A multi-stakeholder perspective on sustainable healthcare: From 2030 onwards

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18 April 2024

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Abstract

Over the past years, the interest in sustainable healthcare has been growing globally and the transition toward environmentally, economically and socially viable health systems is perceived as inevitable and necessary. All the approaches to this emerging field are mainly focusing on short-term specific issues and involving a limited number of stakeholders. This study aimed to address the topic of the possible futures of sustainable healthcare from a multi-stakeholder perspective, in order to define a long-term scenario and the key strategies to enhance this transition. A series of workshops have involved a representative selection of stakeholders based in Nordic countries and concerned with sustainable healthcare through a collaborative foresight process. A design-based approach has been adopted to investigate the current scenario and deepen foresight outcomes. The results highlighted three different horizons and the drivers to reshape the roles of individual stakeholders, enhancing the socio-technical transition towards a desirable scenario based on collaboration between distributed dynamic networks. The identified transition strategies move from the local to the international level, focusing on innovation, information and collaboration between stakeholders. This study provides the framework for future studies to deepen the transition process towards sustainable healthcare and its implications at Nordics, European and international levels.

Keywords: sustainable healthcare; collaborative foresight; systemic design; multi-stakeholder systems; socio-technical transitions

1. Introduction

Healthcare systems aim at meeting the health needs of populations by providing services to satisfy the people's right to health. They help to preserve and restore good health, and enable people to live independently by providing social care services. There are several types of healthcare systems worldwide, but they are all facing radical changes and common challenges. Firstly, the health care sector is moving toward defragmentation, pushed by increasing and emerging financial cuts to cope with massive budget deficits in public spending. This is leading to merging individual hospitals to increase cost-efficiency and exploit economies of scale while offering broader service (Deloitte, 2016). New technologies play a key role in this new trend by optimising treatments procedures and enhancing the digital connection between hospitals and physicians. The need for keeping health costs down is also leading to increased transparency into care quality, results, and expenditure, due to mandatory or voluntary monitoring. Secondly, healthcare has to face new health needs and find new and efficient ways to meet them. The population is ageing quickly, and by 2050 the number of persons over 60 years is expected to double, from 901 million to nearly 2.1 billion (United Nations, 2017). Population ageing puts pressure on health systems, increasing the demand for care, services, and technologies to prevent and treat noncommunicable diseases and chronic conditions associated with old age. Overall, there is a shift toward chronic care: chronic noncommunicable diseases are responsible for 68% of world's deaths (WHO, 2014) and account for over 70% of healthcare spending in the US and European Union (Gerteis et al., 2014; Busse et al., 2010). Overall, the healthcare sector plays a significant economic role, by accounting, in the European Union, for 10% of GDP and 8% of the total workforce. Public expenditure on healthcare and long-term care is expected to increase, driven by high levels of public expenditure and debt in most countries, demographic pressures and technological advances. Today, *"the need to make health systems sustainable by making them more effective, accessible and resilient has been duly recognised by policy-makers at the EU and national level"* (European Commission, 2016) and in the near future, policy actions will be needed to ensure long-term population health and care systems.

This attention to regulations, policies and management practices of healthcare does not concern only Europe. Healthcare systems worldwide need to respond to these challenges, and healthcare stakeholders need to cooperate to face these new societal needs and move towards more sustainable systems. Expenses and patient numbers will inevitably increase, and healthcare must pursue the goal of becoming more effective, more efficient, and more equitable for all people, by controlling spending, improving and implementing the use of available technology and engaging patients in prevention and self-care. The transition toward more resilient health systems is both delicate and complex, and it needs radical changes of perspective as regards the patients' role and the systemic and multi-disciplinary approach to healthcare.

The increasing of chronic disease and long-term care requires people to play an active role in their own care, changing their behaviours for preventing the disease or its effects, and becoming active caregivers from a self-care perspective. This trend is reinforced by the widespread use of the Internet to search for information on health and health services. The impact of web deeply affects health decision-making and, leaving aside the information issues, it contributes to motivating patients toward being involved in their health (Powell, Darvell, & Gray, 2003; Oh & Lee, 2012; Tan & Goonawardene, 2017), also creating new ways of communication with physicians (Van der Eijk et al., 2013). This change towards patient-centred care demands a holistic approach to designing new healthcare products and services: today, different disciplines and sectors are working for innovation in healthcare, but a broader approach to the system is needed to relate different domains to achieve a more comprehensive understanding of sustainability in healthcare innovation (Smith, 2012). Technical and medical innovation is undoubtedly crucial, but innovative healthcare solutions must meet the criteria of usability, utility, and acceptability to enhance self-management and improve the care experience. In order to make the current system into a new patient-centred system, healthcare stakeholders must empower patients, creating services and products that actually start from people's needs to make them able to desire, understand and use these innovations. Different disciplines must cooperate to address innovation in healthcare, managing the complexity of this sector, and focusing on people without losing sight of the system perspective.

Overall, the transition of current health systems is perceived as inevitable and necessary, aiming at increasing the economic sustainability of health care systems, reducing their impacts on the environment and promoting a new social perspective to care. However, the objectives and the way to achieve this transition are not yet clear. Over the past years, interest in what is called 'sustainable healthcare' (SH) has grown globally, although the literature shows there is still no consensus on the definition of sustainable healthcare (Fischer, 2015; Braithwaite et al., 2019). Different approaches are addressing methods and processes to allow health systems to meet the healthcare needs of individuals and the population by achieving optimal health care outcomes while responding to present and future cultural, social, and economic conditions (Prada, 2012). The work of Fischer (2015) highlights how *"in spite of the different ways to define sustainable healthcare systems, and regardless of whether the three-pillar model or the integrated understanding of sustainability is applied, all approaches seem to have in common that a comprehensive approach with a long-term focus and a need to balance economic, social, and ecological interests needs to be used in the discussion of sustainable healthcare systems."* (p. 298).

Economic sustainability is indeed a key factor, which has not only led to budgetary cuts to the quality healthcare services (Clemens et al., 2014), but has also encouraged qualitative views to approach savings from the point of view of selective reduction and optimisation of resources, processes, and supplies (Evans, Hills, & Orme, 2012). Besides the economic

issues demanding for higher efficiency and sustainability, many healthcare stakeholders called into question the Hippocratic principle "primum non nocere" (first, do no harm) to rethink their roles and responsibility towards human and planetary health, aiming at preventing environmental impacts and, consequently, environmental diseases (Sherman & Ryan, 2010). Moreover, an increasing number of hospitals and health organisations have committed to reducing the adverse environmental effects of their operations on patients, staff, and communities, becoming role models for the whole health sector (Kaplan et al., 2012).

Although in a fragmented manner, sustainable healthcare is taking concrete form in the local and international policies that wish to foster greater sustainability of the healthcare systems (Jamieson et al., 2015; Walker & Brammer, 2009; Richardson et al., 2014), as well as in the several organisations that are promoting a sustainable approach to the sector. At a European level, healthcare systems are facing the common challenge of high healthcare costs, endeavouring to ensure that economic pressures do not undermine universal coverage and equitable access and financing (Thomson, Foubister, & Mossialos, 2009). Therefore, the European focus on sustainable healthcare lays its foundations on the economic paradigm, starting from a new concept of health system resilience that aims at responding to contemporary challenges and ensuring high-quality care also in the future (European Steering Group on Sustainable Healthcare, 2015).
While the link between economic and social sustainability was initially evident in the common goal of providing more efficient and higher quality health services, the shift towards a vision that also includes environmental issues is currently underway. Environmental sustainability strategies aiming at reducing energy, water and waste, and their associated costs, have a direct financial return on investment. Other environmental initiatives, such as the procurement of non-toxic chemicals, medical devices with fewer chemicals, or healthy foods, provide positive outcomes on patients' health (Sutter, 2012). Although there is a growing awareness of the connection between the three sustainability dimensions in healthcare, the challenge for most hospitals and health organisations is how to manage the wide-ranging efforts that support environmental sustainability, and how to integrate them into clinic operations effectively, given the complex facilities and range of activities involved in delivering healthcare services (Boone, 2012).

The European framework shows growing attention to the environmental sustainability of public healthcare, which is mainly achieved through the promotion of environmental standards for healthcare organisations and the deployment of Green Public Procurement strategies (Chiarini & Vagnoni, 2016). These strategies seek to combine different levels of responsibility that today health stakeholders are facing independently: on the one hand, health providers are directly responsible for the huge consumption of resources and the impact of substances and waste produced by health processes; on the other hand, the medical and pharmaceutical industry is indirectly responsible for some major impacts, such as the presence of chemicals in the environment. The collective attention to sustainability, although discontinuous and often failing to define common directions, is fostering a shared responsibility approach that makes it possible to act upstream and downstream of the healthcare system.
Nevertheless, there are still significant differences between the implementation of European directives in the different member states. The Nordic area, where this study has been carried out, certainly presents favourable conditions to foster the sustainable transition of healthcare systems, based on well-established experience in other public sectors (Nissinena, Parikka-Alholaa, & Ritab, 2009). Sustainable healthcare represents an actively growing research and policy trend in the Nordics, which are in a leading position at European level (Eriksson et al., 2015). However, the transition towards sustainable healthcare is a complex issue that brings many challenges: on the one hand, the need to acquire new knowledge and skills in the field of sustainability; on the other hand, the difficulties of creating a dialogue between very different disciplines and sectors.

Alongside the health-related and the managerial-technological disciplines traditionally involved in the sector, new environmental disciplines are needed to foster sustainable healthcare, ranging from environmental management to sustainable waste management, to clean technologies. In healthcare design, traditional disciplines are also being enriched with new knowledge for the sustainable design of facilities, services and products. At the same time, new design disciplines, such as systemic design, are enabling to create a new mindset of professional care in designing for people, practitioners, and societies (Jones, 2013) and to promote a comprehensive approach to the healthcare systems, tackling their economic, social and environmental issues.
In order to allow this interdisciplinary collaboration, several organisations and centres are working to create networks of health stakeholders, aimed at exchanging good practices, promoting technology transfer and providing fertile ground for collaboration projects and trans-sectoral contaminations (Pereno, 2017). However, the complexity of the sector and the issues to be addressed, make it essential to understand the possible transition scenarios and the drivers needed to guide this process.
From that perspective, health systems are seeking for sustainable business models for integrating sustainability goals into the proposition, creation, and capture of value in business (Boons & Lüdeke-Freund, 2013). The work of Nosratabadi et al. (2019) explores the health-related research in this domain, highlighting how the healthcare industry has used sustainable business models to address sustainability issues that have been brought digital technologies into play. In particular, mobile health and telehealth offer tools claimed to provide sustainability to hospitals (Merchant, Ward, & Mueller, 2015) by strengthening preventive care and reducing transport and resource consumption through the

digitalisation of medical care. This is all the more important in an ageing society where assisted living technologies and services are gaining momentum but still need to find a sustainable framework to scale-up into viable and widespread commercial services (Oderanti & Li, 2016). Although the implicit sustainability of telehealth processes offers valuable business models and fosters more sustainable care scenarios, we argue that eHealth alone cannot drive towards complex sustainable healthcare patterns. The transition of socio-technical systems requires a holistic approach to manage multi-level and multi-stakeholder complexity: eHealth services can give rise to niche innovations that are relevant to the transition but not self-sufficient.

