

# Triggering a patient-driven service innovation to foster the service ecosystem well-being: a case study

Antonietta Megaro, Luca Carrubbo, Francesco Polese and  
Carlo Alessandro Sirianni

*Department of Business Sciences Management and Innovation Systems,  
University of Salerno, Fisciano, Italy*

## Abstract

**Purpose** – The aim of this paper is to understand if service innovation (Helkkula *et al.*, 2018), based on artificial intelligence (AI) systems, may guarantee healthcare service ecosystem (H-SES) well-being (Frow *et al.*, 2019; Beirão *et al.*, 2017), taking into account that many doubts relieved in terms of transparency may compromise the patients' perceived quality of health services provided through AI systems.

**Design/methodology/approach** – A literature review on service innovation, detected in terms of value co-creation, and service ecosystem, investigated in terms of well-being, is drawn. To analyze the implications of service innovation on a H-SES well-being, through the technology acceptance degree and predisposition to use by actors, a case study based on TAM-model 3 determinants as categories is carried out.

**Findings** – AI-based service innovation archetypes in healthcare may be considered as antecedents of the service ecosystem well-being conditions as long as they enable actors to co-create value. To make it possible, a patient-driven service innovation is necessary in order to mitigate the risks of its inactivity due to fears in terms of transparency.

**Originality/value** – Service innovation and service ecosystem well-being may be studied in an integrated way, with a multidisciplinary approach, and are linked by value co-creation, because only thanks a patient-driven service innovation is possible to foster service ecosystem well-being in healthcare.

**Keywords** Artificial intelligence, Service innovation archetypes, Service ecosystem well-being, Value co-creation factors, Patient-driven innovation, Transparency

**Paper type** Research paper

## 1. Introduction

In recent years, in the healthcare context, there has been an increasing complexity, in terms of governance and decision-making (Gummesson *et al.*, 2019), that forced healthcare decision-makers to seek new solutions (Badr *et al.*, 2021) and has accelerated the restructuring and digitization process.

The healthcare system is today increasingly patient-centered (Lapão, 2019) and aimed at implementing predictive governance models based on data-driven decision-making (Grimaldi *et al.*, 2020). Data, if correctly interpreted, provide knowledge (Troisi *et al.*, 2020) to healthcare decision-makers to understand individuals' behavior (Barile *et al.*, 2017a), and allow them to personalize healthcare services for more effective interactions (Carrubbo *et al.*, 2021).

AI systems in healthcare could generate a service innovation, enabling faster choices, more timely diagnoses and pathways to more personalized treatment and data-based governance models (Polese *et al.*, 2021a).

AI systems allow the retrieval and analysis of huge amounts of data, but doubts in terms of data quality (Tao *et al.*, 2019) arise.

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The implementation of AI systems in healthcare is characterized by fears about their transparency (de Fine Licht and de Fine Licht, 2020); there is a perceived risk that the AI black box may generate an inadequate automated decision, also for the quality of the data used, shared by patients affected by privacy threats (Kashef *et al.*, 2021). Transparency fears may undermine the perceived quality of health services provided by using AI systems.

To make AI tools effective decision support systems, able to foster the service ecosystems (SES) well-being, the design of more understandable, useable and explainable AI systems would be necessary.

The motivation for this contribution lies in the need to investigate, in an integrated way, the service innovation and the service ecosystem well-being, concerning the use of AI systems in healthcare, to understand if one can enable the other.

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

*RQ.* Can an AI systems-based service innovation in healthcare enable H-SES well-being?

This paper starts with the description of the methodology (par. 2) and the theoretical background (par. 3). The health system is then described as a service ecosystem (par. 4), to understand if service innovation may enhance the H-SES well-being conditions, considering the challenges posed by AI systems in healthcare. A case study (par. 5) is described and many doubts are detected in terms of transparency and good quality data.

The patient-driven service innovation is presented (par. 5.6) as a solution to neutralize any gaps about perceived service quality. Finally, non-conclusive considerations have been prompt (par. 6).

## 2. Methodology

To answer the research question, the research approach used, to investigate enabling factors of an AI-based service innovation in a healthcare service ecosystem, is exploratory that allows the identification and clarification of the problem. A qualitative analysis, to reach a better understanding of the phenomenon, seems the most adequate.

A case study was then chosen, to be carried out with interviews, to explore the phenomenon in its reference context. The case study was initially performed using a logic-inductive approach, subsequently the data were analyzed with the aim of contributing to the literature and proposing new interpretative insights starting from the case study results, with an abductive approach.

