Chapter 1
Healthcare Sustainability Challenge

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Abstract Healthcare structures are supposed to protect and improve Public Health, but in the meanwhile they are highly energy-demanding and socially impactful structures, which cause negative side effects on the people's health and on the environment. Building hospitals able to cope with the definition of Health as complete well-being and which can fit to the future means therefore constructing sustainable structures. Such complex realities work as a whole, single organism, that can be robust and productive only if every single part is healthy. So when it comes to healthcare facilities, sustainability has to be taken into account as both a main requirement and a quality issue, since they must be capable to deliver high standards also in changing circumstances. Starting from these assumptions the Sustainable High Quality Healthcare project is born with the aim of providing a new original insight into such a complex subject. Its goal is to define, through the construction of an innovative assessment system, solutions and strategies towards the realization of sustainable existing operative or in-design hospitals, where sustainability applies to the main macro-areas.

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Being Sustainable in Healthcare

According to the World Health Organization (WHO), *Health* can be described as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization 2012). Although this definition has been subject to controversy, in particular as lacking operational value and because of the problem created by use of the word 'complete', it remains the most enduring one (Callahan 1973). Within this context, healthcare providers carry out those crucially important activities aiming to promoting good health in humans by systematically preventing or curing health problems. Healthcare can thus be described as "the prevention, treatment and management of illness and the preservation of mental and physical well-being through the services offered by the medical and allied health professions" (Medical Dictionary 2012).

Access to healthcare is deeply influenced by a variety of social factors such as economic conditions or existing national health policies, thus greatly varying across countries, populations and individuals (Capasso et al. 2014). Undoubtedly though, regardless the system that is taken into consideration, there is one symbol that is universally recognized as representing the healthcare system being in its most complex, and diverse structure: the hospital. A hospital is a healthcare institution where patients are systematically treated by specialized staff and equipment or, more generally, an institution providing medical and surgical treatment and nursing care for sick or injured people (Oxford Dictionaries 2012).

Public health is recognized as a resource that must be preserved and improved. Within this context, hospitals are the healthcare system's most recognized structures pursuing this goal: one would therefore, naturally, believe such structures to be designed to protect public health. Continuous studies though have unveiled how traditional hospital structures, theoretically built to preserve public health, actually

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have an indirect negative effect on public health and, on a wider level, on the community and environment they are set in.

The Italian hospital network, with its 1,170 hospital structures spread across the country, is not only extremely complex but also considerably old. Italian hospital structures are, on average, outdated both in their infrastructures and, especially, in the way they have been designed. Today, fewer than 50 % of these structures have been opened, less than 20 years ago, with 5 exceptional hospitals having been functioning in the same facilities since before the 1900 (Nuovo Sistema Informativo Sanitario 2006). Most importantly though, if one considers the average time which passes between when a hospital is designed and when it is finally opened almost 80 % of the operating structures in Italy have been conceived over 20 years ago (e.g. the Humanitas Research Hospital in Rozzano, Milan, which is a best-in-class example within the Italian reality, took 10 years to be completed (Colombo 2012). Only in the region of Lombardy, for example, which has often been cited because of its concentration of well-managed and well-operating structures, 45 % of the hospitals are now well over 65 years old (Capolongo 2006).

If one therefore considers the traditional problems that affect the National Health Service (NHS) and its hospital network, the Italian hospital reality is brought to face an even more difficult scenario because of the age of its healthcare infrastructure.

The recent increase in public conscience towards environmental issues has brought an immediate focus on the importance of environmental sustainability: whereas hospital facilities are the symbol of a system supposed to defend people's health, their outdatedness actually brings them to be part of those structures which pose the greatest threat to us if put into the environmental perspective. There are therefore increasingly more issues facing hospitals on the environmental front, with regulators and communities now clearly changing their expectations of healthcare facilities for energy reduction and environmental improvements (Cantlupe 2010).