This paper aims at contributing to the debate on the possible future models of sustainable healthcare by proposing a multi-stakeholder perspective on the health systems transition, that is based on the considerations emerged by a series of workshops exploring the needs and expectations of different health stakeholders over the medium and long term. The goal of the study is to answer two main research questions:
1. How will the relationships between the stakeholders be shaped in future scenarios of sustainable healthcare, and which drivers will determine this change?
2. Which strategies can foster this transition towards sustainable healthcare?

In the literature, we found studies that address the topic (Singh, 2019; Sainsbury et al., 2019; Charlesworth & Jamieson, 2019; Aquino et al. 2018; Desmond, 2017), but they mainly focused on special issues or specific stakeholders: no research has involved all the stakeholders concerned in the healthcare sector, addressing the sustainability of the whole system. The present study aims at contributing to fill this gap by exploring the vision of stakeholders on long-term models of healthcare systems.

The study has been carried out within the project 'Världens hållbaraste sjukvård 2030' funded by Vinnova, the Sweden's Innovation Agency, that aims to explore the visions of key actors in the Swedish and Nordic health systems to define strategies for transition to sustainable healthcare. The aim is to develop collaborative approaches within the system that can support the implementation of the identified scenarios. Although the project starts from the Swedish context, the explicit interest is to explore the Nordic and European scenarios to encourage exports and the development of a cross-border market and governance. The Nordic Center for Sustainable Healthcare, as the main partner of the project, has allowed to effectively involve numerous stakeholders in the health sector thanks to its consolidated network of members concerned with sustainable healthcare. The paper illustrates the future scenarios that emerged from the foresight process implemented through a series of workshops and outlines the main strategies emerged

The paper is therefore structured as follows: the first part introduces the methodological framework and the specific method developed to involve health stakeholders in a collaborative foresight process. The second part illustrates the current healthcare system and the primary relationships between stakeholders, as emerged from the analysis of the state of the art. The third part shows the main results of the study to discuss the emerging long-term scenario on sustainable healthcare and the key strategies to enhance the transition.

2. Research Methods

2.1 Methodological Framework: Designing Stakeholder Participation in Foresight

A long-term approach is needed when dealing with complex socio-technical systems, as the multi-layered nature of the problems requires long-term processes to undertake a sustainable transition. In the late 90s, Brand (1999) argued that "*society is revving itself into a pathologically short attention span. The trend might be coming from the acceleration of technology, the short-horizon perspective of market-driven economies, the next-election perspective of democracies, or the distractions of personal multitasking. All are on the increase*". In the following two decades, the importance of thinking in longer time horizons has increased as has the difficulty of enabling long-term decision-making.

The issues of strategic foresight and transition are central to several domains that address the contemporary debate on how changes occur and how they can be predicted and managed within complex systems, directing the transition towards a sustainable future. This transition entails new ways of planning that are based on a deep understanding of complex systems, such as healthcare, and the definition of specific tools and methods to design for change and transition (Irwin, 2011; Loorbach & Rotmans, 2010; Broerse & Grin, 2017).

Contemporary societies are increasingly aware of the 'wicked problems' (Rittel & Webber, 1973; Rith & Dubberly, 2007) they have to face, ranging from climate change to population growth and inequality, from responsible production to sustainable health systems: the interrelated and interdependent nature of these problems is becoming more and more evident (Banathy, 1996; Li, 2002; Capra & Luisi, 2014). The wickedness of sustainable healthcare lies in the difficulty of predicting the implications within a complex system as healthcare. For example, the pursuit of patient-centred and distributed healthcare systems leads to delegating to local stakeholders the problems of managing health resources and waste, with possible consequences on the environment and, consequently, on human health. Equally, environmental

strategies must be evaluated in relation to their economic and social impacts on the system, that is not easily predictable in the long term. For example, the reduction of materials used in the production of a medical device may bring environmental benefits and can be evaluated through current technical and regulatory tests. Conversely, the reuse of medical devices is a large-scale environmental strategy that requires new systems of collection, transport, sterilisation, regeneration, testing and distribution of the reused devices. When environmental strategies require not only technical but also logistical and organisational innovations, it is difficult to assess all the economic and social effects, such as the actual costs for the healthcare system or the long-term effectiveness of medical treatments.

The sustainable transition of large public sectors, such as healthcare, is a complex challenge that requires new environmental policy approaches to foster systems changes. These changes require research methodologies able to manage their complexity, based on co-evolutionary, multi-dimensional, multi-stakeholder, long-term processes (Geels, 2005). Therefore, innovative methodologies have been emerging to challenge socio-economic and political paradigms, aiming at addressing multiple levels of scale in the long-term. Among the tools identified in the studies on systems change and transitions policy, participatory methods to facilitate multi-stakeholder interactions and foresight processes are deemed as effective to support policy approaches for the transition (Geels et al., 2008).

The foresight process starts from a deep understanding of local socio-technical systems and culture, looking *"for 'emergent possibilities' within problem contexts, as opposed to imposing pre-planned and fully resolved solutions upon a situation"* (Irwin, 2015). Foresight stimulates systemic capacities by providing internal and external signals to identify threats and opportunities of these 'emergent possibilities' to drive the creation of innovative socio-economic structures (Ahlqvist, Valovirta and Loikkanen, 2012). However, to describe and understand complex systems, long-term strategic planning requires transdisciplinary teams that aim to develop innovative solutions based on transition visions that are built on a comprehensive perspective (Irwin, 2011). To this aim, collaborative foresight is crucial to enable a heterogeneous group of participants to define the diversity of visions that are needed to describe and understand complex problems (Weigand et al., 2014). The involvement of different stakeholders allows to have a variety of visions able to give evidence of the different levels of a system, yet managing large working groups may be challenging. Collaborative foresight techniques stimulate stakeholders to present their vision of prospective innovations and explain multiple perspectives in the evaluation and analysis of multiple visions (Könnölä, Brummer, & Salo, 2007)

When dealing with nonobvious future problems that entail discontinuous and sustainability-oriented innovations, collaborative foresight enables engaging stakeholders in addressing a type of problem that calls into question collective interests (Eames, & Egmose, 2011; Wiener, Gattringer, & Strehl, 2020). Therefore, complex issues such as those involved in the transition towards sustainable healthcare require a collaborative multi-stakeholder approach to define future scenarios by elaborating the different perspectives and shaping a shared vision on collective issues.

Previous works suggest that linking foresight and design can make a valuable contribution to collaborative innovation and co-creation (Wilkinson, Mayer & Ringler, 2014; Celaschi & Celi, 2015; Celi & Rudkin, 2016; Jones, 2018), by providing means for a validated qualitative inquiry into human behaviours, organisational processes, and systemic relationships of services and artefacts in a social system (Jones, 2014). Design methods enable determining the hidden possibilities of the present, due to the ability to establish connections and enhance the existing potentials of a socio-technical system, based on the experience gained in other design fields (Buchanan, 1992; Margolin, 2007; Manzini, 2015). In particular, systemic design represents *"an integrative interdiscipline with the potential to implement systems theory with creative methods and mindsets, by bringing deep technical knowledge, aesthetic skill, and creative implementation to the most abstract programmes of collective action"* (Jones, 2018, p. 9). Indeed, systemic design provides innovative tools to analyse and achieve an in-depth understanding of complex environments (Battistoni, Giraldo Nohra, & Barbero, 2019).

This methodological framework has allowed to analyse the existing scenario by identifying relational and decision-making mechanisms. Moreover, it has built the holistic approach that has enabled to analyse the emerging visions to define possible and desirable future scenarios of sustainable healthcare, and the driving factors required to foster a socio-technical transition.

2.2 Methods

The methods adopted in the present research are based on a collaborative foresight approach that involved a model of committed stakeholders that corresponds to the multiple system levels to which they belong, within the health sector. Figure 1 shows the methodological pathway followed to involve the stakeholders in defining a plural but common vision of sustainable healthcare in the medium-to-long term.
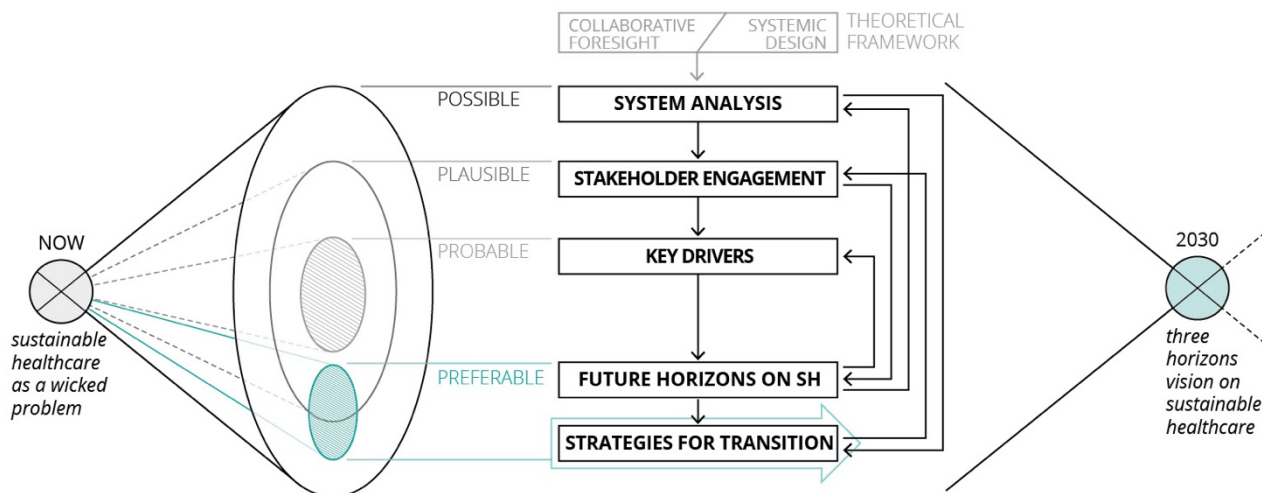
Figure 1 *Methodological pathway (partially adapted from Hancock & Bezold, 1993)*

The analysis of the current system has allowed to define the state of the art of the healthcare sector in Sweden, thus highlighting common trends at the Nordic and the EU level. The analysis supported stakeholder mapping and led to building a package of knowledge to be shared with the involved stakeholders, in order to lay the groundwork for common knowledge of the sector and to share key concepts and terminologies. The experience gained by the Nordic Center for Sustainable Healthcare in sustainable healthcare, as well as its members' network, has facilitated this process, allowing an effective identification of key stakeholders; the expertise of the Systemic Design research group at Politecnico di Torino in analysing and designing complex systems has supported building a robust healthcare system analysis. Hence, the combination of foresight techniques and systemic design skills - well established in large socio-technical systems transition - has been fundamental in the construction of the multi-stakeholder process and, especially, in the analysis and visualisation of the present system and future scenarios.

