A REVIEW ON REQUIREMENTS AND EXISTING QUALITATIVE TOOLS FOR DESIGNING SUSTAINABLE LARGE-SCALE HEALTHCARE FACILITIES: A CASE STUDY IN THE CONTEXT OF FLANDERS

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ABSTRACT

In the context of the increase in population and life expectancy of people, it is evident that the demand for healthcare facilities is growing. Not only the number of health-care buildings increases, but these facilities also enlarge in scale. Consequently, there is a trend to plan large-scale healthcare facilities on green-fields outside of the city boundaries, which requires large infrastructure works and induces a major impact on the surrounding environment. Moreover, the use of transport increases and so the CO_2 emissions proportionally grow. This research aims at developing a sustainability assessment method of large-scale healthcare buildings in Flanders. The research is based on a combination of a systematic scientific component at university, and an empirical approach gained in the industrial practice. This paper focuses on the first part of the study and provides an overview of current requirements for planning large-scale healthcare facilities in the context of the Flemish region and of available methods and tools for the sustainability assessment of healthcare facilities.

Keywords: healthcare facilities, early design phase, sustainability assessment, method development, environment

INTRODUCTION

With an increasing population worldwide, the large-scale healthcare facilities are becoming one of the most needed facilities for healing and well-being of people [Decker 2002]. Built for the community, they should be exemplary and fully integrated within their environment. Due to their constant operation 24 hours a day and seven days a week, high flow of people, intensive HVAC and lighting requirements, healthcare facilities are heavy users of energy and water. They also produce large amounts of waste. Furthermore, the healthcare sector accounts for more than 5% of the greenhouse gas emissions in Europe [Leetz, 2014]. The healthcare projects cover a range of characteristics of different common projects such as residential, offices and service buildings, and due to various complex project requirements, these buildings are not sufficiently designed and operated in a sustainable way [Castro et al, 2012]. Moreover, the quality of their planning and improvement depends largely on professionals' experiences in practice as well as guidelines provided by the local authorities. Most important decisions are made during the early design phase. These early design phase decisions are difficult to change afterwards and have a high impact on the life cycle environmental burdens and cost of the building. In order to reduce the life cycle impact and cost of healthcare facilities, designers and building practitioners hence need appropriate methods to support decision taking during the early design phase. Such methods are however not available to date and is the focus of this research. As a first research step current requirements and assessment methods have been analysed and are presented in this paper.

REQUIREMENTS AND SUSTAINABILITY INCENTIVES FOR HEALTHCARE FACILITIES IN THE FLEMISH REGION

Flemish Royal Decrees and specific standards for healthcare facilities

The notion *healthcare* in Belgium covers six types of healthcare facilities [Royal Decree of 10 July 2008 on law relating to the hospitals], each with a specific care, private infrastructure and operation as well as private financing. These types of facilities are listed as follows:

- hospitals
- psychiatric hospitals
- university hospitals
- nursing homes
- protected residential spaces and temporary residence homes
- small hospitals

As the focus of this study is on large-scale healthcare facilities, i.e. hospitals, psychiatric and university hospitals, we analysed the existing regulations for these facilities in the Flemish region. Each one of them is covered by a specific Royal Decree of the Flemish Government addressing the general, architectural and functional norms. Regarding the architectural norms for hospitals, a list of requirements has been provided by the Royal Decree laying down standards to which hospitals and their services must meet from October 1964. These requirements refer to:

- the general hygiene of the building standards (non-combustible materials, mitigation of humidity and prevention of infiltration, installations, lighting, ventilation, etc.);
- the hospitalisation standards (room size in m^2 per bed for sick people, location of the rooms within hospital, heating, lighting, etc.);
- the specific standards for each hospital department in terms of their surface and equipment necessity to function properly (specific rooms for medical treatment, operation rooms, m^2 per beds in single or multi-bed rooms, sanitary blocks, utility rooms, etc.).

By satisfying the described norms, the hospitals are approved by the government and are eligible to provide services to the patients. However, as these standards are almost five decades old, they do not provide any specific requirements regarding the sustainability of the hospital buildings. Most of the time, practitioners rely on the needs of a client, as well as their previous experiences when designing large-scale healthcare facilities.

Additionally to these norms, there are basic fire safety standards for new buildings [Royal Decree of 7 July 1994 on basic safety standards for the prevention of fire and explosion in new buildings, 1994] complemented with strict fire safety standards for healthcare facilities for: elderly services and centres for rehabilitation stay [Royal Decree of 9 December 2011 on the specific fire safety standards for older facilities and centres for rehabilitation residence, childcare facilities, 2011], childcare [Royal Decree of 22 November 2013 on the quality of family child care and group care for babies and toddlers, 2013], hospitals [Royal Decree of 6 November 1979 on protection against fire in hospitals, 1979] and nursing homes [Royal Decree of 15 March 1989 on fire safety in nursing homes, 1989]. For all other healthcare facilities there are no specific fire safety standards and it is usually necessary to involve specialists in the design process.