The involuntary negative impacts that hospital structures may have on their communities and on the environment affect a variety of fields, with this being even more true for outdated facilities. From the environmental point of view, for example, the existing hospitals are extremely complex buildings that have more or less three times the energetic consumptions of a residential building with the same size, not to mention their water consumption. Furthermore, these often obsolete structures continuously produce high amounts of air emissions (in the United States, the Department of Energy states the nation's hospitals contribute 2.5 times the carbon dioxide emissions of commercial buildings), together with solid and liquid wastes which also can be dangerous or toxic. Hospitals generate an excess of 2 million tons of general waste each year: according to a Johns Hopkins University study, they are the second largest waste producers after the food industry (Cantlupe 2010). Hospital structures also have a noteworthy social impact: their establishment within an urban or suburban center significantly alters the location's equilibrium, for example through the naturally consequent increase in traffic, noise and surrounding means of transportation. Furthermore, their spaces host

a variety of different individuals, cultures, stories and professional backgrounds, all framed within an extremely delicate environment where joy and pain are intrinsically intertwined. Once again, the inconveniences in such spheres are particularly emphasized as the hospital's age increases, both because of the obsolescence of the project and of course, because of the unavoidable transformations that both the hospital's facilities and its urban setting face over time.

Parallel to this, healthcare forms a significant part of a country's economy but according to the WHO, a well-functioning healthcare system requires a robust financing mechanism; a well-trained and adequately-paid workforce; reliable information on which to base decisions and policies; well maintained facilities and logistics to deliver quality services (World Health Organization 2012). This, of course, requires healthcare sustainability to be increasingly considered from an economic point of view, especially in countries such as Italy that traditionally have reached almost uncontrolled healthcare spending levels while functioning in outdated designed facilities, both from the architectural and operational point of view. In fact, hospitals drain a substantial amount of financial resources from either their community or their users: only for energy costs, hospital structures in the United States, for example, spend more than $5 billion annually (Index Mundi 2012). In 2010, the healthcare industry consumed an average of 9.5 % of the Gross Domestic Product (GDP) across the most developed Organization for Economic Co-operation and Development (OECD) countries, with the United States (17.6 %), the Netherlands (12 %), France and Germany (11.6 %) being the top spenders.

Within this context, Italy placed itself slightly below OECD average with 9.3 % of GDP spent on healthcare activities in 2010 (Nuovo Sistema Informativo Sanitario 2006). A more in-depth analysis of the Italian healthcare system though reveals a worrying scenario: from 2005 on, the Italian's NHS expenditures have continuously increased, as clearly showed by Fig. 1.1. This has brought the average Health Service cost to almost €2,000 per capita, in a country where the average person's income did not exceed €29,900 (Index Mundi 2012).

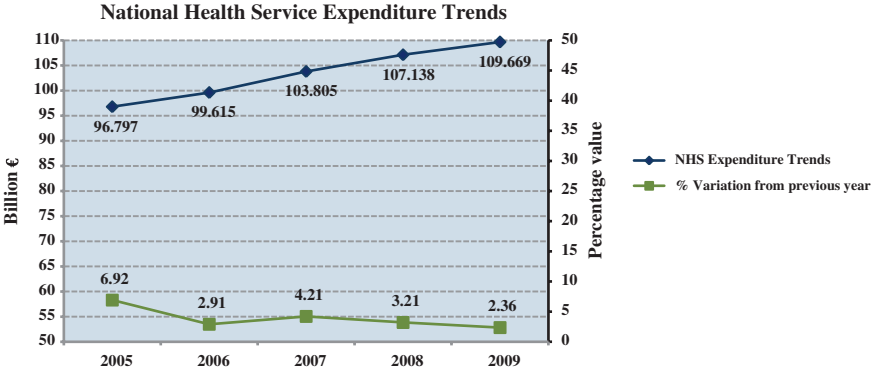

Fig. 1.1 Italian national health service (NHS) expenditure trends. The data of the graph are taken from Index Mundi

Furthermore, if the ratio between this NHS expenditure and the overall national GDP is taken into consideration, continuously increasing NHS costs combined with a currently unfavorable economic scenario result in a drastic increase of the overall NHS impact on the country's economic tissue, as the trends from Fig. 1.2 clearly show. Most importantly though, Fig. 1.3 historic data clearly shows how, parallel to this continuous increase in its expenditures, the Italian NHS system is also constantly struggling to cover its costs which regularly exceed those forecasted by the annual national budget, and for which only a certain amount of economic resources were preventively assigned.

The remaining costs, sum up to at least 3 % of the nation's GDP, must then be covered by redirecting resources that could, or should, otherwise be dedicated to different projects.