A selection of stakeholders, mainly based in Nordic countries, was involved in five workshops aimed at defining future visions on sustainable healthcare. The workshops were structured in two stages. The first introductory part featured the participation of speakers who addressed different aspects of sustainability in healthcare, with the dual objective of offering interesting content to encourage participation and building a common ground and a shared language. The second, central part was dedicated to the foresight process on sustainable healthcare, through the guidance of facilitators following a common questionnaire, as further explained in par 2.2.1. Facilitators noted the emerging visions on the guiding questionnaire, while leaving the freedom not to address all questions and to do so in free order. The workshops then produced written documents (the questionnaires), possibly supported by diagrams or visualisations made in the subgroups, and subsequent annotations made by the facilitators.

The results of the workshops provided the key drivers that will mark the future prospects of sustainable healthcare in relation to the main categories of stakeholders. Starting from that output, three future visions on sustainable healthcare have been defined. The final step was the definition of strategies to enable the transition to sustainable healthcare, understood as the start of a long-term process of change in the healthcare system, which is characterised by complexity and uncertainty, due to the large number and diversity of the stakeholders involved and the unpredictability of the course the transition will take (Geels et al., 2008).

2.2.1. Stakeholders Engagement Process

The research is based on the involvement of the main healthcare stakeholders in the definition of key drivers for a transition to a new vision of sustainable healthcare. Figure 2 shows the three phases of the engagement process, which allowed the selection and involvement of stakeholders in the foresight process.
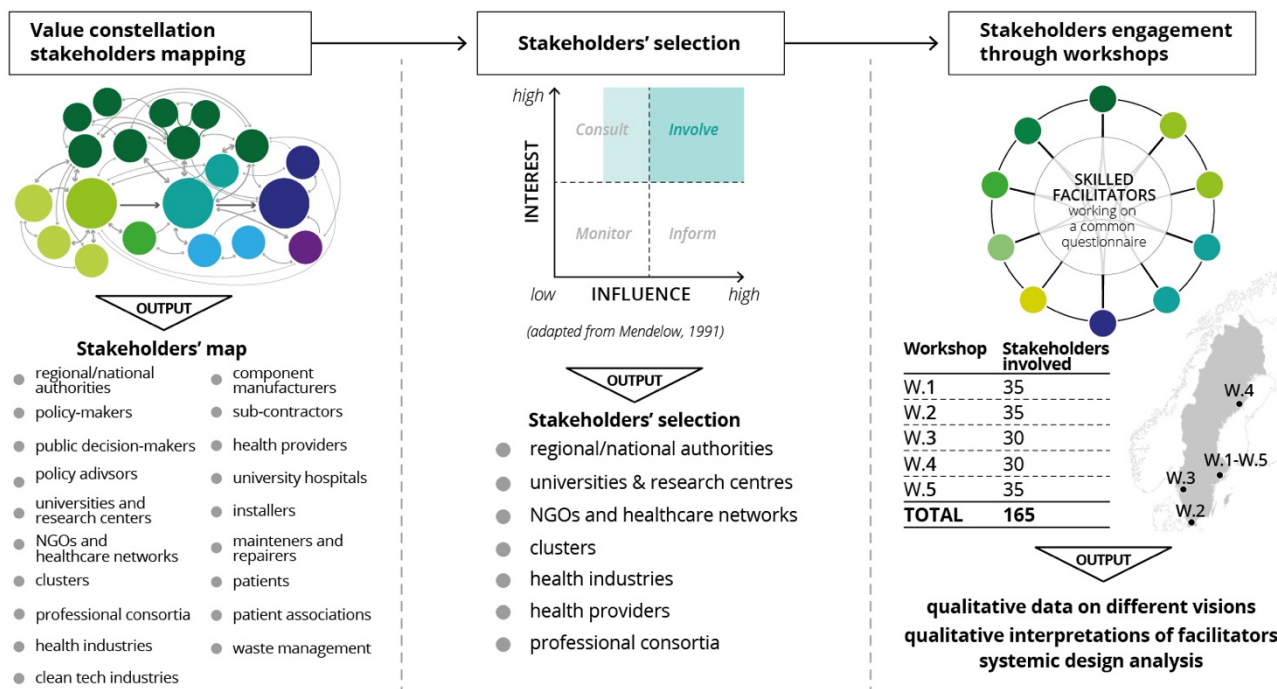
Figure 2 *Stakeholders engagement process*

The nature of the health sector is best represented by the concept of value constellation (Normann & Ramirez, 1994), which goes beyond the idea of value chain to define the complexity of the 'value-creating system' (Normann & Ramirez, 1993), within which different actors work together to co-produce value. Sustainable healthcare encompasses a value constellation in which different stakeholders from different sectors operate around healthcare delivery, generating a system of services, goods, design, and social value that defines the system itself.

The mapping of the healthcare constellation has allowed defining the whole system of stakeholders involved, the relationships between them and their influence and interest in sustainable healthcare. A total of 17 main stakeholder categories emerged, which interact in the system to supply, provide and receive healthcare services.

The second phase was the selection of stakeholders, based on the relationship between their interest in healthcare and sustainable healthcare and their influence on the system, concerning sustainability. Starting from the Mendelow's matrix (1991), the selection process focused on identifying the stakeholders who are strongly interested in the sustainable transition of the healthcare sector and who have the power to make decisions that can foster this transition. However, we have decided to extend the selection to some stakeholders who are interested in sustainable healthcare but currently have limited decision-making power (see Figure 2). This for two main reasons: on the one hand, some stakeholders have a limited influence on the sector in the present scenario, but the system analysis showed they could play a more important role in the future, for example patient associations that, in a user's empowering perspective, can bring meaningful visions. On the other hand, some stakeholders do not have a strong influence in the Swedish and Nordic scenario but at European and international level play a key role in the promotion of sustainable healthcare, such as Nongovernmental Organizations (NGOs).

Figure 3 shows the selected eight stakeholder categories: the prevalence of health providers and health industries is due to the central role played by these stakeholders within the system, as well as to the diversity of the players concerned. The direct involvement of patients, another key stakeholder in the health system, was not possible due to the very nature of this stakeholder: the bottom-up investigation of patients' vision requires a separate analysis, carried out on significant samples of the patient population. Since this analysis is outside the scope of the present research, the patients' perspective has been primarily carried by professional consortia which also included patient associations.
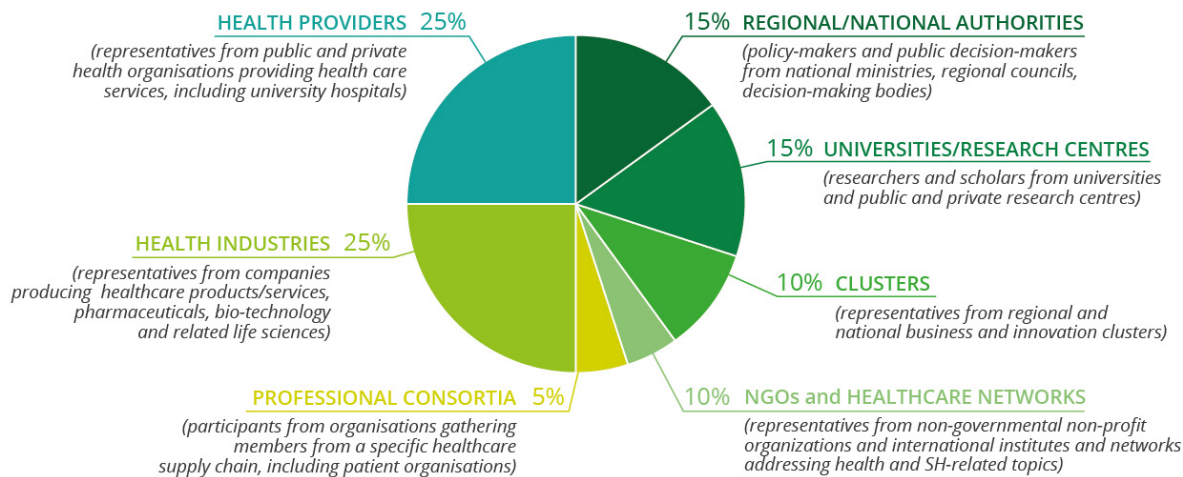
Figure 3 *Composition of the stakeholder group*

The third phase was the stakeholder involvement through a series of five workshops that involved 165 participants representing the selected health stakeholders (Figure 2). The workshops were held in several cities in Sweden to ensure the participation of a significant number of stakeholders. Each workshop involved from 30 to 35 participants, who were divided into five heterogeneous subgroups, each one moderated by an experienced facilitator, who led the discussion based on a common questionnaire. The presence of a facilitator enabled to manage the discussion by encouraging stakeholders to present their ideas and keeping track of the emergent vision, while addressing the challenge of maintaining the interest of stakeholders. Facilitators also have the task of managing different levels of knowledge, as well as different values and assumptions among stakeholders.

Each workshop consisted of two main phases: the first phase of content sharing, starting from the present scenario (see par. 3), and the second phase focused on the foresight process of sustainable healthcare in 2030. The facilitators guided their groups starting from agreeing on a definition of 'sustainability' and 'healthcare' to identify risks, barriers and opportunities of the current scenario, then moving towards a vision of future roles and relationships between stakeholders from a sustainable healthcare perspective. The questionnaire at the basis of the discussion was designed as a tool to support facilitators in leading the discussion by addressing key issues relevant to the foresight process, without forcing the compilation of the questionnaire, but allowing to draw qualitative data on common issues. Equally fundamental, at the end of the workshop, were the integrations of the content by the facilitators, that acted as 'knowledge brokers' between stakeholders and the authors (Gramberger et al., 2015). Therefore, the workshops led to a twofold output: on the one hand, the answers and qualitative visions emerged from stakeholder workshops; on the other hand, the interpretations of the facilitators that allowed to harmonise the results and clarify any interpretative doubts.

