LIFE CYCLE ASSESSMENT OF DIFFERENT MEDICAL DEVICES AND THEIR INFLUENCE ON THE ENVIRONMENTAL IMPACT OF HEALTHCARE BUILDINGS

Manuel Botejara Antúnez. Department of Graphical Expression. University of Extremadura (Spain). manuelba@unex.es
Pablo Garrido Píriz. Department of Graphical Expression. University of Extremadura (Spain). pgarridovs@alumnos.unex.es
Gonzalo Sanchez-Barroso Moreno. Department of Graphical Expression. University of Extremadura (Spain). gsm@unex.es
Jaime Gonzalez Domínguez. Department of Graphical Expression. University of Extremadura (Spain). jaimegd@unex.es
Justo García Sanz-Calcedo. Department of Graphical Expression. University of Extremadura (Spain). jgsanz@unex.es

Background

Currently the optimization of raw materials, energetic efficiency and the reduction of environmental impact are aspects of such importance at the time of choosing a product, process or system. The healthcare buildings are a kind of building composed by a whole group of systems, products and processes. This means a great margin for improvement in energy efficiency and environmental impact caused during the construction as well.

Research Questions

The main objective of this work is to test the viability of applying a Life Cycle Assessment (LCA) study to various medical devices, as well as to see the influence of these on the life cycle of a healthcare building.

Methodology

Firstly, an exhaustive search was carried out for studies based on the LCA of different products in the healthcare field using the following keywords: medical device, LCA and environmental impact. Then, the state of the art was shaped, checking the viability of the work. The bibliography was then analysed in order to obtain the various characteristics provided by the LCA methodology when applied to devices in the healthcare field.

Then, with the different characteristics extracted from this bibliography, an analysis of the results was carried out, adapting the information obtained to the case study of this work, so that a series of advantages and drawbacks of applying this tool to health devices were obtained. To get this, each of the different studies had to be analysed, trying to extract the information that best adapted to this type of healthcare product. With the information obtained from this analysis, the viability of applying the LCA methodology to healthcare devices was evaluated, as well as analysing the impact that it generates on the life cycle of healthcare buildings. In this way, the aim is to visualise the various synergies obtained.

An outline of the methodology is shown in Figure 1.

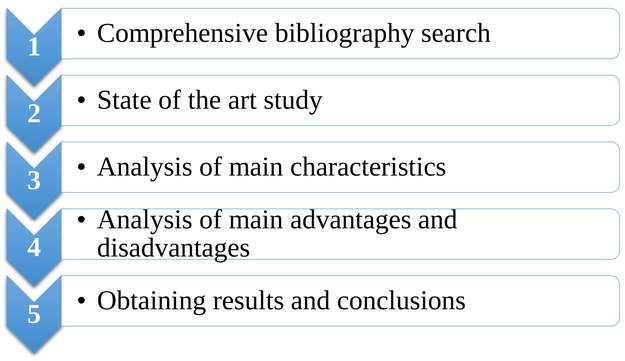

Figure 1. Scheme of the used methodology.

Results and Discussion

Among the different studies, tasks and projects the following advantages and drawbacks have been found, as shown in Table 1.

Table 1. Advantages and drawbacks obtained once applied the LCA method in healthcare devices.

Advantages	Drawbacks
Reduction of the environmental impact generated in the selection of systems, processes, materials, etc	Complexity of the study development
Generation of a tool for planning environmental strategies, policies and programmes	Subjectivity in the study development
Generation of a tool for the evaluation of energy savings (Energy Efficiency)	Limited influence of the specialist's preferences
Selection of alternatives for proper waste management and sustainable construction	Possible renounce to certain technical characteristics, quality, etc, in exchange for the reduction of the environmental impact of the device (Cost of Opportunity)
Comparison between the functionality of products with similar characteristics	
Evaluation of the effects produced by the consumption of resources in the facilities	

All these advantages have not only an economic benefit, but also considerably reduce the levels of emissions and environmental impact. This translates into sustainable construction materialised as an effort to maintain the planet with sustainable development ethics.

The main drawbacks of this type of study are its high degree of complexity and subjectivity. On the one hand, the subjectivity of the LCA depends mainly on two factors. The first factor is associated with the individual who carries out the analysis or study, since the choice of factors involved is made at the will of the individual. The second factor is associated with the low degree of reliability of the input data of the LCA method, since there are no standardized libraries of life cycle inventory, therefore, this is done at the discretion of the researcher.

On the other hand, the complexity of this type of study is given by the high degree of knowledge required for its elaboration.

Some of the solutions proposed to improve these drawbacks are: creation of a guide for the application of LCA methodology, training courses, use of probability distributions, etc.

In addition, this communication opens up the possibility of developing future studies and lines of research, such as: the generation of indicators for reducing environmental impact, the improvement of existing techniques, the quantification of the benefit of applying LCA in healthcare buildings, the development of new products, techniques and systems that are more respectful of environmental impact, etc.

Conclusions

This analysis of different case studies indicates a growing attention to sustainability in the health sector. Current regulatory frameworks are being developed to facilitate the implementation of environmental performance assessment. Despite some limitations of the LCA technique, it remains a powerful, science-based tool for assessing environmental impacts.

It can be seen that the application of the LCA study in the procurement of a healthcare device generates a large number of advantages not only in the device itself, but also in the life cycle of a healthcare building. This will not only have a social benefit, as it improves the image of the company in relation to its competitors but will also generate an economic benefit that will normally be associated with the reduction of waste generated and operating costs.

Finally, there are many advantages to be gained from applying the LCA methodology to healthcare buildings. Among the most important there are: the reduction of environmental impact, waste and operating costs, and energy savings. All these advantages translate into sustainable construction. It is a characteristic of vital importance, since it contributes among other things to energy efficiency and the reduction of emissions. Therefore, contributes to the maintenance of the planet.

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References

Unger, S., & Landis, A. (2015). Chung, J.W., & Meltzer, D.O. (2009). Estimateof the carbon footprint of the US health care sector. J. Clean, 1-9.

Chung, J.W., & Meltzer, D.O. (2009). Estimateof the carbon footprint of the US health care sector. JAMA, 302, 1970-1972.

Campion, Nicole, Thiel, Cassandra, L., DeBlois, Justin, Woods, & Noe, C., Landis, Amy, E., Bilec, Melissa, M., (2012). Life cycle assesment perspectives on delivering an infant in the US. K. Sci. Total Environ., 425, 191-198.

Guinée, J.B., (2002). Handbook on life cycle assessment operational guide to the ISO standards. Int. J. Life Cycle Assess., 7(5), 311-313.

Campion, N., Thiel, C.L., Woods, N.C., Swanzy, L., Landis, A.E., & Bilec, M.M., (2015). Sustainable healthcare and environmental life-cycle impacts of disposable supplies: A focus on disposable custom packs. J. Clean. Prod., 94, 46–55.