To give reliability to the analysis, the categories were taken from the TAM-model literature (Venkatesh and Devis, 2000), adapted to a qualitative analysis following an approach already used in the literature (Gasaymeh and Waswas, 2019; Vogelsang *et al.*, 2013; Abbad, M. 2010) in order to firmly connect the analysis to an existing construct for the definition and evaluation of technological acceptance.

## 3. Theoretical background

A literature review on service innovation (Helkkula *et al.*, 2018; Koskela-Huotari *et al.*, 2016; Vargo and Lusch, 2016; Akaka and Vargo, 2014) and on service ecosystem well-being (Beirão *et al.*, 2017; Frow *et al.*, 2019) is carried out, in order to build a new theoretical framework.

### 3.1 Service ecosystem well-being

The service ecosystem is an autonomous, dynamic, changing, reconfigurable and self-regulating, emerging system (Vargo and Lusch, 2016), aimed at the co-creation of value (Wieland *et al.*, 2012), pursued by the actors involved (Lusch *et al.*, 2016) and nested within three ecosystem levels: micro, meso and macro (Vargo and Lusch, 2016); any change in one

level can impact the other levels (Ciasullo *et al.*, 2020). 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).

The service ecosystem behavior depends on institutions, which coordinate the integration of resources among actors (Vargo and Akaka, 2012), not as established structures to manage human action (Wieland *et al.*, 2016), but as tacit rules, symbols and meanings (Koskela-Huotari and Vargo, 2016). The set of institutions makes up the institutional agreements that favor coordination between the different service ecosystem levels (Vargo *et al.*, 2015).

It 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.*, 2021b) through distinct dynamic levels (Taillard *et al.*, 2016).

The service ecosystem well-being is a dynamic state that occurs when there is a configurational adaptation of resource integration practices (Frow *et al.*, 2019).

The micro-level of the ecosystem contains the individual actors who interact to co-create value in a sphere of co-creation of value. The meso level affects well-being at the community level (Gallan *et al.*, 2019). The macro level refers to the overall social and public value (Meynhardt *et al.*, 2016).

A configurational adaptation of practices, a shared vision of the world, ecosystem levels that reinforce, co-evolve and self-regulate iteratively, service ecosystem resilience, flexible resource integration practices, are considered as key characteristics of the service ecosystem well-being (Frow *et al.*, 2019) that is based on value co-creation phenomena (Vargo and Lusch, 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. These value co-creation factors contribute to the system well-being by generating benefits for actors at each level.

Actors participation in co-creation practices can help shape the ecosystem well-being (Frow *et al.*, 2016).

New technologies can also play an important role in this sense since, facilitating the liquefaction of resources and promoting the integration of resources by allowing an efficient and effective exchange of services (Lusch and Nambisan, 2015), they can simplify the value co-creation (Ciasullo *et al.*, 2018a; Barile *et al.*, 2017b).

### 3.2 Service innovation

According to traditional literature, innovation is understood as a combination of new ideas to propose to the market (Suroso and Azis, 2015). Tuominen and Toivonen (2011) defined service innovation as a new service, Skålén *et al.* (2015) extend the definition of service innovation to include the development and implementation of results. Today innovation is increasingly linked with the achievement of a competitive advantage (Damanpour, 2010).

Coombs and Miles (2000) identified three research perspectives: assimilation, distinction and synthesis. The synthesis perspective refers to an integrated perspective, which is not limited to technological innovations (Bon and Mustafa, 2013) but that concerns a multidimensional nature of service innovation (Yu and Sangiorgi, 2018).

According to service-dominant logic, service innovation refers to a networked approach to innovation (Vargo *et al.*, 2015); it can no longer be considered as the result of a dyadic perspective (Lusch and Nambisan, 2015) and it takes place through a 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).

Toivonen and Kijima (2019) argue that innovation involves the creation, renewal and transformation of pre-existing knowledge.

Koskela-Huotari *et al.* (2016) state that innovation does not emerge 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 players (Akaka *et al.*, 2017). Institutionalization, understood as maintenance, disintegration, change of institution, is the process underlying innovation (Vargo *et al.*, 2015).

Technology is considered as an operant resource (Akaka and Vargo, 2014) that, acting with other resources, is able to provide new knowledge and new solutions. It may allow new institutionalized practices to co-create value (Fulco *et al.*, 2021), new value propositions and new SES (Kaartemo *et al.*, 2018).

The value of a technology depends on the perception of actors who have to use it and, therefore, its effectiveness also depends on the resources they already hold (Wieland *et al.*, 2018). They can assign different meanings to technology, based on the resources they hold, based on personal, social and contextual perceptions (Edvardsson *et al.*, 2018).