2.2.2. Definition of Key Drivers and Future Visions to Determine Transition Strategies

The stakeholder involvement allowed to define the key drivers (see par. 4.1) that will mark the prospects of sustainable healthcare in relation to three main categories of stakeholders: health industries, health providers, and patients. The focus on these three typologies allows highlighting the triggering factors in the three key actions on which the system is based: producing products and services to enable providing and receiving health care before, during and after the clinical treatment. Therefore, the drivers affect both the single role of stakeholders and the collaboration methods and processes established between them.

Starting from the stated drivers, we applied a systemic design-based approach to define the desirable long-term system in which sustainable healthcare reframes the roles and relationships among the constellation of different stakeholders, fostering the creation of value in new forms and by new stakeholders and organisations. In order to report the plurality of perspectives that emerged from the workshops, the systemic analysis of results was supported by the Three Horizons framework (Sharpe et al., 2016), which allowed to channel multi-stakeholder visions into three possible future scenarios for sustainable healthcare (see par. 4.2).

Therefore, the final phase was the definition of the strategies needed to govern the sustainable transition towards sustainable healthcare (see par. 5), by identifying the strategic activities to be implemented, the barriers to face, the stakeholders involved and the time horizons concerned.

3. The Multi-stakeholder System Behind Sustainable Healthcare

The analysis of the current systems aims at identifying and mapping the stakeholders that make up the healthcare value constellation and the relationships between them, defining the hierarchy of roles and influences within the system. To that end, a systemic design approach has been adopted to define and visualise this conceptual system (Figure 4) in order to highlight the main issues in terms of relationships, communications, and decision-making.

The three main actors - health industries, health providers, and patients - underlie the current system and represent the three main stages of the value constellation, around which a multitude of actors revolve.

Health providers include public and private health organisations providing health care services. With regard to sustainable healthcare, health providers have a strong influence on the system because they procure products/services and deliver them to patients, while entertaining relationships upstream and downstream of the delivery process. Increasingly widespread tools such as Green Public Procurement demonstrate the importance of providers in demanding sustainable innovations and leading research in that direction. In some cases, health providers may include *university hospitals*, hosting the health faculties of local universities and being in close contact with research organisations while, in other cases, they collaborate with universities through external collaborations. Overall, the relationships that health providers maintain with other actors through different channels are poorly structured, resulting in communication failures.

Health industries mainly include companies producing healthcare equipment and services, pharmaceuticals, biotechnology and related life sciences. They have well-established networks of suppliers (*component manufacturers* and *sub-contractors*) and *distributors* which, however, are mainly based on commercial agreements rather than collaborations on research and innovation topics, including sustainability. The distribution network also includes *installers* and *maintainers/repairers* who provide technical support to local health providers, often dealing personally with customers but with limited feedback to the client company. Recently, collaborations with the world of *clean tech industries* are growing in order to implement new clean solutions in the healthcare sector, mainly concerning renewable energy, information technologies, green chemistry, lighting, and recycling. Especially in public systems, characterised by large public tenders, there is a lack of structured dialogue between companies and health providers: this further reduces the possibility of receiving direct feedback from the users who interact with the products or services. As regards the relationship with patients, large companies usually dialogue with *patient associations* (disease-specific patient organisations and national coalitions of patient groups) on problems related to specific diseases, but issues such as sustainability are hardly considered.

Although they represent a key stakeholder in the system, *patients* have very little influence on the changes taking place, either because of their multiple and fragmented nature or because, unlike other sectors, they are users but not purchasers and, especially in public systems, they have little possibilities actually to choose products and services. The shift towards patient-centred care has already modified the patient's role, mainly thanks to new self-care technologies; however, at state of the art, the patient is still mostly passive within the system.

The other actors of the system may dialogue with the three main stakeholders through different relational modalities and hierarchies.

The *regional and national authorities* have strong decision-making power on the value constellation and determine incentives and policies aimed at promoting the sustainability of the sector. Often the main decision-maker is the local health authority, but the complexity of healthcare requires the involvement of different authorities, in particular the environmental authority in the case of sustainable healthcare. Within them, regional and national authorities include *policy-makers*, who carry out policy agendas on the sector, and *public decision-makers*, who deal with technical-administrative issues and ensure continuity of action in the sector. Especially at the national level, *policy advisors* are a key player in the health sector as they advise on policy programmes and initiatives, having the possibility to influence policy decisions, especially on new topics such as sustainable healthcare.

Dialogue with stakeholders varies from region to region and from country to country, but in general, the regional and national authorities directly or indirectly communicate with all actors. This allows them to pursue a vision that balances economic, social and environmental sustainability; today, however, the economic issues are still pressing and short-term economic concerns often constrain the choices made about healthcare services and innovations.

Universities and *research centres* are potentially essential to drive innovation in the sector, especially in terms of environmental sustainability. However, today, their influence in the value constellation is limited, and their role is tied to specific relationships with companies, providers and other actors in the system.

NGOs and networks working in healthcare are of various kinds, from scientific organisations, to foundations addressing specific health challenges, to solidarity and international cooperation bodies. As regards sustainable healthcare, international NGOs were the first to deal with this topic, and today they gather hundreds of stakeholders: on the international scene, therefore, NGOs and healthcare networks have an influential role in driving environmental strategies and promoting projects and campaigns that involve a large number of actors.

Business and innovation clusters are established groups of companies, start-ups, and associated institutions working in the medical and life science sector: they represent important stakeholders at the regional level, since they often act in close collaboration with regional authorities to foster investments and establish sector strategies that can bring significant changes in system innovation. Besides medical clusters, clusters from other fields, such as green chemistry or clean technologies, are also looking into sustainable healthcare.

Professional consortia are self-governed platforms that gather representatives from a specific supply chain, e.g. pharmaceuticals or specific diseases, to promote innovations and governance mechanisms. Their involvement is, therefore, essential for the long-term vision of the system.

Finally, product end-of-life management is carried out by *waste management stakeholders*, i.e. public and private organisations that usually deal with urban waste management and have developed systems dedicated to medical waste; however, the actors that manage this last phase of the life cycle have no contact with the upstream ones.

Overall, many critical points are emerging. First of all, the existing system sees a multiplicity of stakeholders dialoguing in a partially structured way and, often, communications are unidirectional: in a public system, the regional authorities relate directly with public health providers (hospitals and health organisations), and in parallel they have a dialogue with organisations acting as spokesmen for the industrial sector, primarily clusters and professional consortia. Relations with NGOs and healthcare networks, patient associations and universities are usually discontinuous. In Nordic Countries, some regional authorities have been experimenting some working groups involving representatives of the different levels of the supply chains, putting together suppliers and providers: this is certainly a good strategy, but it is necessary to develop organisational solutions able to network more stakeholders and more sectors.

The hierarchy of the system is clear, but the unbalancing in the decision-making power is critical if combined with the difficulty of gathering the multiple visions of stakeholders acting individually. The decisional imbalance is due in some cases to the very nature of stakeholders, such as patients, who are difficult to aggregate and lack organisations able to dialogue with other actors. In other cases, such as non-medical research centres, waste end-of-life actors, or clean tech companies, the sector shows resistance to give prominence to stakeholders outside the traditional healthcare field.

The supply chain approach is strongly compartmentalised, and there is a lack of a systemic vision that would align the actors downstream with those upstream. The sustainable healthcare undoubtedly increases the complexity of the system, introducing new stakeholders; therefore, a holistic approach is required to create new organisational structures to foster dialogue between different actors and balance decisions according to a long-term and shared vision.
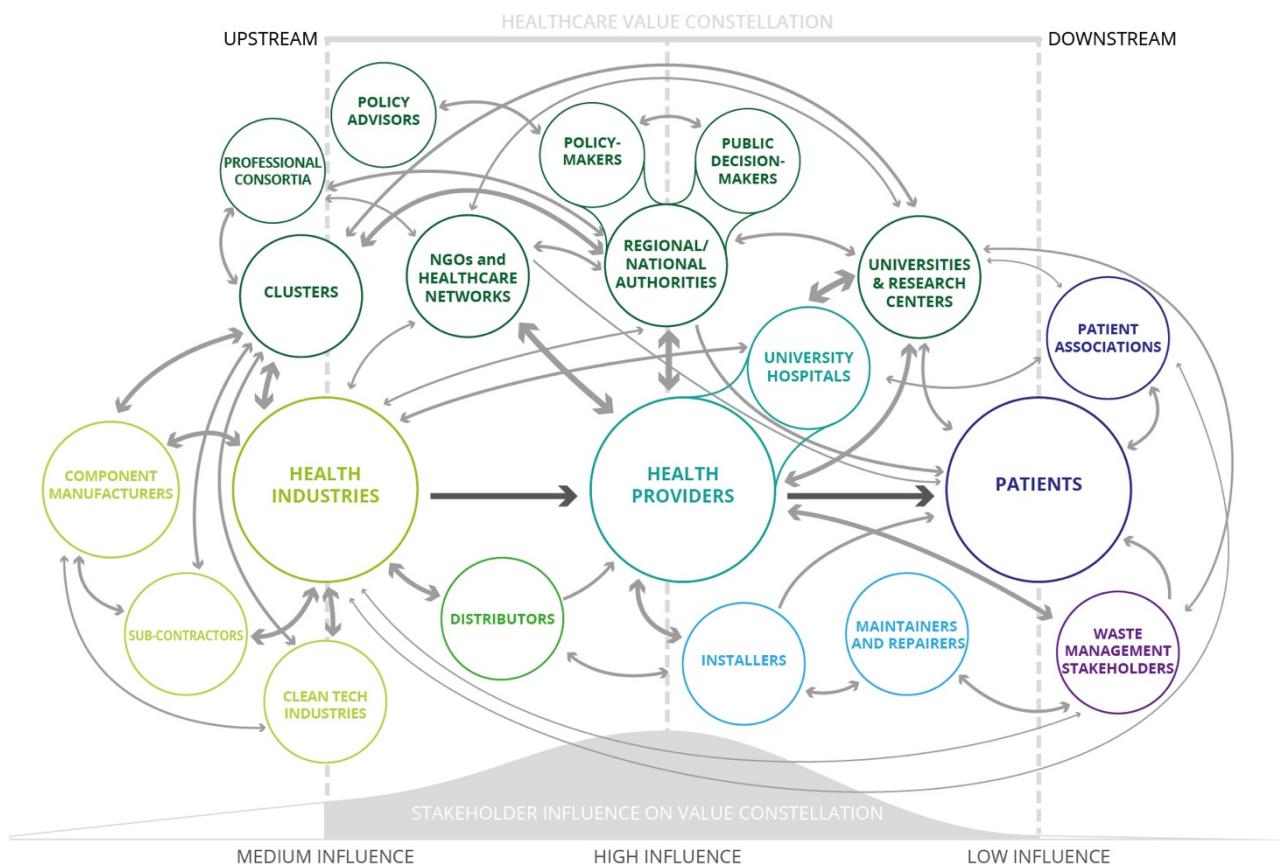