The VIPA sustainability requirements to obtain subsidies

Regarding the sustainability of the healthcare facilities, the Flemish Infrastructure Fund for Person-related Matters (VIPA) in collaboration with the Flemish Government published in 2009 a Ministerial Decree [Ministerial Decree determining the VIPA sustainability criteria, 2010] establishing a set of minimum requirements that projects need to fulfil to obtain VIPA

investment subsidies. These requirements rely on the principles and objectives included in the *Flemish Sustainable Development Strategy* [Flemish Government, department for sustainable development, 2006] and the *Flemish Climate Plan 2006-2012* [Heirman, J.P., 2006]. For each healthcare facility a specific requirement explanation is elaborated in the appendix of the Ministerial Decree as well as a checklist with five criteria as follows:

1. User comfort
2. Energy control
3. Sustainable material and renewable resource
4. Integrated approach
5. Building operation

5 building operation		Residential facilities	Offices and schools	Other specific facilities
5.1	basic quality monitoring	compulsory ☐	compulsory ☐	compulsory ☐
5.2	energy flows measuring			
5.2.1	counters	compulsory ☐	compulsory ☐	compulsory ☐
5.2.2	monitoring	compulsory ☐	compulsory ☐	compulsory ☐
5.3	training in management	free ☐	free ☐	free ☐
	minimum	3	3	3
	maximum	4	4	4
	score	☐	☐	☐

Table 1: Example of a building operation criteria checklist part for different facilities [Ministerial Decree determining the VIPA sustainability criteria, 2010]

Table 1 represents the building operation criteria and a list of compulsory and free sub-criteria for facilities with residential, office and educational or other specific character. However, with the new, recently published Flemish Climate plan and constant amendments of Royal Decrees regarding the healthcare facilities, the VIPA sustainability criteria have become out-dated.

SUSTAINABILITY ASSESSMENT METHODS FOR HEALTHCARE FACILITIES IN THE FLEMISH REGION

Many tools with various purposes, and dedicated to different users, have been developed in the most recent decades in order to assess the sustainability of buildings. These tools differ in scope as some focus on only one the three sustainability pillars while others combine two or three pillars. Some of these tools moreover assess building products, others building elements (e.g. outer walls, floors, roofs) or whole buildings [Haapio and Viitaniemi, 2008]. They furthermore differentiate in covering the spectrum of a building's emissions and/or energy usage and in a quantitative or qualitative approach.

Qualitative sustainability assessment methods

The VIPA started collaborating with the Department of Environment and Natural Energy (LNE), Royal Haskoning DHV and the Services for the General Government Policy (DAR) in order to develop a new certification system for healthcare facilities, adjusted for the context of the Flemish region. This tool, called Duurzaamheidsmeter (Sustainability meter) is largely based on the British BREEAM (Building Research Establishment Environmental Assessment Method) New Construction certification system; however it has been adapted for the Flemish region by relying on the VIPA sustainability criteria [Oosterbaan, 2014].

Building practitioners who had the opportunity of using it, and were involved in the development of this tool, claim that it is neither innovative, nor user-friendly and that the scoring system is subjective and thus leaves space for doubts for achieving real sustainable

buildings when using this tool (based on conversation with VK experts). The tool has moreover not yet been fully developed as the third (final) development phase has just begun. As it however is still the only qualitative sustainability assessment method available for the Flemish region, we present some of the most important available information in the subsequent paragraphs.

Similarly to the BREEAM New Construction, the VIPA Duurzaamheidsmeter is composed of three important parts: criteria, assessment indicators and credits. Figure 1 shows the criteria and their importance (in percentages) of both methods.