The focus is therefore on the end-user (Flint, 2006). Helkkula *et al.* (2018) describe the four archetypes of value-centric service innovation: *output-based archetype*, which depends on a new service or new product, *process-based archetype*, based on new ways of delivering output to the customer, *experiential archetype*, which considers that actors are subjectively engaged in service innovation, experiencing and co-creating value according to their experience, *systemic archetype*, according to which service innovation is the result of new value propositions and new institutionalized resources integration practices.

#### 4. Challenges posed by AI in a H-SES

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 activities, from diagnosis to treatment, to rehabilitation, with the ultimate goal of protecting public health (Masucci and Megaro, 2021); it is a set of resources such as skills, knowledge, tools, technologies, regulations (Ciasullo *et al.*, 2018b), connected by value propositions in a network of relationships (Frow *et al.*, 2016). In this service 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).

##### 4.1 Service innovation based on AI systems may allow service ecosystem well-being conditions

Service innovation, in healthcare, may depend on the integration of multiple factors (Helkkula *et al.*, 2018):

- (1) the introduction of new technologies can upgrade the healthcare sector, with effects in terms of value-in-exchange (output-based archetype);
- (2) a change in the health services may depend on data-driven decisions, with implications in terms of value-in-use (process-based archetype);
- (3) health services can be increasingly personalized, thus favoring the involvement and empowerment of the patient, with effects in terms of value-in-experience (experiential archetype);
- (4) a shared new vision of health may foster the attractiveness of resources from multiple ecosystem levels to reconfigure resourceness, actors and institutional structures, with

implications in terms of value-in-context, an example may be the precision medicine (systemic archetype).

However, in SES, value co-creation can be understood as a lever to improve its well-being and viability (Polese *et al.*, 2017b) that depends on adaptation and reconfiguration (Ciasullo *et al.*, 2021). For this reason, Beirão *et al.* (2017) identify value co-creation factors that 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 of the ecosystem as a whole.

The service innovation thus proposed can also retrain the factors of co-creation of value:

- (1) access to resources: is now mediated by the new technology and digital tools;
- (2) resource sharing: is now voluntarily and in real-time;
- (3) resource recombination: resources are now used as inputs for an upgrade of the of healthcare services;
- (4) resource monitoring: it now takes place through the support of new actors with new roles and skills;
- (5) governance/institution generation: personalization of care and precision medicine can stimulate a new shared vision of healthcare and a new approach to it.

#### *4.2 AI in healthcare: service quality perception and behavioral intention determinants*

Mosadeghrad (2015) propose a model that allows to measure the implementation of TQM in healthcare organizations to show how important is quality in this area, leading decision-makers to an overall improvement in system performance (Talib *et al.*, 2019).

According to the TQM, quality implies knowing the customer's wishes and providing solutions to fit with them (Zaid *et al.*, 2020); perceived service quality is defined as the customer's assessment of the overall superiority or excellence of the service (Zeithaml, 2000). The focus is on customers (Gronroos, 1988); customer perceived service quality is considered one of the key determinants of business performance (Yoo and Park, 2007), it is characterized by reliability and responsiveness that precede customer satisfaction (Dabholkar and Overby, 2005).

Reeves and Bednar (1994) describe quality as excellence and, although value and quality are two distinct constructs (Zeithaml, 2000), and the perceived quality of service can influence the consumer's perception of value.

Concerning quality in healthcare, four key factors are identified in the literature that determines patient loyalty to healthcare organizations (Sadeh, 2017) from the point of view of service quality: general quality, quality of interaction, environmental quality and result (Nguyen and Nagase, 2019).

Opportunities for healthcare organizations to co-create value are considered to depend on the ability of these organizations to improve patient participation in healthcare delivery and this can be achieved through the increasingly widespread use of digital health platforms (Aghdam *et al.*, 2020), which can influence customers' perceptions of service quality (Cantrill, 2010) and can enable actors to co-create value (Masucci *et al.*, 2021).

However, the predisposition of users to implement new technologies in their daily actions depends on their acceptance of the technology (Venkatesh and Devis, 2000). The technology acceptance determines the use behavior that depends on the behavioral that is affected by the perceived usefulness and the perceived ease.

Perceived ease of use is an important user reaction to IT, even if they have experience with IT. Venkatesh and Bala (2008) show how numerous cases of errors in corporate IT systems

are due to the resistance of users to use them since they are inherently complex to understand and use, leading many to stop using them, for not having found any advantage in their use, contributing to unfavorable perceptions of the perceived utility of such systems.

