the 67 predefined clinical parameters for the calculation of a *clinical stability index*. This indicator, via the app, is made available to the primary care physician, the control room doctor and the hospital doctor, to evaluate any clinical actions and plan the most

appropriate clinical and therapeutic path, built on the needs of each patient, realizing a continuous and effective integration between hospitals and local healthcare, built based on a timely and effective doctor-patient relationship.

RicovAI-19 represents a driver on which to act to develop a sustainable, efficient and support model of territorial healthcare, of personalized and integrated medicine that adds prognostic support to diagnostic support thanks to the real-time understanding of the clinical parameters of the symptomatic patient, thanks to artificial intelligence, support for the doctor and strategically for improving the quality of life of individuals. It is believed that this model can be applied in multiple healthcare areas capable of enhancing the value proposition offered by local healthcare, for the benefit of citizens and doctors and the entire reference community.

Artificial intelligence technologies implemented as part of RicovAI-19 can support the development and spread of precision medicine. The project, as shown in the figure below (Figure 2), is based on some fundamental principles such as promptness, sharing, personalization, continuity and precision.

**Figure 2. RicovAI-19 design**



*Source: www.almawave.it* 10
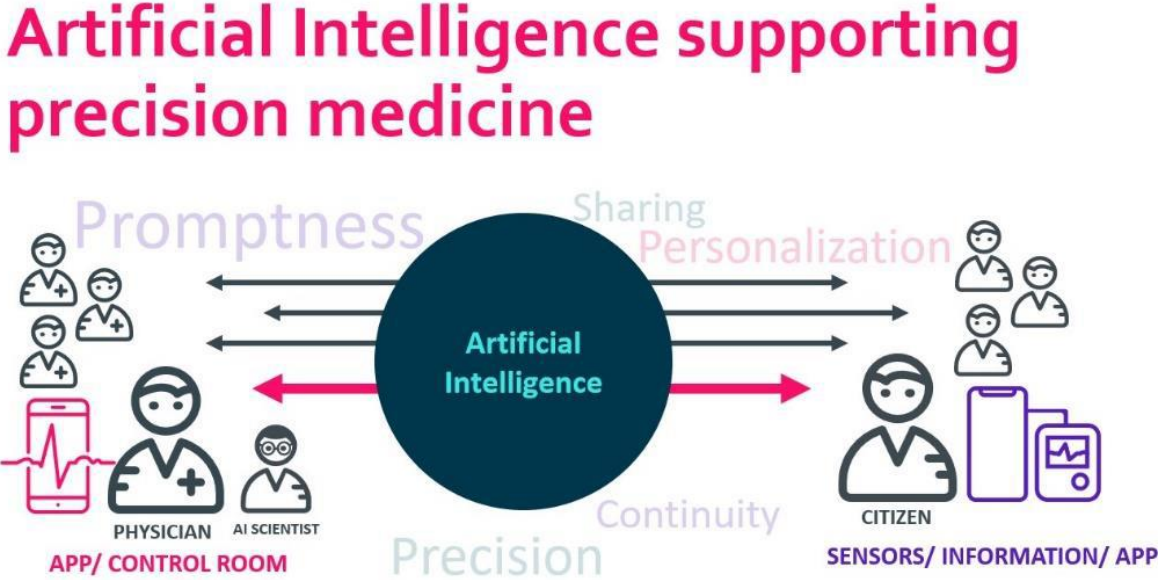
## 5 Discussion and research agenda

RicovAI-19 is a pilot project capable of generating service innovation with effects on the healthcare service ecosystem.

As explained in the following figure (Figure 3), the innovation stimulated in the healthcare context with RicovAI-19 can be described by identifying the archetypes of service innovation with implications in terms of value co-creation.

