Proposal for a Healthcare Building Sustainability Assessment (HBSA) Method

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Abstract: *The healthcare building project contains different aspects from the most common projects. Mostly due to various design requirements, these buildings are rarely designed and operated in a sustainable way. Therefore, the best practices of a sustainable healthcare building design that should be taken into account: in the design phase (to support the decision to adopt solutions that contribute to building sustainability); and in the operation phase (to support users and managers in the operation and in equipment maintenance at an high level of efficiency).*

In this context, the aim of this study is to present a proposal for a Healthcare Building Sustainability Assessment (HBSA) method adapted for the Portuguese context and considering the work developed so far in the standardization bodies (CEN and ISO). The most relevant building sustainability assessment tools in the context of healthcare buildings will be also analysed and compared.

Assessment methods, HBSA method, Healthcare buildings, Sustainability

1. Healthcare buildings sustainability assessment methods

In order to promote the introduction of sustainable practices in the design of healthcare buildings, several countries and building sustainability assessment bodies have published guidelines to support improved design approaches. Among them, it is possible to highlight the recommendations for healthcare projects that the Green Building Committee of the American Society of Healthcare Engineering (ASHE) published in 2002 (ASHE, 2002). This partnership between the American Hospital Associations and the United States Environmental Protection Agency, pointed out the principles of sustainable architecture that are intended to reduce waste and other impacts associated with hospitals (Roberts & Guenther, 2006). The ASHE proposes an architectural development of these recommendations in order to develop buildings capable of improving the health concerns at three scales (ASHE, 2002):

- Protecting the immediate health of building occupants;
- Protecting the health of the surrounding community;
- Protecting the health of the larger global community.

1.1. Existing methods and their characteristics

Analysing the state of art in the field of HBSA methods it is possible to identify the following: BREEAM New Construction; LEED for Healthcare; Green Star – Healthcare; and CASBEE for New Construction.

In general, the abovementioned building sustainability assessment tools have the same structure. They all have sustainability assessment categories and indicators, and allow the

calculation of a single overall score based on a set of weights. The weights are based in the relevance of each category for the sustainability of healthcare buildings and higher weights are given to indicators of greater importance (Castro, Mateus, & Bragança, 2013). BREEAM New Construction, LEED for Healthcare and Green Star – Healthcare have a similar structure and an identical weighting system. Therefore they can be compared and Image 1 shows how the weight is distributed among each sustainability category in the three HBSA methods. The final weights of CASBEE for New Construction vary, according to the final scores achieved at the level of each indicator, according to the methodology specified in the CASBEE manual.

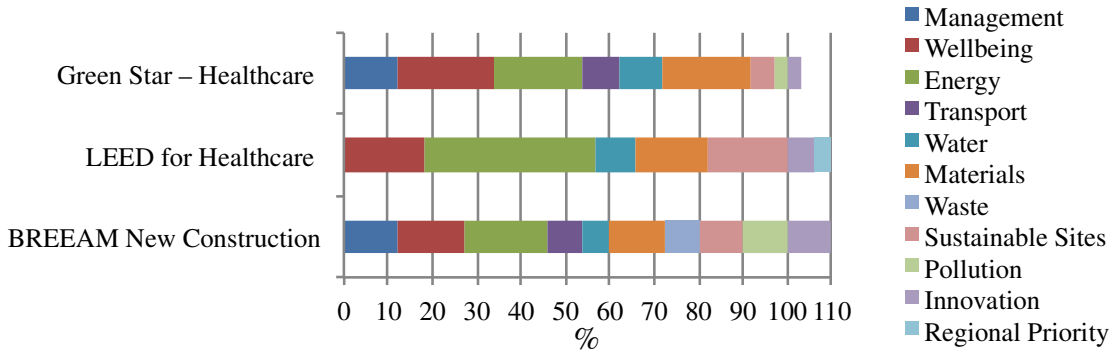

Image 1 - Weights distribution of HBSA methods in study

1.2. Ongoing standardization

In the last years ISO and CEN have been very active in developing a definition for the sustainable construction concept. As a result they have been publishing the set of standards: ISO 15392; ISO/IEC TS 17021-4; ISO 20121; ISO 21929-1; ISO 21930; ISO 21931-1; ISO/TR 21932; EN 15643; EN 15942; EN 15804; EN 15978; and prEN 16309. Analysing these standards it is possible to conclude that sustainable construction does not only mean improving the environmental performance but also, and above all, seeking an optimized balance between environmental, societal and economic aspects. Within this context, Image 2 outlines the relation between the sustainability categories of the studied HBSA methods and the three sustainability dimensions (and related potential impacts), according to the division proposed by ISO/AWI 21929 (ISO TS, 2010).