Not only, also social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) can significantly influence user acceptance (Venkatesh and Bala, 2000).

AI systems in healthcare are potentially valid for improving diagnosis, treatment, health research and drug development and for supporting governments that perform public health functions (Reddy *et al.*, 2019); a problem arises in terms of ethics and protection of users' rights regarding the design, distribution and use of AI systems (World Health Organization, 2021) which could affect their acceptance of the technology and perception of quality.

## 5. Case study

In this work, we have conducted a qualitative analysis because it favors the free expression of the interviewees and it is more effective for the description and interpretation of social phenomena, due to the spontaneous emergence of ideas and of solutions and, thanks to the exploration, it favors the identification and clarification of a problem (Yin, 2015). A case study lets an in-depth, multi-faceted understanding of a complex issue in its real-life context (Stake, 1995).

The case study is based on the analysis of an ecosystem of territorial services as our health system is characterized by a strong territorial autonomy. The analyzed territory is made up of Avellino and Salerno (AV-SA), two neighboring cities in southern Italy, and their surrounding territory.

### 5.1 Research planning—choosing group of interest

To define the interest group to interview, the approach proposed by Eisenhardt and Graebner (2007) was followed which suggest identifying the key informants, intended as experts selected in a non-random way. The key informants are not chosen because they are representative of the general population but because they are relevant to the specific interpretation of the phenomenon studied.

A reasoned choice sampling was therefore adopted within the selected territory to identify the interviewees for their relevant properties to the research.

In the present case study, the key informants were not selected as AI experts but as relevant subjects to evaluate the effective adoption of AI systems in healthcare. The full implementation of new technologies depends on the ecosystem's key players predisposition to use them.

Key players in the healthcare ecosystem were considered, in the context of this work, patients, citizens, doctors, healthcare professionals and innovative start-ups (which could be involved in the design of such new systems).

As shown below (Table 1), 39 people were interviewed divided as follows: 15 citizens (potential patients), 8 patients (currently treated in local health facilities), 11 doctors, 5 nurses.

Patients and citizens have stated that they frequently interact with/use AI systems in their daily lives, such as mainly voice assistants, interactions with chatbots, e-commerce, and streaming platforms use, less than using them in their professional life. The usage rate is minimum in their professional activities since it suggests that their specialized skills in terms of using AI systems are not very sophisticated. Also on the side of health professionals, AI tools use in their professional activities is minimal; a little higher in their daily life, even if they present greater reticence than previous users, perhaps due to the higher average age.

Furthermore, representing local innovative start-ups, the CEO and founder of a local business incubator (Incubatore SEI) was interviewed to evaluate the predisposition of

innovative local companies to invest in AI solutions projects in healthcare; Incubatore SEI is specialized in consulting startups and entrepreneurial teams in accompanying paths aimed at creating sustainable and innovative businesses, at strengthening managerial skills and competencies, at the analysis of the reference markets, at the validation of ideas and products in the pre-seed phases, at the creation and consolidation of good practices in the field of innovation and economic sustainability. The choice to interview a business incubator lies in the desire to understand how much local entrepreneurial realities are interested in innovative projects in health in order to understand how these solutions can probably be accepted in this territory, not only from the user side but also from the point of view of design and production actors.

The choice of these key informants was therefore based on rational considerations and not random procedures, given the explanatory and not descriptive purpose of the work.

### 5.2 Research planning–research design

To define the research path, it was necessary to identify the key concepts of the analysis.

In an attempt to contribute to the literature, with respect to the problems identified and the approach considered, the key concepts that it was deemed necessary to investigate and deepen the empirical evidence with respect to the case study are the following: transparency and quality of data collected through AI systems.

On the basis of these two key concepts, the analysis categories were identified which then, in turn, made it possible to detect and classify the elementary analysis units.

The acceptance of technology is a function of use behavior that is a function of behavioral intention which, in turn, depends on perceived usefulness (PU) and perceived ease to use (PEU).

For this reason, PU and PEU have been considered in this work as categories of analysis.

The research path was thus defined: data collection, analysis and interpretation.

The research is exploratory, carried out using an inductive-logical approach with which an attempt was made to detect, in the case, what was observed in the literature.

### 5.3 Research path–data collection

The case study was carried out through the collection of primary data and their analysis. The data collection took place through individual interviews addressed to key informants. It has been chosen to use primary data as they are collected for the specific purpose of the research and are specifically connected to it. 40 interviews were conducted in the form of semi-structured conversations: conversations realized through a series of open questions on specific discussion topics, upstream defined, which made up the so-called conversation guide, but with a low degree of directivity and standardization in order to grant the interviewee autonomy. To investigate the technology acceptance degree in healthcare, the interviewees were questioned about their predisposition to use AI tools to favor virtual healthcare pathways.