Figure 4 *Visualisation of the current multi-stakeholder system related to sustainable healthcare*

4. A Framework for Futures Development of Sustainable Healthcare

4.1 Multi-Stakeholder Visions on Sustainable Healthcare

The foresight process involved in a direct and structured way a significant representation of the stakeholders that compose the healthcare value constellation. Stakeholders were guided in formulating different perspectives on the medium-long term future of the sector towards sustainable healthcare. The first step, however, was to share a definition of 'sustainable healthcare', as the novelty of the topic generates different interpretations and possible misunderstandings. In particular, it was important to circumscribe the field of sustainable healthcare and distinguish it from 'sustainable health', which concerns public health strategies aimed at ensuring healthy lives and promoting the well-being of present and future generations (Mori & Todaka, 2009). Although important, the 'sustainable health' approach addresses wide-ranging topics that go beyond the healthcare value constellation. At the same time, it was necessary to unhinge assumptions that are too focused on health treatment in its local dimension, so as to achieve a macroscopic and systemic view of sustainable healthcare. Therefore, in the workshops we came to a common starting definition according to which sustainable healthcare is a comprehensive approach with a long-term focus to hospitals, behaviours and technologies within the healthcare systems, that aims at balancing the economic, social, and ecological interests of several stakeholders involved in the whole value constellation (cf. par. 1).

The facilitators moderated the discussions within subgroups of 6-7 participants through a standard questionnaire aimed at guiding the discussion through two phases.
The first phase focused on the introspective vision: each stakeholder proposed his/her view connected to his/her role in the sector, based on his/her own experience: what are the trends of his/her organisation towards sustainable healthcare, what are the present and future obstacles and triggers that have allowed or will allow implementing sustainable healthcare, as well as future risks if choosing not to pursue strategies towards sustainable healthcare.
The second phase addressed the systemic visions: participants expressed their views on how they see sustainable healthcare in ten years, how their role will change and which modes of interaction within the system will foster a holistic approach to sustainable development in the sector.

In this phase of open discussion, several contributions and key concerns have emerged that allowed the development of long-term horizons. Stakeholders have often highlighted potentials which, at the same time, are major obstacles to the transition of the system. For example, most of them have brought out the importance of being interdisciplinary and breaking up the 'silos' structure that compartmentalises the healthcare system. However, the discussion revealed that everyone has great difficulties in taking action on this issue and many stakeholders are concerned about the risk of creating a new 'silo' competing with the existing ones instead of including them. Another interesting example is the vital importance of information, that many stakeholders synthesised as the need for 'aha moments' that allow them to understand their possible role within new systems, as well as the advantages of being part of the transition.

Facilitators kept the peculiarity of each perspective in mind, but pushed the participants to harmonise the individual visions in order to define collective visions and, above all, explore the methods perceived as effective for enhancing future collaborations among stakeholders.
Each workshop ended with a moment shared by all participants, in which they have summarised the emerging visions to collectively exchange foresight of sustainable healthcare and confirm the triggering factors.

Therefore, each workshop resulted in five visions that, in the total of the five workshops, allowed to obtain multiple perspectives deriving from the material produced by participants, from what facilitators reported and from the final collective discussions. Starting from these outputs, the authors then carried out further analysis of the results to define a general future vision of sustainable healthcare, adopting a systemic design approach that provided a valuable framework for defining complex scenarios from an interconnected and transdisciplinary perspective. The findings focus on three main types of actors and collaborative strategies at a systemic level. Figure 5 summarises the key drivers that distinguish the three main categories of stakeholders: health providers, health organisations, and patients.
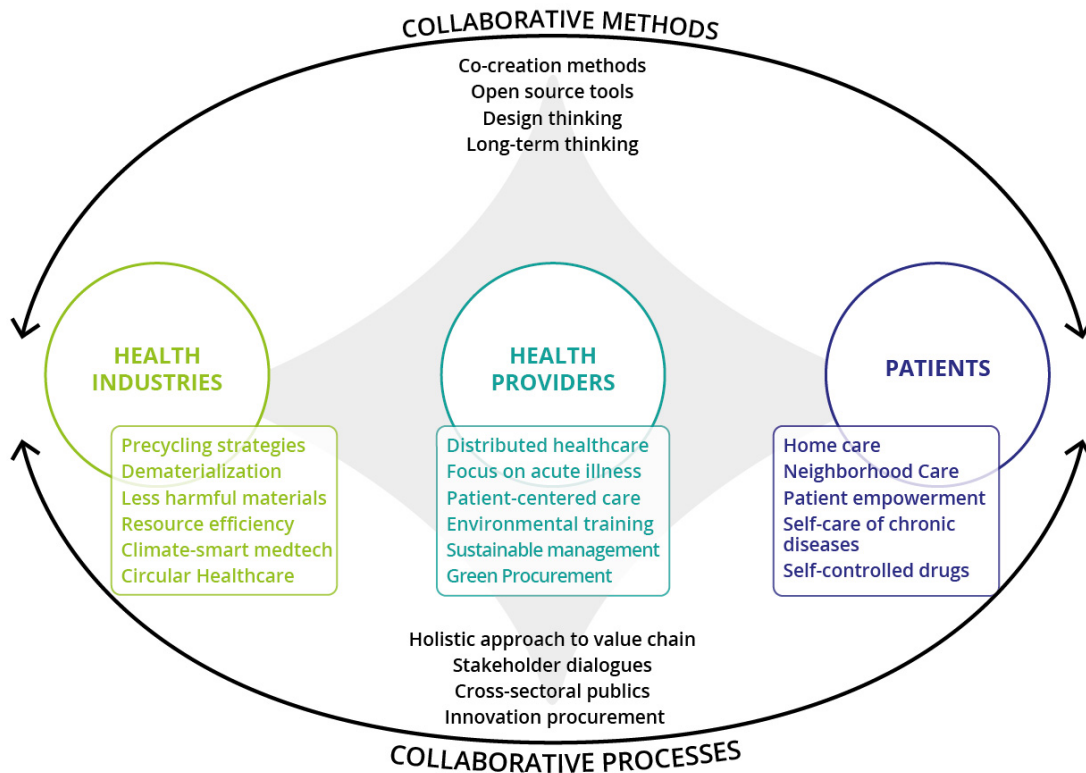
Figure 5 *Key stakeholders and drivers in the long-term model of sustainable healthcare*

What is emerging is a change of perspective on the roles of the different stakeholders, which also comes from more direct and continuous collaborations between them. Undoubtedly, changes in the relationship between health professionals and patients are influencing the hierarchy of all the stakeholders and the way they perceive the healthcare system. A patient-centred care approach is being consolidated, combining attention to the patients' real needs with an empowerment process. The transition from a supply-driven to a demand-driven approach increases the resilience of long-term care systems: on the one hand, the patient acquires awareness and becomes more autonomous in the management of his chronic conditions and necessary therapies. On the other hand, medical treatments move towards the domestic dimension, shifting from a hospital-centred to a distributed healthcare approach, as evidenced by the spread of new models of Neighbourhood Care (Johansen & van den Bosch, 2017) as well as the Health Homes and Accountable Care Organization models introduced by the US Affordable Care Act (Shields, Patel, Manning, & Sacks, 2011). Although depending on the specific socio-economic context, patient-centred medical home models are leading to restructuring primary care to provide high-quality care tailored to different individuals' needs (Jackson et al., 2013), shifting the focus to enhanced interaction between users and care services in a home care context (Rajkomar, Mayer & Blandford, 2015). In addition to a proven increase in the care quality, distributed healthcare also shows significant potential in terms of cost savings for hospitalisations and improved preventive care, as highlighted in the report on the US Health Home State Plan Option (HHS, 2018).

If the patients become protagonists of their own care, hospitals and health providers evolve in a twofold direction. On the one hand, distributed care requires a greater capillarity of health services and a stronger local presence through units and individual professionals who provide support to home care for chronic diseases. On the other hand, large health centres must continue to increase their expertise in the management of acute illness and non-chronic diseases. To this end, the defragmentation strategies of the health system are essential to foster skill centralisation and offer high-quality, specialised care for acute conditions. In many countries, this means merging individual hospitals to increase cost-efficiency and bring high-quality care to a larger number of people (Deloitte, 2016). New technologies are supporting this phenomenon by providing digital connection between hospitals, staff, and patients. The low population density and the climatic and geographical features of the Nordic countries are further accelerating this process which, in the future, will see the polarisation of acute care in fewer specialised centres and the capillarisation of chronic care across the countries, mainly thanks to telehealth services.

Health providers are also increasingly attentive to environmental sustainability, in terms of staff training, facility management and dialogue with suppliers. Many healthcare organisations are introducing specific training programmes dedicated to the promotion of environmentally sustainable behaviours (Richardson et al., 2014), in particular for staff

involved in the management of energy and waste, such as nurses (Ryan-Fogarty, O'Regan, & Moles, 2016). This trend will consolidate, and training programmes for healthcare professionals will address sustainability issues: the development of new skills will enable building teams that can manage the specific environmental problems of the sector, and implement the most far-reaching environmental strategies. As regards hospital management, the focus today is on specific issues such as energy efficiency or waste management, but in the future, a systemic approach will be needed, in order to coordinate interventions and investments to address all sectors and not just focus on a few areas. Green Public Procurement is a fast-growing strategy which seeks to connect supply and demand in the field of sustainability (Wilson & Garcia, 2011; Chiarini & Vagnoni, 2016), allowing health providers to incentivise more sustainable products and services. A coordinated vision across hospital networks is required for Green Public Procurement to effectively support the transition to sustainable healthcare by building a critical mass of health providers.

As regards health industries, the response to new needs and sustainability standards is an important driver, which stakeholders expect will lead to new design strategies. First, precycling strategies may help to rethink the current product system (Greyson, 2007) in order to reduce upstream waste production and, where possible, the use of disposable products, which today represents a high environmental and economic cost. The contribution of biomedical, digital, and clean technologies will be twofold: on the one hand, they will support the product dematerialisation to reduce the impacts of physical items and meet the requirements of Distributed Healthcare services, especially for chronic and no-communicable diseases (Weller, Boyd, & Cumin, 2014). On the other hand, they will make it possible to assess the long-term impacts of the substances and materials used in healthcare: the awareness campaigns on the use of mercury or PVC have led to a growing awareness of the problems associated with their use. In the future, attention will focus on the impacts of pharmaceuticals on the environment and the long-term implications of materials, especially plastics. Besides, there is a greater focus on resource consumption at all stages of the supply chain, with the introduction of shared protocols and greater communication between companies, suppliers and distributors to optimise processes and transport.