Potential Impacts / Core Categories	Environmental		Economic		Societal			
	Change/ Deterioration	Use/Depletion of resources	Economic value	Productivity	Health	Satisfaction	Equity	Cultural value
Management								
Wellbeing								
Service quality								
Energy								
Transport								
Water								
Materials								
Waste								
Sustainable Sites								
Pollution								

Legend: *1 method* *2 methods* *3 methods* *4 methods*

Image 2 – Relation between the potential impacts set in ISO/AWI 21929and the categories of the analysed HBSA methods

Regarding Image 2, it is possible to conclude that the environmental dimension is the one with the greater presence in all core categories. Therefore, it is possible to highlight that HBSA methods have an unbalanced consideration of core categories across the three dimensions.

2. Sustainability performance in healthcare buildings

Defining benefits, both organizational and community, that arise from sustainable building strategies is a continue challenge in healthcare area. These benefits need to be defined, quantified, and communicated and understood through the industry.

Benefits that include the concepts “less” and reduce” are always misunderstood in healthcare industry, because this industry is about people and about their wellbeing and therefore these concepts are delicate. At the same time, healthcare organizations have been implementing many efforts to achieve social benefits with implementation of improved environmental performance strategies. A lot of organizations and healthcare buildings received recognitions for these initiatives: treatment of medical waste; recycling programs, environmental improvement programs resonate with communities; reduction the consumption of energy; reduce the consumption of water; sustainable site planning; etc.

So, in this context, it is important to promote the dialogue between evidence based design and sustainable design strategies in healthcare industry. The major distinction between these two concepts is that: evidence based design is a process of investigation focused in medical and workplace outcome objectives that lead to a recommended set of built environmental strategies; and sustainable design is a process that defines a set of built environmental strategies informed by broader considerations (Hamilton, 2006). The strategies of the last one are often based and linked to larger public health, community, and societal concerns. It meets the principles of the triple bottom line: strategy and leadership.

As presented in Image 3, this “Triple Bottom Line for Health” defines the industry approach to sustainable building and operations and is the basis for the most relevant design tools and guidance documents that have been developed for the purpose of making known healthcare organizations and your designers these challenges (Robert & Guenther, 2006). However, these assumptions increase its high complexity when consider the interests of the community and the population, which can also lead to failure of the same at its misapplication. In this sense the health industry should make an effort to take into account not only the technical needs of the hospital, the patients, the environment, but also the community at large (Image 4).

Image 3. The Triple Bottom Line for Health (Roberts & Guenther, 2006)

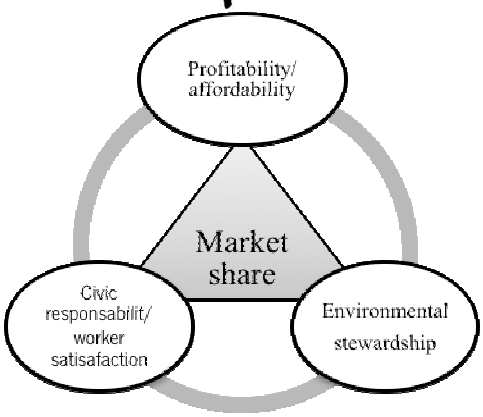

Image 4. Applying the Triple Bottom Line Approach at the Community Level (Roberts & Guenther, 2006)

Shepley and Baum as have been studying the conflicts between EED (Eco-Effective Design) and EBD (Evidence-Based Design) and publishing papers about these issues. They are conflicts like built larger patient room (Baum, Shepley, Rostenberg, & Ginberg, 2009b). On one hand this can promote comfort for the patient, with more space and better conditions, but it also implies more resources to construct, more consumption of water and energy conservation leads to less light and fresh air. Nevertheless, more than 50% of the experts in EED and EBD framed concepts defend that these two concepts should walk together promoting benefits to each other (Baum & Shepley, 2009).

2.1. Sustainable-effective design versus evidence-based design

Relationship between EBD and EED has already been discussed in some papers and literature reviewed (Baum, Shepley, Ginberg, & Rostenberg, 2009a), but the concept EED does not reflect all concerns that are involved on the concept of sustainable construction. So in this paper, the concept Sustainable-Effective Design (SED) is introduced to reflect the issues that should be taken into account in HBSA methods. Most discussions on EED facilities focused on how the building itself was designed to reduce harm to the natural environment, not to create a "healing environment". In this context, Image 5 reflects synergies and conflicts between EBD strategies and core categories of HBSA methods that are in study.

Main EBD / Core categories	Patient health, safety and wellbeing	Staff health, safety and wellbeing	Operational Efficiency	Technology	Life cycle flexibility
Management					
Wellbeing					
Service quality					
Energy					
Transport					
Water					
Materials					
Waste					
Sustainable Sites					
Pollution					

Legend: *Clear conflict* *Possible conflict* *Possible synergy* *Clear synergy*

Image 5 - Relationship between EBD strategies and the core categories of HBSA methods

Rarely exceptions of core categories, like “Water” and “Transports”, are not related with EBD strategies, and no one has “clear conflict”. The majority of categories have possible or clear synergies with the issues considered in HBSA methods, and category “Service quality” is the one that has a “clear synergy”. For a best analyse and understanding of this relationship, all the criteria of each category should be taken into account to effectively understand witch criteria are in par or not with the EBD strategies. In similar way, the best practices of EBD should be included in this analyse. Therefore, it is fundamental looking in for these synergies and conflicts to promote the dialogue between these two realities. One of the objectives of these methods is to help design teams in the design and construction stages and therefore it is important to combine the EBD strategies and EED facilities to achieve SED criteria and to clearly include that in HBSA methods.