Key informants	N
Citizens	15
Patients (currently being treated in local facilities)	8
Doctors	11
Nurses	5
CEO and Founder Incubatore SEI	1

**Table 1.**  
Key informants

**Source(s):** Authors' elaboration

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The interview outline was based on some topics to be dealt with necessarily but not rigidly, ensuring flexibility in the conversation. The interviewee had the opportunity to freely explore each area deemed relevant to the subject of the research. This allowed for the spontaneous emergence of data considered as important and strategic by the interviewees, the so-called active data that represented a starting point for new, unplanned questions, useful for a better understanding of the topic.

Each interview lasted about 20 min and was carried out in the Italian language. All individuals voluntarily agreed to participate in this study.

Respondents underwent face-to-face or, in some cases, video call interviews. The purpose of the interview was briefly explained to them, after which the interviews, with prior consent, were recorded and then transcribed.

#### 5.4 *Research path–analysis*

The primary data thus collected were analyzed with an inductive logical approach: the reading of the transcribed interview made it possible to refer to the categories considered and therefore to move from the particular to the general observed how practical evidence can contribute to the theory. A content analysis was therefore carried out to extract meanings from the transcripts.

The small number of texts made it possible to carry out a qualitative investigation of the content of the texts, also carried out with the help of some keywords. The iterative and manual coding process was based on the classification and qualitative interpretation of the content of the collected data.

The texts were examined several times, according to feedback circuits, in order to connect each statement to the categories of analysis. The circuit ended when all the statements could be traced back to a category.

#### 5.5 *Research path–results*

Over the course of the 40 interviews, approximately 695 claims regarding software acceptance were detected. On average, we extracted 17 statements per interview, directly linked to the TAM-model categories.

The analysis categories are PU and PEU; experience, voluntariness, and age were considered moderating variables (Venkatesh *et al.*, 2003) while the gender is not considered a relevant variable.

The determinants of each dimension identified in TAM-model 3 (Venkatesh and Bala, 2008) were considered in this work as elementary units of analysis, relating to the previous categories as shown in Table 2.

For similarity in terms of trend in the answers, two macro-categories of respondents were investigated, doctors/nurses and citizens/patients, in addition to the Incubatore SEI CEO.

Given the characteristics of the key concepts investigated (transparency and data quality), only the results related to the following elementary units will be detected: output quality; result demonstrability; self-efficacy computer; computer anxiety.

The Table above (Table 3) shows that doctors and nurses perceive the usefulness of these technologies in an average high way and also the perception of high quality of the output produced, but perplexity in terms of results explainability. This skepticism, however, does not affect the intention of doctors and nurses to use them but they would like to acquire more skills to be able to use them to the fullest and enjoy the actual benefits. In terms of PEU, on average they believe they can use them without particular difficulties or efforts, but they hope that these tools' operation may be clear and the language simple. Particularly relevant also from the point of view of these actors is the influence of the Subjective Norm and Job Relevance; many declare: "For my professional managers, my colleagues, my family and my



**Table 2.**  
Categories and  
elementary units of  
analysis

Categories	Determinants – elementary units of analysis
Perceived usefulness	Perceived ease of use Subjective norm Image Job relevance Output quality Result demonstrability
Perceived ease of use	Computer self-efficacy Perception of external control Computer anxiety Computer playfulness Perceived enjoyment Objective usability

**Source(s):** Authors' elaboration

**Table 3.**  
Extracts of interviews  
with doctors and  
nurses

Categories	Elementary units of analysis	Extracts of interviews
Perceived usefulness	Output quality	“I believe that new technologies can improve the doctor–patient relationship and favor more precise diagnoses in favor of more timely interventions, and can improve my work performances” “According to me, a digital instrument cannot interfere in the doctor–patient relationship: human contact is necessary”
	Result demonstrability	“I believe that the results provided by artificial intelligence, in terms of medical history and information to support the diagnosis/treatment/monitoring, are reliable, but if it were clearer how artificial intelligence systems release information, the standards on which they are based and the way in which they process information from data, I would be more comfortable using them” “I fear that the results provided by artificial intelligence systems are inadequate and unreliable; even if I could, I wouldn't use them”
Perceived ease of use	Computer self-efficacy	“I believe I can be able of doing my job using systems based on artificial intelligence” “I believe I can use these tools in my work without any particular effort”
	Computer anxiety	“If I use them at work, I hope that, they are not too complex to understand in terms of functioning” “The only fear is that they use not very simple language”

**Source(s):** Authors' elaboration

community, it would be important that I use these tools for my work performance as they could improve and optimize them”. This shows that the behavioral intention in this cluster of actors can potentially be high if only they felt more trustful about the reliability of the results and aware of the machine functioning for processing results.