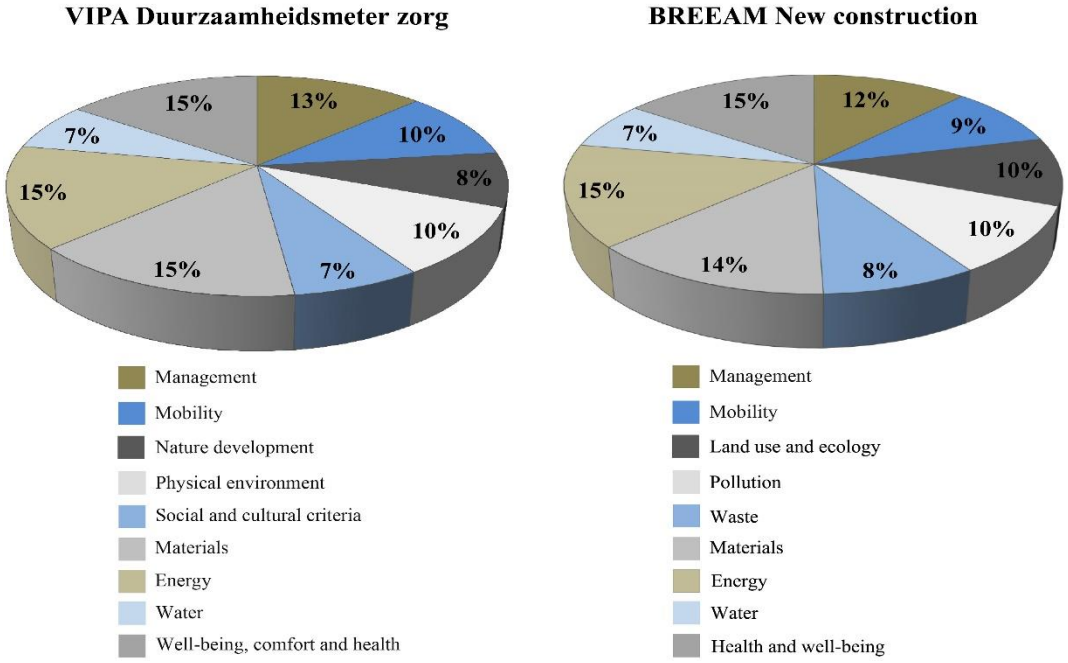

Figure 1: Criteria distribution in percentages for Duurzaamheidsmeter zorg and BREEAM New Construction sustainability assessment method [Oosterbaan, 2014]

Although the two tools are very similar, there are some difference between both. For instance, the VIPA Duurzaamheidsmeter zorg is specifically intended for healthcare facilities, covering buildings from nursery to home care and hospitals, whereas BREEAM New construction is used for all new non-domestic buildings. Another difference is the "pollution" criteria which exists as a separate one in BREEAM New construction, while it is included in *Physical environment* criteria of Duurzaamheidsmeter.

The main change introduced in the VIPA tool is that it includes the "social and cultural" criteria contrary to BREEAM. The indicators used for evaluation are as follows: (1) lively community; (2) inclusive community; (3) functional flexibility; (4) cultural value and (5) hospitality. Furthermore, the "management" criteria of Duurzaamheidsmeter has been complemented with the indicator *corporate social responsibility (CSR)* aiming at engaging institutions in Flanders to take a more active attitude towards sustainability.

The ranking in the VIPA Duurzaamheidsmeter is similar to the ranking in the BREEAM New Construction, with five qualitative sustainability performance levels provided by a star rating from 1 to 5 (Table 2).

	Performance levels				
	*	**	***	****	*****
Required relative score in order to achieve the performance level	≥ 30%	≥ 45%	≥ 55%	≥ 70%	≥ 85%

Table 2: Sustainability performance levels of VIPA Duurzaamheidsmeter [Oosterbaan, 2014]

DISCUSSIONS

This paper summarises the requirements for designing large-scale healthcare facilities (hospitals) complemented with the currently available methods and tools for healthcare sustainability assessment in the context of the Flemish region. Both VIPA Duurzaamheidsmeter zorg and BREEAM New construction belong to qualitative methods used to assess the sustainability in the construction sector. They present a list of criteria with indicators that can be used for either only healthcare facilities, or for all newly built non-domestic buildings. Although these qualitative methods have their strengths: they are easy to apply and are holistic, they also have important weaknesses. The two most fundamental ones are:

1) their subjectivity and hence the doubt that these lead to truly sustainable buildings and
2) their static character due to their approach of checking the application of a list of measures which does not allow to respond to the rapidly changing requirements and needs of healthcare buildings.

On the other hand, quantitative tools based on the life cycle thinking perspective, such as life cycle assessment (LCA), assess the environmental impact of a process or product, including a building, over its entire life cycle. This technique has become the recognized international approach to assess the comparative environmental merits of products or processes [Stephan, 2013]. The broad acceptance is amongst others reflected in the international standards ISO 14040 and ISO 14044 and in the European standards EN15804 [CEN 2012] and EN15978 [CEN 2011], focusing respectively on construction products and buildings. Besides the environmental impact, costs are an important issue in the sustainability context. This for two main reasons. Firstly, when measures are unaffordable, these will not be taken, even if these are beneficial for the environment. Secondly, considering the cost of environmentally beneficial measures, will allow to prioritize the most efficient measures within a limited budget. In terms of sustainability, it is important to, not only consider investment costs, but also life cycle costs as also affordability in future is important. The life cycle costing (LCC) approach is a well-known approach to estimate the life cycle costs of a building. It is therefore considered that the quantitative methods might hence be more appropriate to evaluate the sustainability of healthcare buildings and will be further investigated during this research.

CONCLUSIONS

There is clearly a lack of specific architectural and urban regulations for large-scale healthcare buildings in Flanders. Furthermore, with the constantly evolving sustainability concept and development of new Flemish climate plans, the current regulations in this regard are already outdated. On top of that, there is no comprehensive method to assess the sustainability of the projects supporting building practitioners.

As most important design decisions are taken in the early design phase, it is important to develop a reliable sustainability assessment method from a life cycle thinking perspective which allows practitioners to achieve the desired sustainability level. This method should moreover include the assessment of the integration of the building in its surroundings as the scale of healthcare facilities is increasing. In addition, such method could serve as a guide

towards establishing clear and comprehensive healthcare facilities regulations and to update the existing ones.

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