**Figure 3. RicovAI-19 inputs for service innovation in healthcare**

| Archetypes-Service Innovation | Service innovation in healthcare | RicovAI-19 findings | Innovation-Insights | Service ecosystem-Insights |
|---|---|---|---|---|
| Output-Based Archetype of Service Innovation.<br><br>*Value-in-exchange* implications. | Introduction of a new technology. | Artificial Intelligence in healthcare. | A new digital solution has been introduced in a context where it has not been used until now. | This result has redefined the mere logic of exchange between actors, retraining the dyadic relationships between doctor and patient considering a new value proposition. |
| Process-Based Archetype of Service Innovation.<br><br>*Value-in-use* implications. | New ways of providing health service based on data-driven decisions. | Exchange of information and data between doctor and patient (sharing) to design a more efficient and effective health care service provision process (promptness). | The introduction of new technologies has generated a new way of providing health services. This implies the need to consider new resources not considered before and the possibility of revising existing value propositions through the integration of new resources (e.g. data). | This result implies new players, new roles (e.g. control room), new specialist skills and new professional figures are required (e.g. data analysts) and new relationships have been sealed. |
| Experiential Archetype of Service Innovation.<br><br>*Value-in-experience* implications. | Personalization. | Personalization and continuity. | The innovation is given by the genesis of an increasingly personalized value proposition and concerns the consumer/patient experience of consumption. All the attention is focused on the patient and therefore the concept of offer and service traditionally understood and of optimization of the service supply process is overcome, but a co-creative perspective is favored. | The processed data, which have helped to review the decision-making process that leads to the provision of the health service, lays the foundations for the creation of a timely and personalized proposal, determines an increasingly customer-based and customer-oriented approach in order to provide the patient with an experience increasingly consistent with his actual needs |
| Systemic Archetype of Service Innovation.<br><br>*Value-in-context* implications. | A new shared approach to healthcare system (multi-part, multi-actor and multi-level). | Precision medicine. | According to Service-Dominant logic innovation depends on institutions so it is important to focus on institutionalization. Innovation does not occur when a new idea or product is introduced, but when new practices and solutions become institutionalized. Institutionalization is the process behind innovation. | The new technology imposes and requires a cultural change in the way of relating and interacting between the various interconnected actors. Each actor, on the basis of his own resources, will have to remodel himself according to the new logics that regulate the methods of integration of resources. Technology has spawned new institutions. |

*Source: authors' elaboration*

The introduction of a new digital solution, based on artificial intelligence technologies, provides healthcare professionals with the possibility of modifying and upgrading the healthcare offer, with effects in terms of exchange value given that a proposal was previously unavailable for the patient. The introduction of the new technology, however, would also entail a requalification of the process of providing healthcare services as it would now be based on data-driven decisions, but this entails the definition of new roles, the identification of new players, with new skills. specialists and holders of new resources. The new process achievable thanks to the new technology, however, is based on data and information sharing by the patients to doctors; this would help to make the provision of healthcare services more effective and efficient in compliance with a principle of promptness. These new practices would generate insights in terms of value in use, then in terms of value emerged through change related to the process of applying new ideas or existing ideas following different methods.

The possibility of overturning the process of providing healthcare services, basing it on data, contributes to making the patient-centered healthcare service more and more with the possibility of making the care continue to personalize. The personalization of care would have positive effects in terms of value-in-experience as it would modify the patient's approach to healthcare making him

increasingly aware and influential, thus contributing to patient empowerment (Polese and Carrubbo, 2016).

The new technology imposes a cultural change in the way of relating and interacting between the actors, with repercussions in terms of the value context by reworking the methods of integration of resources between a whole series of actors operating within an eco-service system, aiming at the importance of the exchange of knowledge and new resources necessary to co-create value. These new ways of interacting and integrating resources have stimulated the generation of new institutions, effective key elements of innovation.

AI technology, a process of providing healthcare services based on data-driven decisions, continuity and personalization of care and precision medicine, also retrain the factors of co-creation of value. RicovAI, as clarified in the following figure (Figure 4), upgrades the method of access to resources which is now mediated by the new technology and digital tools connected to it, modifies the method of sharing resources in the health sector which now takes place, voluntarily, and in real-time, via app modifies the recombination of the resources that are now used as inputs for the regeneration of the provision of healthcare services, modifies the monitoring of resources which now takes place through the support of new actors with new roles and skills and generates new institutions through the personalization of care and precision medicine that helps to stimulate a new shared vision of healthcare and a new approach to it.

**Figure 4. RicovAI-19 inputs renew value co-creation factors**

| RicovAI-19 findings | Value co-creation factors involved and revised |
|---|---|
| Artificial Intelligence in healthcare | Access to resources |
| Data and information sharing and promptness | Resource sharing and resource monitoring |
| Personalization and continuity | Resource recombination and new institutions |
| Precision medicine and a new shared approach to healthcare system | New institutions and possible institutionalization of new practices |

*Source: authors' elaboration*

RicovAI-19 is designed to manage the emergency from Covid-19 and avoid crowding of hospitals through predictive actions. The pilot project could help strengthen the resilience of the health service ecosystem by allowing it to overcome the accident and adapt to the disturbance through an aligned configurational adaptation that involves actors flexibly integrate resources and are placed on different ecosystem levels; the different ecosystem levels involved, therefore, through this new mode of interaction (between healthcare workers and between healthcare facilities and the territory), can simultaneously and synergistically reinforce and co-evolve.