The same variables were investigated with respect to citizens/patients macro-category, as indicated in the following table (Table 4).

The table shows that citizens and patients recognize the possible general health service quality improvement; however, on average, they reveal doubts in terms of use, both with respect to the ability to release their data correctly and with respect to the protection of their privacy but also a medium skepticism regarding the reliability and provability of the results produced.

Categories	Elementary units of analysis	Extracts of interviews
Perceived usefulness	Output quality	<p>“I believe that virtual health care can be useful to mitigate the difficulties of the health system”</p> <p>“I believe that virtual health care can improve the quality of the health service”</p>
	Result demonstrability	<p>“If it were clearer how they work, I would use them without any doubts”</p> <p>“Even if according to me, these are useful tools, I do not trust results released by a machine. I am willing to interact only with human professionals”</p>
Perceived ease of use	Computer self-efficacy	<p>“I do not know if I am very capable of using them for such a delicate thing as health: if I am wrong to use them, do the doctors not treat me adequately?”</p> <p>“I suspect my privacy is not fully protected”</p>
	Computer anxiety	<p>“I think the functioning of these tools is very complex”</p> <p>“When I interact with these tools, we often don’t understand each other. I would kill Siri when I ask her one thing and she answers another. I fear our languages are a little bit different”</p>

**Table 4.**  
Extracts of interviews  
with citizens and  
patients

Source(s): Authors’ elaboration

On the other hand, the influence of the Image is particularly relevant from their point of view, many declare: “knowing how to use these technologies would make me feel important in my social system” and “as a patient, knowing how to use these technologies would make me feel useful for the health system”. The behavioral intention in this cluster can potentially be high if only they felt more confident about the use of these systems and the impact of this tool in the care of their state of health and in their relationship with the doctor.

In general, citizens, especially patients already under treatment at local health facilities, declare that they do not want to interface with a machine but that they always and in any case need contact with a human, even and above all, about health, for which any kind of errors is neither admitted nor tolerable.

Compared to all the interviewees, a good level of voluntariness was found, while experience and age have slightly changed the trends: in elderly people, the perplexities increase (one of the interviewees declares: “even if I could, I would never use them”), as well as in people who have declared they rarely use AI tools in their daily life activities. These factors contribute to make them less confident with AI systems in healthcare.

In the interview with the CEO and Founder of Incubatore SEI, other units of analysis seemed relevant for the purposes of this analysis: Subjective Norm, Job Relevance, Perception of external control and Objective usability (see [Table 5](#)).

As shown by the table above, there are some concerns at the local start-up side to propose innovative solutions in this field.

The local healthcare is strongly relational so they don’t feel the need for innovative solutions that revise the traditional doctor–patient interaction ways and, above all, it is thought that these innovations cannot be well received by the population, which a bit typically wary of welcoming innovative solutions in healthcare also due to a “form of distrust of statistics”.

The fear that the population does not accept such solutions doesn’t make these projects attractive but particularly risky, although the existence of investment funds in the field.

### 5.6 Discussion

These results confirm for the users many AI algorithms are difficult to interpret or explain and it can affect their perception of quality and their intention to use AI tools, as shown in the following table ([Table 6](#)).

**Table 5.**  
Extracts of the  
interview with  
Incubatore SEI CEO  
and Founder

Categories	Elementary units of analysis	Extracts of interviews
Perceived usefulness	Subjective norm	“Typically, innovative ideas start from a problem, there has not been an interest in this sector, both because statistically young people (startuppers) suffer fewer hospital problems and because in this area the relationship with the general practitioner is very personal so there isn’t a hard need to digitize it”
	Job relevance	“Due to the high start-up failure rate (9/10), there is skepticism about this type of innovation because there is a high risk it may be poorly accepted by the population. There is a risk of low confidence in the doctor’s professionalism as the luminary would hardly interact online; on the other hand, citizens, although potentially enthusiastic about the idea of innovating, would still be wary of using such solutions, also and above all because it is a delicate issue such as health. These projects are ambitious and highly failing investments that could only be backed by university spin-offs”
Perceived ease of use	Perception of external control	“Although it is a sector for which there are currently many investment funds, talking about automation, creating smart contexts, means referring to ideas that require considerable capital, however difficult to support for local nascent companies”
	Objective usability	“We are Italians, those in the queue at the motorway toll booth: on average, in order not to pay by card where the lanes are typically free, we create queues at the toll booth for hours to pay in cash”

**Source(s):** Authors’ elaboration

This upholds that one of the main limitations in the use of AI systems in healthcare is transparency (Davenport and Kalakota, 2019) that can discourage health professionals from using them (Shinners *et al.*, 2020) due to fears in terms of results reliability, and end-users for doubts about trust and fairness (Das, 2020) and poor PEU.