The attention to resource efficiencies is combined with the concern for climate change: the healthcare sector heavily contributes to climate changes and, at the same time, is affected by it. A holistic approach to life cycle thinking allows to optimise resources but also to significantly reduce the carbon footprint of the healthcare sector, adopting a Climate Smart Healthcare approach (Dhillon, & Kaur, 2015; Charlesworth & Jamieson, 2019). In the same way, a new circular vision of the health value constellation combines process optimisation with the valorisation of healthcare waste, which is conceived as possible resources for new processes. A life-cycle approach in the design phase will make it possible to establish new connections between processes and companies to reduce the impacts of the whole system.

Another interesting point that emerged from stakeholder engagement was the introduction of new methods and processes of collaboration that undermine the current rigidity of the sector. The problem of 'silos' in healthcare leads to communication and collaboration problems between different stakeholders (Hajek, 2013). The issue is more evident when dealing with sustainable healthcare, due to the inclusion of new players from other sectors, such as clean technologies. Almost all stakeholders deem essential to develop new forms of collaboration but many of them perceive the risk of creating a new 'silo' instead of building a cross-sectoral and multi-disciplinary system. Therefore, collaborative methods and processes are at the heart of the desirable models of sustainable healthcare, to allow shared planning and collaborative dialogue between stakeholders.

Specifically, the collaborative methods emerging in the shared future scenario have a dual function: on the one hand, they include an innovative approach of co-design; on the other, they allow co-creation processes able to involve the other stakeholders. The need of adopting design methodologies is perceived as necessary because of the designers' ability to frame complex problems, such as sustainable healthcare, and for the ways design organisations deal with 'frames' to define and visualise possible solutions (Dorst, 2011). The integration of evidence-based and user experience-based approaches can provide effective results in designing for healthcare services (Hagen 2014). Design methods come together with the importance of adopting a longer-term vision, that increases the need for foresight methods in sustainable healthcare: thus, an integration of foresight and design techniques can improve strategic decision-making processes, moving beyond short-term product and services (Bühring and Liedtka, 2018). At the same time, co-design methods and tools are needed to enable greater collaboration in the design phase of products and services, to meet new patient needs in the emerging home care settings. From this perspective, the workshop results highlighted how open source tools are considered, even by companies, an important way to encourage co-design and create digital and infrastructural standards that can enhance a holistic approach to the healthcare sector. Specifically, cost-benefit analysis and risk-benefit assessment tools are fundamental for companies to evaluate long-term strategies in the field of environmental sustainability. Long-term cost assessment tools are instead relevant for health providers in order to assess suppliers and investments over time. The open-source nature of these tools is deemed important to enabling national and international implementation and standardisation.

Collaboration methods support the vision of new collaborative processes that establish and consolidate relations between stakeholders according to a new holistic approach to the healthcare value constellation. While the transition to distributed healthcare scenarios offers benefits in terms of patient empowerment and increased resilience and sustainability of the system, it also makes the collaboration between greater numbers of smaller actors more complex. Hence, there is an urgent need for what, in social systems, is defined as 'collective impact initiatives', i.e. long-term

commitments by a group of key stakeholders from different sectors to a common agenda for addressing a specific system-wide problem (Kania & Kramer, 2011). This is challenging in the health sector since healthcare organisations are typically complex, hierarchical, and highly socio-technical setting, and these features may also affect the collaboration dynamics within interdisciplinary teams or networks. Therefore, multi-level forms of institutionalised dialogue between stakeholders and policy-makers are needed to define a common agenda which can meet the cross-sectoral needs of sustainable healthcare. As Robert and Macdonald (2017) underline, it is fundamental to create a 'publics', that provides a democratising space inhabited by the essential stakeholders where they can work collaboratively; the creation of 'publics' can *"be supported by infrastructuring using a wider range of engagement activities from the social sciences and design"* (p.127). To that end, new multi-stakeholder forums are needed, aiming at establishing forms of dialogue between different actors: not only decision-makers, industries and providers, but also research centres, NGOs and healthcare networks, clusters, waste managers and patient associations. In those forums, design methods can support cross-sectoral collaboration providing *"a set of practices aimed at realizing a certain desirable future"* (Storni, 2013, p. 51). From that perspective, design-based tools have proven to be effective in fostering collaboration and exploration of new scenarios: Coughlan, Fulton Suri and Canales (2007) identify learning and tools for organisational transition such as stimulus cards, mappings, storyboards, scenarios, games, mock-ups and visualisations, as well as prototyping tools as means of 'building to think' that can enable interdisciplinary thinking to develop concretely through action.

4.2 A Systemic Approach to the Three Horizons of Sustainable Healthcare

The multiday workshops resulted in multiple visions on the transition of healthcare systems towards sustainable healthcare. These visions defined different drivers, either complementary or opposite, which overall outlined a desirable scenario, characterised by radical system-wide innovations but also by greater uncertainty, and a scenario closer to the current framework, characterised by a significant but streamlined implementation of existing tools. Led by facilitators, stakeholders were guided to identify the key factors enabling a transition to the desirable scenario, thus defining a third transition scenario towards sustainable healthcare.

Systemic design's foresight expertise enabled deepening the emerged perspectives by evaluating the outcomes of the predicted systems and exploring the triggering factors.

The systemic approach integrated a Three Horizons framework (Sharpe, 2013) which is based on the representation of three different patterns: *"an established first horizon pattern giving way over time to an emerging third horizon, via transitional activity in the second horizon"* (Sharpe et al., 2016, p. 6). The adoption of the framework enabled better defining the three scenarios (Figure 6) and the drivers needed for the transition towards desirable futures.
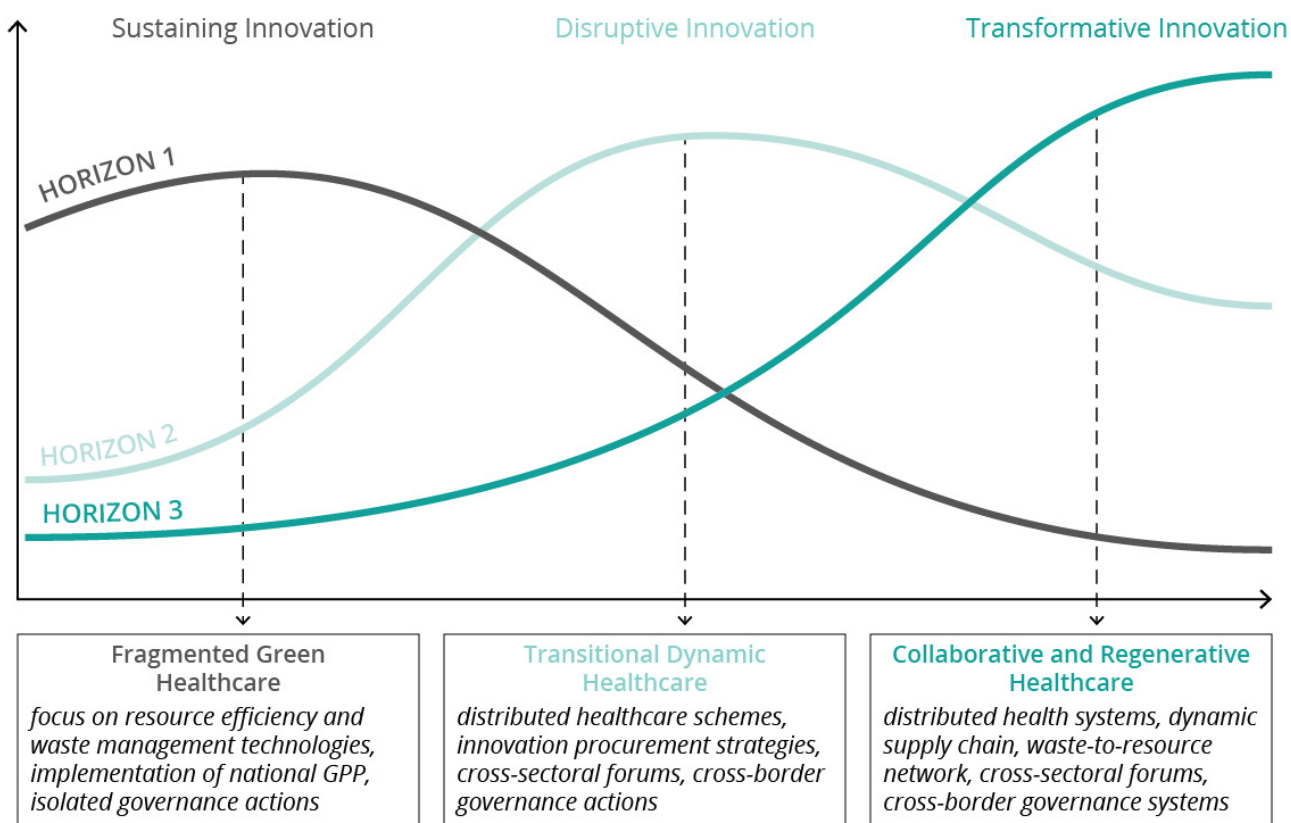

Figure 6 *Visualisation of the Three Horizons on SH*

4.2.1   Sustaining Innovation: Fragmented Green Healthcare

The first horizon is based on the status quo and linear evolution of the existing approach to sustainable healthcare. As highlighted above, health systems are characterised by an unbalanced decision-making power and stakeholder influence on sustainable strategies (see par. 3). In a future scenario that seeks to preserve the current hierarchy of relationships, health providers maintain a driving role in the implementation of solutions aimed at reconciling environmental and economic sustainability. The approach to sustainable healthcare focuses on the promotion of innovative 'green' solutions to address the most pressing social, environmental and economic challenges, such as the efficient use of resources or better waste management to improve recyclability and encourage reuse. Innovation focuses on solutions that have an extensive impact on the system but are fragmented, as they address specific issues (such as energy efficiency of health facilities) without building a comprehensive overview and holistic management of the system.

The fragmentation is also reflected in the Green Public Procurement schemes: in the first horizon, this tool leverages the economic strength of health providers and it is implemented in a more structured way at the national level and in the Nordic Countries, also thanks to a longstanding commitment to environmental sustainability. However, governance policies on sustainable healthcare are focused on the national scale and there is a lack of a European vision that can give momentum to cross-border markets and strengthen pan-European innovation instruments.

4.2.2   Disruptive Innovation: Transitional Dynamic Healthcare

The second horizon defines the disruptive solutions that can break the linear evolution of the first horizon and move towards a radical transition of the system. The transitional scenario of sustainable healthcare has been defined based on three levels of innovation.