In the definition of the indicators of the HBSA Portuguese method presented bellow all concerns presented in existing HBSA methods and also SED issues are considered.

3. Portuguese context

In Portugal, during 2008, the Ministry of Health developed a document that lists the recommendations and technical specifications for the healthcare buildings. This document, re-published in 2012 (ACSS, 2012), has recommendations for several issues: such as architecture; facilities and equipment for water supply and drainage; electrical and mechanical systems; centralized technical management; outdoor spaces; integrated management of solid waste; maintenance; etc. Together with these documents, there are other regulations that specify the requirements of each specific space at the level of lighting, indoor air quality, temperature and ventilation. Nevertheless, in what regards to the sustainable management of the healthcare buildings there is not any document with the force of law or recommendation. In 2013, the Ministry of Health published a Guide called “Guia de boas práticas para o setor da saúde” presenting it as an instrument to promote the reduction of consumption and energy costs and water, the reduction of waste and the spread of behaviours that promote low carbon economies. This guide can be used as a tool for dissemination and outreach of best practices to all users of the buildings. The idea was to demonstrate measures requiring very low investment costs and begins to introduce such concerns in healthcare buildings (ACSS, 2013).

3.1. Proposal for a Portuguese HBSA method

There is no simple answer to the question “what makes a healthcare building sustainable?” That is because sustainability is not a single entity that can be measured and labelled. But HBSA methods have trying to answer this question. So, they need to be as comprehensive as possible, but also they need to be, simultaneously, clear and easy to use. The following Image 6 presents the indicators that should be taken into account when it comes to implementing sustainable design practices in healthcare buildings. In this structure the following information is taken into account: I) the existing HBSA methods; II) the guide published by Portuguese Ministry of Health; III) the key sustainability indicators defined by Sustainable Healthcare Architecture (Guenther & Vittori, 2013); the SED practices identified when analysing the recognised case studies; and the EBD issues discussed in literature.

Dimensions	Categories	Indicators
Environmental	Climate change and outdoor air quality	Environmental impact associated with the life cycle of buildings
	Soil use and biodiversity	Urban density
		Reuse of previously built or contaminated soil
		Use of autochthonous plants
		Site Selection
		Heat island effect
	Energy	Non-renewable primary energy
		Renewable primary energy
		Energy produced locally
		Electricity
	Materials and Solid Waste	Reuse of materials
		Use of recycled materials
		Use of certified materials
		Use of cement substitutes in concrete
		Use of local materials
		Coating materials
		Storage conditions of solid waste during the building's use phase
		Construction Waste
		Use of mercury
		Toxic waste
	Water	Water consumption
		Reuse of non-potable water
	Pollution	Reduction of CO2 emissions
		Monitoring energy used for each order
		Monitoring energy used by the user area
Social	Comfort and health of users	Efficiency of natural ventilation in indoor spaces
		Toxicity of finishing materials
		Microbial contamination
		Thermal comfort
		Visual comfort
		Acoustic comfort
		Indoor air quality
		Indoor Environmental quality
		Passive design
		Local development
		Equipment
	Accessibility	Accessibility to public transport
		Low impact mobility
		Amenities
		Space distribution
	Space flexibility and adaptability	Spatial organization and indoor program
		Furniture
		Space adaptability
	Awareness and education for sustainability	Education of occupants
	Cultural Value	Form and implementation
	Innovation	Innovation of the project design
Economic	Life cycle costs	Initial cost
		Operation costs

Image 6 – Proposal for HBSA Portuguese method

4. Conclusions

In the beginning, this kind of tools was called "Building Environmental Assessment Methods", and now is more appropriate to call them "Building Sustainability Assessment Methods". This is because the constant evolution and adaptation of the concept of sustainability. It is not possible to talk only about environmental without thinking about economic and societal aspects. It is fundamental not only have these other two pillars in background, but it is important to consider all of them in HBSA methods. The way of thinking about healthcare projects is starting to change and sustainability is not one more thing to think, but it needs to be present in all project stages and ideas. This is why it is important to speak about Sustainable-Effective Design (SED) practices and not only about Evidence-Based Design (EBD) or Eco-Effective Design (EED) issues. Therefore, the HBSA methods should be more and more comprehensive and not only one adaptation of the main tool of each BSA system. These methods should integrate all concerns even if there are many ways to answer to each indicator.

This raises the importance of developing a methodology that includes the indicators discussed in this paper. For that purpose, future research on sustainability assessment of healthcare buildings should be focused in finding the best assessment method and parameters to evaluate the performance at the level of each proposed indicator. At the end, it is necessary to develop a manual to guide the practical implementation of the methodology.

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