Table 6 shows the need to involve end-users in the innovation path and to act to improve the transparency in AI tools that can enhance PU and PEU determinants and be a driver of usage behavior.

If users perceived the algorithm as fairer, more responsible, transparent and explainable, they could see it as more reliable and useful (Shin, 2020), with positive effects in terms of the trust and behavioral intention (Table 7).

Virtual health care paths, through AI systems, can have interesting and highly impacting effects on the doctor–patient relationship, with benefits for both.

Doctors can avoid tedious and repetitive tasks and pay more attention to more complex operations; patients can receive quick answers from chatbots that can understand some

**Table 6.**  
Key determinants of  
perception and  
behavioral intention

Categories	Elementary units of analysis	Positive perception and behavioral intention	
		Doctors/nurses	Citizens/patients
Perceived usefulness	Output quality	✓	✓
	Result demonstrability	X	X
Perceived ease of use	Computer self-efficacy	✓	X
	Computer anxiety	✓	X

**Source(s):** Authors’ elaboration

Categories	Elementary units of analysis	Positive perception and behavioral intention		Transparency in AI system as an enabling factor of behavioral usage
		Doctors/ nurses	Citizens/ patients	
Perceived usefulness	Result demonstrability	X	X	It can improve the degree to which an individual believes that the results of using AI system may be tangible, observable and reliable because thanks to transparency actors know the standards and mechanisms on which the AI functioning is based
Perceived ease of use	Computer self-efficacy		X	
	Computer anxiety		X	Tools more transparent may be more understandable and it can reduce the degree apprehension or fear when actors have to face with the possibility to use them

**Table 7.** Transparency in AI systems as enabling factor of behavioral usage

Source(s): Authors' elaboration

symptoms starting from the questions received and activate, if necessary, an alert system for particular pathologies, with positive effects also on the healthcare structure. Furthermore, patients could thus understand their symptoms and communicate directly with their doctors, without going to health facilities, with the effect of helping to decongest them. AI can also help detect early disease risks as the system uses past information, generally ensuring better access to healthcare by creating a more efficient healthcare environment.

Patient data, collected with AI systems, can provide healthcare facilities with valuable information as doctors, called upon to make decisions, can exploit it to intervene in an increasingly timely manner (Sakr and Elgammal, 2016). Data collection and analysis can improve overall performance (Ciasullo *et al.*, 2018c) and response times (Dautov *et al.*, 2019), but a combination of several intelligent information systems may be useful (Pramanik *et al.* 2017), and the design of a shared database, data storage, data extraction, data processing, more functional, versatile, scalable and contextual (Frow *et al.*, 2016).

However, patients and citizens are rather wary of releasing their data to systems of this type (Reddy *et al.*, 2019) and with inevitable negative effects in terms of potential co-creation of value.

Even if there is a medium-high perceived usefulness, many doubts in terms of results demonstrability are noticed. It depends on poor transparency in AI systems also declared by the WHO. In the case of end-users also reduced perceived ease of use is disclosed that could affect the quality of the data used in the provision of health services through AI systems. It can determine a gap in terms of perception of service quality compared to health services provided with AI systems and undermine the pursuit of well-being conditions of the service ecosystem through service innovation (Polese *et al.*, 2021c).

Consistently with modern marketing logic, according to which consumers are no longer intended as passive recipients of an offer (Payne *et al.*, 2008), an active role must also be considered about the patient (Berry and Bendapudi, 2007). Patient involvement and empowerment can stimulate co-creative events in healthcare through a doctor/patient co-learning process (McColl-Kennedy *et al.*, 2012). This positive interaction depends on information that depends on data, voluntarily released by the patient.

It might be useful to consider a patient-driven service innovation, to adapt innovation to the needs of patients and support them in managing their condition (Aghdam *et al.*, 2020). To pursue the purpose of patient engagement (Badr *et al.*, 2022), it may be useful to embed them in the co-creation of new digital solutions, from use case identification to product design and testing (Stock *et al.*, 2021).