The first level deals with the acceleration of niche innovations in the healthcare sector, even this process has to face the strong influence of the socio-technical regime on niches, that makes it more difficult to test radically innovative solutions in a supportive context. To this end, innovation procurement offers tools that enable the evolution of Green Public Procurement strategies to address needs that still do not find an adequate answer in traditional solutions. This is essential to support, for example, digital innovations that can effectively implement distributed health network management or climate-smart medical technologies that can achieve efficiency and resource savings throughout the product or service life cycle.

The second level, instead, concerns the promotion of a holistic approach to health systems, through the identification of local governance strategies capable of: (i) bridging the 'silos' of the different disciplinary and management areas; (ii) involving external stakeholders in the health sector as key players for the sustainability of the system; (iii) promoting cross-sectoral forms of collaboration towards circular sustainability scenarios. Overcoming the narrow concept of value chain allows, for example, to effectively include stakeholders dealing with maintenance, product end-of-life and regeneration to prefigure new services that can radically change the system.

The third level focuses on the development of governance models for sustainable healthcare at European level. Member states have very different approaches and attention to the issue; this not only creates a lack of homogeneity across European regions but also slows down the creation of cross-border markets where innovations can spread and scale-up. Public health systems identify shared goals and roadmaps towards sustainable healthcare to work collectively and systemically. Although the complexity, the scale and, not least, the public nature of healthcare systems makes this transition challenging, many innovations in other sectors, such as industry 4.0 in large supply chains (Mussomeli, Gish, Laaper, 2016), show the potential for a shift towards more dynamic, distributed and resilient systems.

4.2.3   Transformative Innovation: Collaborative and Regenerative Healthcare

The third horizon is the one that most radically differs from the current scenario (see par. 3) as concern the type of stakeholders and the relations between them. In a collaborative and regenerative system, stakeholders are organised into sub-networks that can maximise their internal organisation and simplify the macro-system of relationships and communications. Figure 7 illustrates these new networks of stakeholders:

1. Distributed health systems: health providers are organised into local networks of care and assistance that are coordinated by specialised health centres. Patients directly interact with this local system, not only by using home care health services but also by establishing new relationships of feedback that contribute to the system evolution. The NGOs and healthcare networks are part of this system and communicate with patients and health providers to better define future strategies.
2. Dynamic Supply Chain Network: the commercial relationship between companies and their suppliers evolves into a dynamic network able to effectively manage the relationships between them, generating a real system that responds with greater flexibility to the needs of other stakeholders, in particular, the increasingly customised needs of

distributed health systems. Distributors are part of the network intending to optimise the service of distribution of products and services.

3. Waste-to-resource Network: in this future scenario, the focus shifts from the end-of-life of healthcare products to their entire life cycle. The concept of waste as a new resource - that the circular economy is introducing in other production systems - is making its way into the healthcare sector to create networks that work on the maintenance and installation of products in close connection with the waste management. This new actor will enable to reduce consumption and enhance waste by adopting a zero-waste approach.

4. Cross-sectoral forums: the creation of cross-sectoral organisations will enhance new collaborations between stakeholders, enabling a direct dialogue in settings designed to encourage the exchange of ideas and expertise. The forums will connect supply and demand, upstream and downstream, policy-makers and target groups.

In addition to the stakeholder organisation, the third horizon also introduces important changes in the decision-making process. Decisions made within the forums reflect the needs and the visions of all stakeholders, influencing the evolution of the entire system. All stakeholders have a better chance of making decisions and influencing the system, thanks to a more systemic organisation of the value constellation. Although the physical division between actors downstream and upstream of the production process, the system enables a shared approach to product and service life cycle.

The third horizon entails a transition based on the evolution in the decision-making dynamics and in the system management tools. Managing dynamic value chains requires multimodal collaboration and communication across the chain, as well as the control of continuous flows of information that are needed to facilitate supply automation and holistic decision-making.
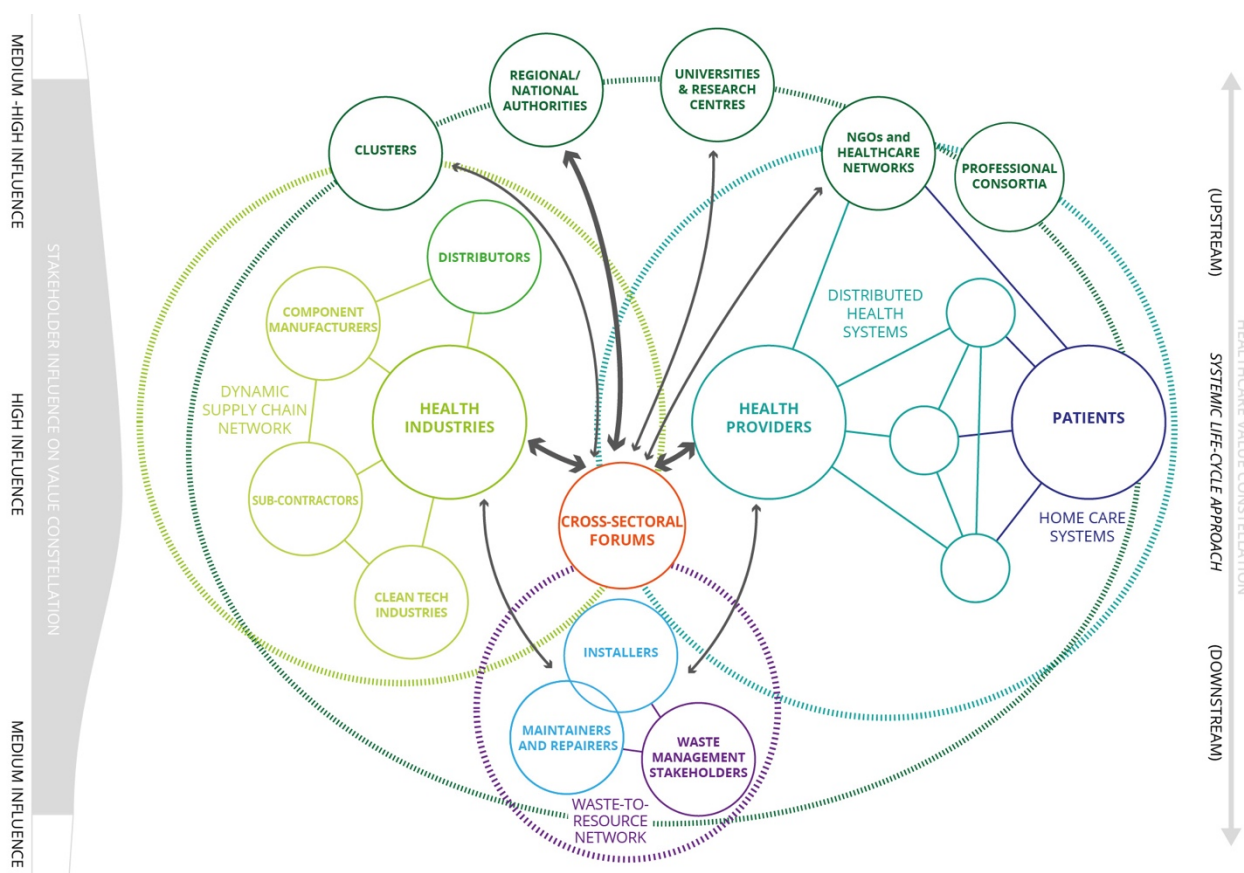

Figure 7 *Visualisation of the future healthcare system related to sustainable healthcare*

5. Fostering the Transition to Sustainable Healthcare

The second part of the foresight process focused on defining key strategies that can support the definition of a common agenda for the transition towards the desirable scenario. This requires radical changes in the organisation of the sector, in the governance mechanisms and in the current regulatory framework. The strategies that have emerged include a dual action plan: on the one hand, strategies at local and national level aim at addressing the political and regulatory framework of reference (Sweden); on the other hand, international strategies identify the needs of businesses and stakeholders to address health system changes at a wider scale.

The strategies are grouped into three main areas: collaboration, innovation, and information (see Figure 8). Collaborative strategies emerged from the stakeholder engagement process focus on the local level, and foster specific actions to increase collaboration around sustainable healthcare, by creating networks of decision-makers and stakeholders and increasing national awareness of the topic. Innovation strategies are instead focused on the role of health industries and innovators, and aim at boosting sustainable innovations through real-life experiments and pilot projects and the engagement with other stakeholders. Finally, information strategies aim to build greater awareness of sustainable healthcare at all levels of the system and to create new knowledge and new professionals capable of managing the sustainable transition of the system.
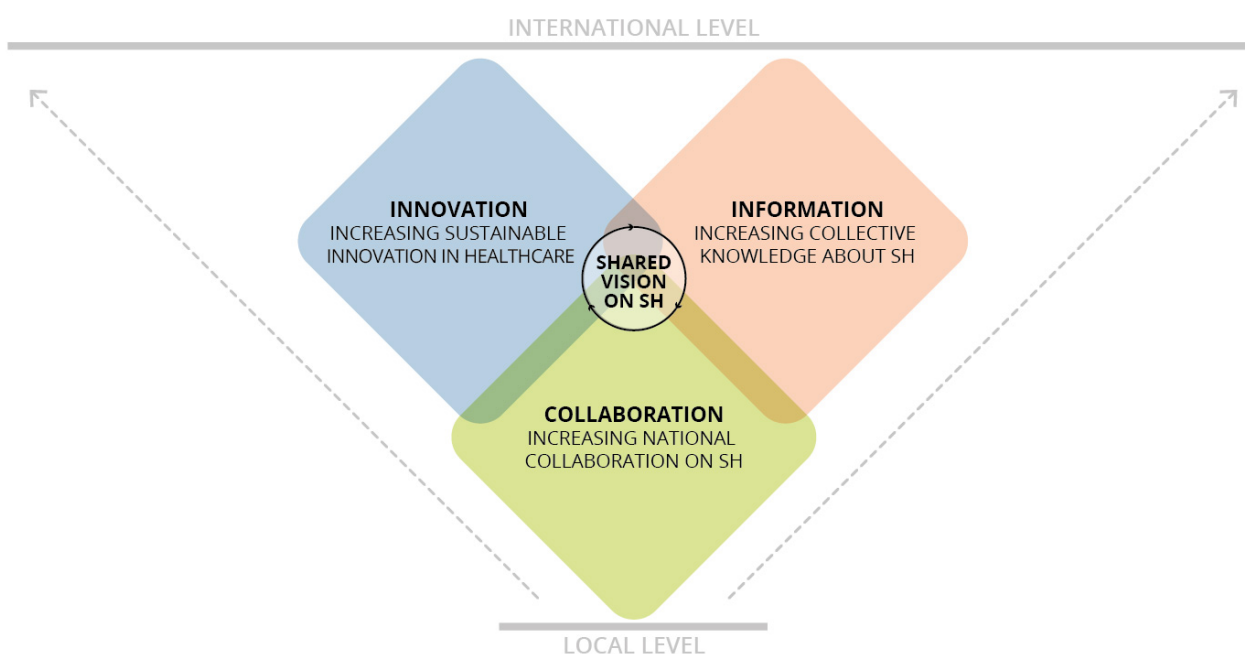

Figure 8 *Visualisation of the three strategic areas for enhancing the transition towards the long-term model of SH*

In Table 1 we have analysed in detail the three strategy categories according to the related strategic activities, the stakeholders involved, the barriers to overcome, and the time horizon concerned.