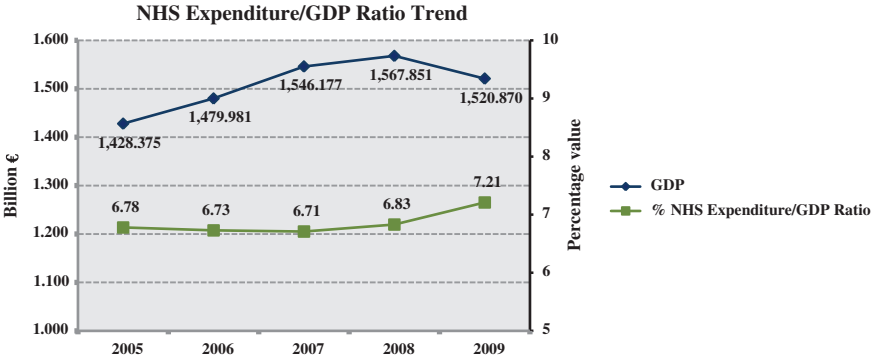

Fig. 1.2 Italian NHS expenditure and GDP trends. The data of the graph are taken from Index Mundi

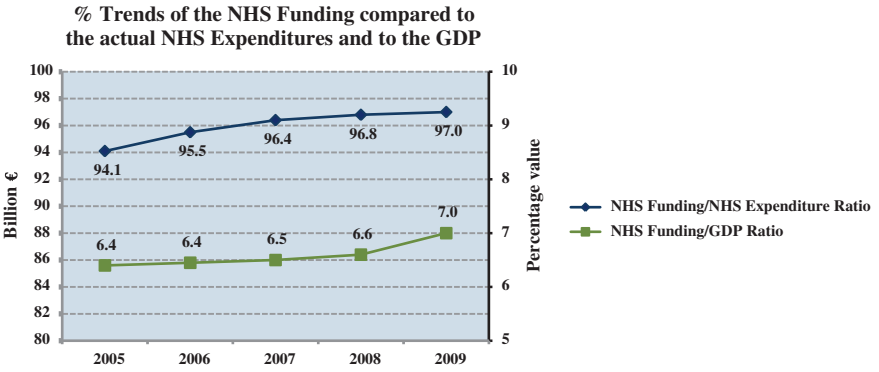

Fig. 1.3 Italian NHS expenditure and GDP trends. The data of the graph are taken from Index Mundi

A careful study of the Italian healthcare system and, especially of its outdated hospital network therefore clearly reveals how the country is currently incapable of facing the new challenges and needs from the healthcare field.

The most recent threads in sustainability have unveiled what can now be considered as the ultimate goal for sustainability itself: social sustainability, or the impact that the surrounding activities have on what concerns people. Within healthcare, in particular, understanding the human sphere is of fundamental importance: from the impact this can have from the clinical point of view, to the people who work in such a demanding environment; from the impression and support that hospital staff and environment can give to those who visit or live in this environment on a daily basis, to the most personal and emotional point of view. Structures conceived with architectural principles from 20, 30 or 40 years ago are today often not adequate to satisfy this sphere of concern, first of all because the care concept has changed from *disease cure* to *person care* (Spinelli et al. 1994). The attention dedicated to spaces, visiting or intimacy has drastically changed as the importance of these factors shifts towards the hospital's users.

As Dr. J. Koster, president and Chief Executive Officer (CEO) of Providence Health and Services, a WA-based company which runs 27 hospitals and employs about 49,000 people, once pointed out hospitals not only have a huge environmental footprint within the communities they serve, they often are also the community's largest employer and therefore have responsibilities which go beyond caring for patients: in fact, leading hospitals, that have been working for years to attain energy and environmental sustainability, have an organizational structure with designated sustainability officers and green teams with clear authority from CEO. This comes down to a 'triple bottom line', as Dr. R. Beam, system director of construction and sustainability in the office of supply chain management for Providence, pointed out: long-term sustainability for the planet and humanity can be achieved integrating performance of environmental practices, social and financial benefits (OECD 2012). One can therefore understand how healthcare infrastructures' out-datedness, even appearing as an insurmountable obstacle to hospitals sustainability at first glance, can still be overcome, as long as a deep change is performed. What the Italian healthcare system, in particular, and its hospitals truly require is therefore a committed, dedicated guidance towards sustainability, aiming to develop an environment where everyone collaborates to bring personal contribution towards the achievement of sustainability.