However, innovation occurs if new practices of integration of resources become institutionalized (Koskela-Huotari et al., 2016), but the well-being of the ecosystem is strengthened by institutional agreements deliberately guided by a shared vision of the world, this means that if innovation, through the integration of four archetypes materialize is because this condition of ecosystem well-being is also satisfied and the actors are potentially enabled and willing to co-create a shared value.

We can therefore answer affirmatively to the research question (RQ1) and argue that the four archetypes of service innovation can support an efficient balance between available resources and health challenges and can be considered as possible antecedents of the six key characteristics for the healthcare service ecosystem well-being also because they contribute to modify and improve the co-creation factors of value in healthcare.

## 6 Non-conclusive considerations and practical implications

The findings of this study suggest that for health systems to be able to manage critical incidents in a resilient and vital way, while preserving their well-being, it is necessary to review the health system as well as its structure, introducing new digital solutions such as those of artificial intelligence. favoring a service innovation which however is realized only through the combination and integration of the 4 archetypes with effects, each, on the value. Service innovation in healthcare appears to be a driver for the well-being of the healthcare ecosystem.

The main limitation of this work is that the illustrative case is a pilot project, therefore there is not enough data on the performance obtained with its implementation. This can be the starting point for future research.

The work sought to trace points of contact, from a cause and effect perspective, between service innovation and service ecosystem well-being that had not previously been investigated in the literature. For the moment, the contact elements have been found only concerning the health context, but they can be replicated for other contexts understood from an ecosystemic perspective.

## References

Akaka, M. A., Vargo, S. L. (2014). "Technology as an operant resource in service (eco) systems". *Information Systems and e-Business Management*, *12*(3), 367-384.

Akaka, M. A., Vargo, S. L., Wieland, H. (2017). "Extending the context of innovation: the co-creation and institutionalization of technology and markets". *Innovating in Practice*, 43-57.

Åkesson, M., Skålén, P., Edvardsson, B., Stålhammar, A. (2016). "Value proposition test-driving for service innovation: How frontline employees innovate value propositions". *Journal of Service Theory and Practice*, *26*(3), 338-362.

Badr, N. G., Carrubbo, L., Ruberto, M. (2021). "Responding to COVID-19: Potential Hospital-at-Home Solutions to Re-configure the Healthcare Service Ecosystem". *HEALTHINF,* 344-351.

Barile, S., Polese, F., Saviano, M., Carrubbo, L. (2017). "Service innovation in translational medicine". *Innovating in practice*, 417-438.

Beirão, G., Patrício, L., Fisk, R. P. (2017). "Value cocreation in service ecosystems: Investigating health care at the micro, meso, and macro levels". *Journal of Service Management*.

Berry, L. L., Bendapudi, N. (2007). "Health care: a fertile field for service research". *Journal of service research*, *10*(2), 111-122.

Bon, A. T., Mustafa, E. M. (2013). "Impact of total quality management on innovation in service organizations: Literature review and new conceptual framework". *Procedia Engineering*, *53*, 516-529.

Breidbach, C. F., Maglio, P. P. (2016). "Technology-enabled value co-creation: An empirical analysis of actors, resources, and practices". *Industrial Marketing Management*, *56*, 73-85.

Bryson, J., Monnoyer, M. (2004). "Understanding the relationship between services and innovation: the RESER review of the European service literature on innovation, 2002". *The Service Industries Journal*, *24*(1), 205-222.

Caridà, A., Melia, M., Colurcio, M. (2017). "Business model design and value co-creation: looking for a new pattern". *Innovating in Practice*, 339-361.

Castellana, C. (2012). "Restructuring the Italian NHS: a case study of the regional hospital network". *arXiv preprint arXiv:1205.3519*.

Colurcio, M., Caridà, A., Edvardsson, B. (2017). "Conceptualizing resource integration to advance service innovation". *Innovating in Practice*, 237-259.

Coombs, R., Miles, I. (2000). "Innovation, measurement and services: the new problematique". *Innovation systems in the service economy*, 85-103.

Damanpour, F. (2010). "An integration of research findings of effects of firm size and market competition on product and process innovations". *British Journal of Management*, *21*(4), 996-1010.

Dautov, R., Distefano, S., Buyya, R. (2019). "Hierarchical data fusion for Smart Healthcare". *Journal of Big Data*, *6*(1), 1-23.

Edvardsson, B., Frow, P., Jaakkola, E., Keiningham, T. L., Koskela-Huotari, K., Mele, C., Tombs, A. (2018). "Examining how context change foster service innovation". *Journal of Service Management*, *29*(5), 932-955.