Doctors, nurses, patients and citizens have declared fears in terms of results demonstrability; it seems necessary to open the “black box” of AI decision-making systems and pursue aims of reasoned transparency, in order to guarantee greater legitimacy perceived by the public and improve confidence in the tool.

Patients reassured about their data protection and more aware of the treatment (Dignum, 2018) would ensure a more favorable environment for value co-creation (Mabillard *et al.*, 2021).

The data used in healthcare services through AI systems have to be of good quality, so AI systems more transparent and explainable, but also simpler to use and user-friendly (with effects in improving PEU), are necessary, perhaps also designed through open and user innovation patterns (Schiafone, 2020; Lundberg *et al.*, 2013).

Therefore, although the introduction of new digital solutions in healthcare, based on AI systems, can foster a service innovation because it may determine the introduction of new technological solutions (output-based archetype), new ways of providing health services based on data-driven decisions (process-based archetype), the ability of health professionals to personalize care (experiential archetype) and to design precision medicine paths (system archetype), to be effective and to enable value co-creation factors for the H-SES well-being, it has to be driven by patients (*patient-driven service innovation*).

A patient-driven service innovation would not only improve the predisposition of users to use these tools, it would also improve the quality of the data processed and the reliability of results provided, but it would also make this innovative field more attractive from the point of view of local start-ups which would no longer fear a poor acceptance by the population and a short life cycle for these projects, and would therefore consider them potentially attractive.

## 6. Non-conclusive considerations

It is possible to answer affirmatively the research question (RQ), but under a specific condition: AI-based service innovation in healthcare may effectively contribute to the H-SES well-being if it is conceived, designed and implemented according to a patient-centered approach, as it is suitable to neutralize doubts in terms of transparency and to spur the Release of Reliable data, useful to co-create value.

The main contributions of this paper can be summarized as follows:

- (1) the work sought, through an integrated analysis, to trace touching points between service innovation and service ecosystem well-being, not previously investigated in the literature;
- (2) service innovation in healthcare has to be treated with a multidisciplinary interpretation (medical, IT, management);
- (3) the use of the TAM method made it possible to evaluate the predisposition of the users involved in this H-SES, to use it, and their service quality perceptions. These factors may affect their willingness in integrating resources through AI systems and co-creating value, with effects in terms of H-SES well-being and, given that the service innovation actually takes place when the new solution is accepted and used by the actors and is able to foster new value propositions and new institutions, the investigation of the TAM factors has shown if the new technological solution can actually stimulate a service innovation, by investigating the predisposition of the actors to use it;

- (4) only a direct patient involvement in service innovation may guarantee new institutions;
- (5) the TAM investigates the technology acceptance by users and this acceptance can influence their predisposition to use it and therefore the service innovation possibilities. However, the service innovation, if patient-driven, is truly stimulated and, given that the patient is also a value co-creator of value, can foster the H-SES well-being;
- (6) service innovation archetypes may be considered as H-SES well-being antecedents only if enable value co-creation factors;
- (7) value co-creation factors can only be enabled if the service innovation is based on solutions deemed potentially acceptable by end users;
- (8) more studies on patient-driven service innovation are necessary.

### 6.1 Theoretical and practical implications, limitations and future research

The link between the service innovation and the service ecosystem well-being has been found only concerning the health context; this analysis may be replicated for other contexts understood from an ecosystem perspective.

In this research, the effect of a service innovation based on the introduction of AI systems in healthcare was investigated, in terms of potential improvement of the H-SES well-being thanks to the renewal of value co-creation factors, focusing on the predisposition of actors to use them due to their perceived usefulness, ease of use and quality. Future research will have to focus on further deepening these concepts and the conceptual links between them, and identifying reasoned transparency factors of AI systems and their effects in promoting not only AI use (by improving behavioral intention) but also a conscious use, in favor of value co-creation phenomena.

Furthermore, the case study was carried out only by considering some H-SES actors (most representative for the aims of this work) not by investigating H-SES all actors' points of view.

The main implication lies in the multidisciplinary approach used to deepen service innovation for service ecosystem well-being. Managers and scholars have to consider that the introduction of AI systems in healthcare may be affected by transparency fears which may undermine the perceived quality of service thus supplied.

An in-depth study of AI systems that can be well accepted by end-users, because clearer and more explainable, could be useful to support the decision-making process in healthcare and ensure that the innovation thus proposed may actually be a driver for SES well-being.

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**Corresponding author**

Antonietta Megaro can be contacted at: [amegaro@unisa.it](mailto:amegaro@unisa.it)