Sustainable Healthcare Project Objective

Public Health is universally recognized as a valuable resource that must be preserved and improved. Health's promotion needs a new system of healthcare buildings that can meet the current and future social demand, being, at the same time, environmentally and economically sustainable.

Fig. 1.4 SustHealth' logotype

Starting from these assumptions the **SustHealth** (Sustainable High Quality Healthcare) project (Fig. 1.4) was born with the aim of providing an original insight into such a complex subject. It has been developed as a multidisciplinary research project, carried out by a team of students, from the schools of Engineering and Architecture, academic tutors and sponsoring companies, with Alta Scuola Politecnica, the joint excellence program of Politecnico di Milano and Politecnico di Torino (Italy).

The goal of the Sustainable Healthcare project is that of developing new strategies that can make the hospitals more sustainable, while also elaborating new guidelines for the planning, management and design of such sustainable hospitals. This broad scope has been narrowed down to a more specific objective: that of conceiving a solution capable of supporting hospital structures in making decisions towards sustainability promotion and improvement.

The need for an assessment system to promote sustainability comes from considerations about the heavy impact that hospitals have on the social, environmental and economic spheres. Within this context, the Sustainable Healthcare project's objective has been that of designing a new tool capable of supporting hospital structures in understanding where they lack in the three sustainability areas and then to guide them in making decisions capable of promoting an environment where sustainability is both understood and continuously promoted and improved. More specifically, the study focused on satisfying a specific requirement: the need for an effective, reliable and especially replicable tool for the evaluation and measurement of the operating and designing hospitals' sustainability, which led the teams to develop an innovative evaluation system based on specific criteria.

As prof. F. Butera, an expert in sustainability matter, would say, it is necessary to operate within a new paradigm in which the choices are confined within a pentagon; at its vertices there are five keywords: *ethics, aesthetics, economy, ecology, energy* (Butera 2012).

This tool has been imagined as an evolution of all the available sustainability evaluation systems, which somehow lacked the wider prospective envisioned by the SustHealth project. Indeed, these evaluation systems prevalently focused on

deeply assessing the environmental features that should be taken into account when designing a new building, without considering neither how the design phase, influence the economic and social aspects nor how the operative structure actually performs in any of these spheres.

Method of Work

The Sustainable Healthcare project developed a standard method of work that can be easily applied to the development of any project requiring the application of innovative solutions to an existing scenario:

- understanding the scenario, with particular focus on the different sustainability issues of healthcare structures, on the main stakeholders interested by such themes and on the relationship between such stakeholders and, especially, their needs;
- identification and study of the so-called 'state of the art' solutions, in this case represented by:
  - hospital structures which have been internationally recognized either for their excellence in one or more sustainable areas, or for any other practices which could directly or indirectly interest the Sustainable Healthcare project's activities;
  - hospital evaluation systems, with focus on their attention, or lack thereof, to healthcare sustainability;
- further study of the identified 'best-practices', represented by the healthcare structures and evaluation systems which were most relevant to the Sustainable Healthcare project, through:
  - interviews both to major experts in different technical and managerial fields and to experienced professionals from the healthcare system;
  - on-site visits to the identified best-in-class examples of European healthcare sustainability;
- data processing of the previous steps, highlighting positive and negative aspects of the different strategies of evaluation and legislative systems for the compliance of the strategies to the emerging needs;
- summarizing the acquired information into a comprehensive evaluation system, capable of assessing the three different sustainability areas, by: development of a set of straightforward criteria aiming to evaluate the hospital's performance in different areas, related to the three sustainability spheres; submission of the criteria, indicators and their specific evaluating questionnaires to an expressly created focus group, composed by the previously mentioned experts and professionals, in order to identify their relative weight according to their improvability in these structures; analysis of the obtained results with a specific software to define the relative weight of the different criteria and of the three sustainability areas within the hospital's global evaluation;

- testing and application of the developed tool on two partner healthcare structures, one operative and one in-design;
- development of a comprehensive sustainability evaluation of each analyzed structure, including guidelines toward sustainability improvement.

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