Finsterwalder, J., Kuppelwieser, V. G. (2020). "Equilibrating resources and challenges during crises: a framework for service ecosystem well-being". *Journal of Service Management*.

Flint, D. J. (2006). "Innovation, symbolic interaction and customer valuing: thoughts stemming from a service-dominant logic of marketing". *Marketing Theory*, *6*(3), 349-362.

Frow, P., McColl-Kennedy, J. R., Payne, A. (2016). "Co-creation practices: Their role in shaping a health care ecosystem". *Industrial Marketing Management*, *56*, 24-39.

Frow, P., McColl-Kennedy, J. R., Payne, A., Govind, R. (2019). "Service ecosystem well-being: conceptualization and implications for theory and practice". *European Journal of Marketing*.

Gallan, A. S., McColl-Kennedy, J. R., Barakshina, T., Figueiredo, B., Jefferies, J. G., Gollnhofer, J., ... Winklhofer, H. (2019). "Transforming community well-being through patients' lived experiences". *Journal of Business Research*, *100*, 376-391.

Gummesson, E., Mele, C., Polese, F., Mele, C., Colurcio, M. Russo-Spena, T. (2014). "Research traditions of innovation: Goods-dominant logic, the resource-based approach, and service-dominant logic". *Managing Service Quality: An International Journal*, *24*(6), 612-642.

Helkkula, A., Kowalkowski, C., Tronvoll, B. (2018). "Archetypes of service innovation: implications for value cocreation". *Journal of Service Research*, *21*(3), 284-301.

Kaartemo, V., Kowalkowski, C., Edvardsson, B. (2018). "Enhancing the understanding of processes and outcomes of innovation: the contribution of effectuation to SD logic". *Sage handbook of service-dominant logic*, 522-535.

Koskela-Huotari, K., Vargo, S. L. (2016). "Institutions as resource context". *Journal of Service Theory and Practice*, *26*(2), 163-178.

Koskela-Huotari, K., Edvardsson, B., Jonas, J. M., Sörhammar, D., Witell, L. (2016). "Innovation in service ecosystems - Breaking, making, and maintaining institutionalized rules of resource integration". *Journal of Business Research*, *69*(8), 2964-2971.

Kuppelwieser, V. G., Finsterwalder, J. (2016). "Transformative service research and service dominant logic: Quo Vaditis?". *Journal of Retailing and Consumer Services*, *28*, 91-98.

Lapão, L. V. (2019). "The future of healthcare: the impact of digitalization on healthcare services performance". *The Internet and Health in Brazil*, 435-449. Springer, Cham.

Laukkanen, T. (2016). "Consumer adoption versus rejection decisions in seemingly similar service innovations: The case of the Internet and mobile banking". *Journal of Business Research*, *69*(7), 2432-2439.

Lusch, R. F., Nambisan, S. (2015). "Service innovation: A service-dominant logic perspective". *MIS quarterly*, *39*(1).

Lusch, R. F., Vargo, S. L., Gustafsson, A. (2016). "Fostering a trans-disciplinary perspectives of service ecosystems". *Journal of Business Research*, *69*(8), 2957-2963.

Manogaran, G., Varatharajan, R., Lopez, D., Kumar, P. M., Sundarasekar, R., Thota, C. (2018). "A new architecture of Internet of Things and big data ecosystem for secured smart healthcare monitoring and alerting system". *Future Generation Computer Systems*, *82*, 375-387.

McColl-Kennedy, J. R., Vargo, S. L., Dagger, T. S., Sweeney, J. C., Kasteren, Y. V. (2012). "Health care customer value cocreation practice styles". *Journal of service research*, *15*(4), 370-389.

Meynhardt, T., Chandler, J. D., Strathoff, P. (2016). "Systemic principles of value co-creation: Synergetics of value and service ecosystems". *Journal of Business Research*, *69*(8), 2981-2989.

Nijssen, E. J., Hillebrand, B., Vermeulen, P. A., Kemp, R. G. (2006). "Exploring product and service innovation similarities and differences". *International journal of research in marketing*, *23*(3), 241-251.

Payne, A. F., Storbacka, K., Frow, P. (2008). "Managing the co-creation of value". *Journal of the academy of marketing science*, *36*(1), 83-96.

Polese, F., Carrubbo, L. (2016). *Eco-sistemi di servizio in sanità*. G Giappichelli Editore.

Polese, F., Carrubbo, L., Bruni, R., Maione, G. (2017b). "The viable system perspective of actors in eco-systems". *The TQM Journal, 29*(6), 783-799.