The analysis on key strategies highlights the need for engaging stakeholders outside the healthcare system: in particular, innovators need networks formed by different actors where they can test innovative solutions, collaborating with other sectors (such as clean technologies) and interacting with decision-makers and lead users. Another important factor is the changing role of decision-makers: so far, healthcare sustainability policies in the Nordic Countries have focused on driving the existing system to respond to ever-higher environmental regulations and standards. A change in policy instruments is needed to promote radical innovations that can accelerate the transition to sustainable healthcare, such as a Green Deal for SH. Finally, the healthcare sector and its stakeholders have a strong international reach, which can enhance a faster and more global spread of sustainable healthcare: promoting knowledge of healthcare sustainability at European and international level brings benefits not only at a social level, but can accelerate industrial and medical innovations and the whole transition process.

Table 1
Analysis of key strategies towards sustainable healthcare

Key strategies	Related strategic activities	Description	Stakeholders involved	Barriers	Time horizon
COLLABOR-TION: Increasing national collaboration on SH	Establishing a national collective impact initiative for SH	Gathering relevant decision-makers and stakeholders to develop a national agenda to enhance the transition	Regional and national authorities; clusters; NGOs and healthcare networks.	Identifying the managing authorities to carry out the agenda, in order to avoid its partial or total non-implementation.	Short
	Creating a Green Deal for SH	Establishing a non-binding agreement between a coalition of public and private organisations to stimulate innovation in SH	Health industries; industries from other sectors; health providers; regional and national authorities.	Need for a shift in the role and a deep commitment of the national authorities. Difficulties and long timescale for amending regulations.	Medium
	Strengthening the cooperation around a shared vision of SH	Promoting training and awareness-raising events to create consensus and gather information to define a national vision of SH	Health industries; industries from other sectors; health providers; clusters; regional authorities; universities; NGOs and healthcare networks.	Identifying permanent and effective forms of cooperation between stakeholders. Determining the most suitable ways to organise events able to reach the target groups.	Short
INNOVATION: Increasing sustainable innovation in healthcare	Developing sustainability assessment models for industries	Developing assessment models and tools to allow companies evaluating the sustainability of health products and services	Health industries; industries from other sectors; health providers; clusters; universities.	Locating financial resources for developing the models. Designing successful models that can be effectively used by companies.	Medium
	Providing industry specific guidance	Creating industry specific guidelines for increasing the sustainability of health products and services.	Health industries; industries from other sectors; health providers; clusters, universities.	Addressing the variety and complexity of technical, economic, environmental and regulatory issues of health products and services	Short-medium
	Creating virtual accelerator for SH companies	Exploring the feasibility of a virtual platform for young companies where they can get specific tools and support on SH.	Health industries; industries from other sectors;	Identifying existing models and the infrastructure needed to make the virtual accelerator effective. Locating financial resources for developing the platform.	Medium-long
	Creating 'publics' as interdisciplinary arenas on SH	Establishing an interdisciplinary arena where industries, providers and universities can meet to facilitate the development of joint innovation projects.	Health industries; industries from other sectors; health providers; universities.	Defining the most effective ways of collaboration, balancing training and cooperative dimensions.	Short
	Increasing support for test beds in SH	Defining new ways for supporting test beds in SH to address complex issues facing patients and the health service	Health industries; industries from other sectors; health providers; universities; regional	Identifying the most suitable settings and modalities for test beds. Attracting public and private investors.	Medium

			and national authorities.		
INFORMATION: Increasing collective knowledge about SH	Introducing SH into university curricula	Introducing SH topics in some relevant university programmes related to the health sector (not only in medicine)	Universities; NGOs and healthcare networks.	Overcoming the reticence of the academic setting. Identifying innovative learning approaches to apply SH strategies to the healthcare professions.	Medium
	Promoting information campaigns targeted at decision-makers	Conducting information campaigns aimed at decision-makers to raise awareness of SH and the opportunities that are linked to this area	National and regional authorities.	Defining the most appropriate communication methods to reach the target group.	Short
	Developing an international communication package on SH	Creating a multi-media communication package to disseminate topics and initiatives related to SH at an international level to increase global awareness.	Health industries; industries from other sectors; health providers; clusters; regional authorities; universities; NGOs and healthcare networks.	Identifying decision-makers and stakeholders to be involved in different EU countries. Defining the most suitable ways of collaboration and communication.	Short

The engagement in the foresight process of policy-makers and key actors of the Swedish healthcare sector (in particular clusters and professional consortia) has increased the commitment of relevant stakeholders towards the sustainable transition of the system and triggered some of the actions envisaged in the study. Specifically, the support of Vinnova Innovation Agency led to a guiding document for industries (innovation strategy n. 2) aimed at building interest and awareness in companies within the value constellation. The Nordic Center for Sustainable Healthcare is implementing its organisational model in the light of the foresight findings to develop an effective 'arena' (innovation strategy n. 4) for promoting democratised collaborations and providing tools to support system innovation. Moreover, all strategies have been shared with other external stakeholders and key policy-makers to create an action plan aimed at implementing an agenda endorsed by the relevant national managing authorities (collaboration strategy n.1), in which specific and measurable sub-objectives are defined.

6. Discussion and Conclusions

The interest in sustainable healthcare has been growing globally, and the transition toward economically, socially and environmentally sustainable health systems is perceived as necessary. All the approaches to this emerging domain focus on making health care environmentally, economically and socially viable, but are mainly addressing specific issues and involving a limited number of stakeholders. A systemic vision is needed to approach the complexity of this issue from a broader perspective, in order to involve the variety of stakeholders that make up the system and to enable long-term decision-making (Charlesworth & Jamieson, 2019).

The present study designed a collaborative foresight process to enable heterogeneous groups of healthcare stakeholders to outline the diversity of visions needed to frame complex systems and define a common future scenario of sustainable healthcare.

As regards our first research question, concerning the future relationships between stakeholders that may enhance a shared vision of sustainable healthcare, our findings highlighted the need for a distributed system in which stakeholders are organised into structured networks to facilitate collaborations and cross-fertilisation. The three macro-categories and their actors at the basis of the system - supply (health industries), health care (health providers) and health treatments (patients) - change radically.

Distributed health systems enable a direct relationship with patients who assume a more active role within the system, in a perspective of patient empowerment. The new cross-sectoral forums play a fundamental role as physical places that are structured to further facilitate the exchange of information and knowledge between different stakeholders. New collaborative methods and processes are implemented to build a collective vision of the system and make concerted decisions.

On the one hand, design and long-term thinking tools are essential to enable co-creation processes that can meet the wide-ranging and varying needs of distributed systems; on the other hand, open tools make it possible to assess the implications and trade-offs of policy and business strategies at the environmental, social and economic levels, thus promoting international standards that facilitate new processes of innovation procurement and long-term planning.

As concern the second research question on the strategies that can foster the transition towards sustainable healthcare, our findings show that key transition strategies should address three main areas: collaboration, innovation, and information. At the local level, new 'democratic' interdisciplinary arenas involving stakeholders from different sectors are essential to create supportive conditions for the development of collaboration tools and radical innovation. At the international level, awareness-raising actions and skills-building programmes are needed to spread the knowledge and interest in the sustainability problems of healthcare and the holistic vision needed to approach them. This is especially important considering the fast-economic growth of the healthcare industry in emerging countries such as, among others, India, China and Brazil. Recent research (Karamat et al., 2019) confirms how the use and management of knowledge resources is strategic to promote learning and innovation in developing countries.

The recent COVID-19 pandemic has made the need to promote new approaches to the global health systems even more evident. Our findings show how the sustainable transition of the sector requires models of distributed dynamic networks both in the care delivery and in management and supply processes. The benefits of a distributed system are twofold: on the one hand, the attention to the environmental sustainability of the sector brings direct (e.g. resource efficiency and waste reduction) and indirect gains (e.g. climate change mitigation) that help to preserve ecosystems and prevent disasters related to environmental factors. On the other hand, studies on distributed dynamic supply management have proven how a distributed model enables a greater resilience of the whole system (Mussomeli, Gish, Laaper, 2016; Jafarnejad, Momeni, Razavi Hajiagha, & Faridi Khorshidi, 2019), providing holistic decision-making and rapid, no-latency responses to what may disrupt the supply chain, as occurred during the pandemic.

The stakeholders involved in this research significantly represent the healthcare sector in terms of their quantity and variety. However, they were mainly from Sweden and Nordic countries, where the workshops were held. Healthcare companies are, for the most part, representatives of multinational groups, thus having a broader and more international vision of the healthcare sector. Regional and national authorities and health providers are more rooted in their local frameworks. However, Nordic health systems play a leading role in the field of sustainable healthcare, and this cultural background was crucial to build a future vision of sustainable healthcare. In order to scale-up the strategies identified, it is certainly necessary to extend the analysis of the current health system to different socio-economic settings. Although the characteristics of a distributed health system make it resilient and, as such, adaptable to radically different contexts, the effectiveness of policy instruments to accelerate the transition are deeply linked to the stakeholders involved and to the political, economic and social context in which they are embedded.

Some of the strategic actions planned in the short term are currently being implemented, in particular concerning the development of networks and permanent bodies committed to defining a detailed agenda for the transition to sustainable healthcare. Future work will support the creation of this agenda for healthcare transition, through the engagement of stakeholders and in particular policy- and decision-makers already involved in this study.

Specific recommendations for follow-up research include expanding the research to the European sector, addressing the vision of sustainable healthcare in different countries and health systems, to build long-term policies at European and international level. However, it is difficult to envisage the implementation of foresight processes in countries where the issues of sustainable healthcare have not yet been tackled. It is therefore urgent to develop knowledge-building strategies and identify the most suitable tools for widespread and international dissemination of sustainable healthcare issues while strengthening the scientific and academic knowledge of the topic.

Conflicts of Interest Statement

Funding acknowledgement

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