Polese, F., Carrubbo, L., Caputo, F., Sarno, D. (2018). "Managing healthcare service ecosystems: Abstracting a sustainability-based view from hospitalization at home (HaH) practices". *Sustainability*, *10*(11), 3951.

Polese, F., Payne, A., Frow, P., Sarno, D., Nenonen, S. (2021). "Emergence and phase transitions in service ecosystems". *Journal of Business Research*, *127*, 25-34.

Polese, F., Pels, J., Tronvoll, B., Bruni, R., Carrubbo, L. (2017a). "A4A relationships". *Journal of Service Theory and Practice*, *27*(5), 1040-1056.

Pramanik, M. I., Lau, R. Y., Demirkan, H., Azad, M. A. K. (2017). "Smart health: Big data enabled health paradigm within smart cities". *Expert Systems with Applications*, 87, 370-383.

Sakr, S., Elgammal, A. (2016). "Towards a comprehensive data analytics framework for smart healthcare services". *Big Data Research*, *4*, 44-58.

Schumpeter, J. A. (1934). "The theory of economic development, translated by Redvers Opie". *Harvard: Economic Studies*, *46*.

Skålén, P., Gummerus, J., Von Koskull, C., Magnusson, P. R. (2015). "Exploring value propositions and service innovation: a service-dominant logic study". *Journal of the Academy of Marketing Science*, *43*(2), 137-158.

Suroso, E., Azis, Y. (2015). "Defining mainstreams of innovation: a literature review". *International Conference on Economics and Banking (iceb-15)*. Atlantis Press.

Taillard, M., Peters, L. D., Pels, J., Mele, C. (2016). "The role of shared intentions in the emergence of service ecosystems". *Journal of Business Research*, *69*(8), 2972-2980.

Tidd, J., Bessant, J. R. (2018). *Managing innovation: integrating technological, market and organizational change*. John Wiley Sons.

Toivonen, M., Kijima, K. (2019). "Systems Perspectives on the Interaction Between Human and Technological Resources". *Human-Centered Digitalization and Services*, 37-56. Springer, Singapore.

Troisi, O., Maione, G., Grimaldi, M., Loia, F. (2020). "Growth hacking: Insights on data-driven decision-making from three firms". *Industrial Marketing Management*, *90*, 538-557.

Tuominen, T., Toivonen, M. (2011). "Studying innovation and change activities in KIBS through the lens of innovative behavior". *International Journal of Innovation Management*, *15*(02), 393-422.

Vargo, S. L., Akaka, M. A. (2012). "Value cocreation and service systems (re) formation: A service ecosystems view". *Service Science*, *4*(3), 207-217.

Vargo, S. L., Lusch, R. F. (2008). "Service-dominant logic: continuing the evolution". *Journal of the Academy of marketing Science*, *36*(1), 1-10.

Vargo, S. L., Lusch, R. F. (2016). "Institutions and axioms: an extension and update of service-dominant logic". *Journal of the Academy of marketing Science, 44*(1), 5-23.

Vargo, S. L., Lusch, R. F. (2017). "Service-dominant logic 2025". *International Journal of Research in Marketing*, *34*(1), 46-67.

Vargo, S. L., Wieland, H., Akaka, M. A. (2015). "Innovation through institutionalization: A service ecosystems perspective". *Industrial Marketing Management*, *44*, 63-72.

Wieland, H., Koskela-Huotari, K., Vargo, S. L. (2016). "Extending actor participation in value creation: an institutional view". *Journal of Strategic Marketing*, *24*(3-4), 210-226.

Wieland, H., Polese, F., Vargo, S. L., Lusch, R. F. (2012). "Toward a service (eco) systems perspective on value creation". *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET)*, *3*(3), 12-25.

Wieland, H., Vargo, S. L., Akaka, M. A., Barbeau, B. (2018). "A unifying perspective for the technological, business model, and market aspects of innovation". *SAGE handbook of service-dominant logic*, 508-521.

Witell, L., Snyder, H., Gustafsson, A., Fombelle, P., Kristensson, P. (2016). "Defining service innovation: A review and synthesis". *Journal of Business Research*, *69*(8), 2863-2872.

Yeh-Yun Lin, C., Yi-Ching Chen, M. (2007). "Does innovation lead to performance? An empirical study of SMEs in Taiwan". *Management Research News*, *30*(2), 115-132.

Yu, E., Sangiorgi, D. (2018). "Service design as an approach to implement the value cocreation perspective in new service development". *Journal of Service Research*, *21*(1), 40-58.