ENVIRONMENTAL IMPROVEMENT OF UNIVERSITIES: BARRIERS, OPPORTUNITIES AND RESEARCH QUESTIONS

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Abstract

In the challenge of sustainability, economic activities need to be further understood, and many of current practices revisited. Beyond industry and energy production, other economic and non-economic activities are also progressively being subject to environmental evaluation. Universities are a very particular sort of institution: they gather high amounts of people, they are referential as to knowledge and behavior, and some of their activities can be almost by definition uncommon in the material flows that they entail. Their environmental activities constitute in some cases much environmental impact as a town or a city, in addition of those of the physical homes where their dwellers live. This paper presents the conclusions, concerns and reflections of the project "Proposal of a methodology for calculating a University's carbon footprint. Case study of the Universitat Politècnica de València", in which this university had its environmental impacts measured through environmental footprinting, carbon footprinting and life cycle assessment. Some methodological concerns were raised along the process, as well as the needs for considering improvement strategies and the way that those strategies reflect on the university's environmental performance.

***Keywords**: Environmental Footprint, Carbon Footprint, Life Cycle Assessment, Universities.*

Resumen

En la carrera por la sostenibilidad, es necesario entender mejor las actividades económicas, y reconsiderar muchas de las prácticas habituales. Más allá de industria y producción energética, otras actividades (tanto económicas como no) están siendo sujetas a evaluación ambiental. Las universidades son un tipo muy particular de institución: congregan a muchas personas, son un referente en cuanto a conocimientos y comportamiento, y algunas de sus actividades conllevan flujos poco comunes de materiales, casi por definición. En muchas ocasiones sus actividades provocan tanto impacto ambiental como una ciudad, como extra al ya provocado por las ciudades o pueblos donde habitan las personas que trabajan en ellas. Esta comunicación presenta las conclusiones y reflexiones del proyecto "Propuesta de una metodología para el cálculo de la huella de carbono de una universidad". Aplicación a la Universidad Politécnica de Valencia", en el que se midieron los impactos de la misma mediante huella de carbono, huella ecológica y análisis de ciclo de vida. Se presentan algunos puntos de discusión metodológica, así como la necesidad de considerar estrategias de mejora y cómo las mismas son capaces de influir en el rendimiento ambiental de la universidad.

Palabras clave: *Huella ambiental, huella de carbono, Análisis de Ciclo de Vida, Universidades*

1. Introduction

One could say that we live in the era of environmental claims, and one could say it meaning very different things. The fact is that the environmentalist discourse has permeated into almost all sectors, and the word "sustainability" is used more commonly in reference to sustainable development than to its original meaning.

The discourse on sustainability, however, has many different faces. Beyond the sometimes trivialized messages communicated by the media, the political and scientific debates try to prioritize problems to tackle, and solutions to implement. Many of such greater-scope decisions deal with policies for countries, regions or cities. For that matter, the concept of environmental footprint (Rees and Wackernagel, 1996) seems like a representative measure of the environmental load, measured in the amount of land needed to sustain a particular area, and as well needed to absorb the emissions generated by the same (GFN, 2010).

But the interest of areas, and in particular social areas, in not only related to their environmental impact. They tend to be the most impacting areas because they are also the most socially and industrially active areas. Most value is generated in such environments, and for that reason we find it acceptable – albeit due minimizing – to have them emit high quantities of polluting chemicals. In particular, cities are one such sort of area, and have received since long ago one of the biggest focuses of attention. Not only the concentration of people has a considerable impact in itself, but current cities are associated with high impacts on consumption, transportation, logistics, etc.

Universities should not escape this focus. They tend to behave, for many reasons, like small cities in their own right. Those with independent campuses occupy the area that a small city would, and even those that do not have one allocate enough of the city's resources and logistics to deserve an independent study. The method to do so may raise disparity, but the aforementioned parallelism points out the potential of environmental footprint for this endeavor. Even if most studies of environmental footprint have been applied to areas of land, suitability to companies and other institutions has been validated (Domenech, 2007).

The main difference is the purpose, however. The main purpose of a city is containing its inhabitants, having intrinsic value for the mere need of it existing. A university, on the other hand, has a particular mission or set of missions, mainly regarding teaching, research and social impact. That would position it closer to other environmental assessment methods or schemes, such as Life Cycle Assessment (LCA, as per ISO, 2006), or even carbon footprint. This has motivated different studies in this direction.

This context motivated the assessment of the Universitat Politècnica de València. Since the data gathering was bound to be synergic for the different methods, the assessment was performed out of environmental footprint, carbon footprint and life cycle assessment, with the purpose of clarifying a methodology that could become a standard when assessing universities (Mondejar-Navarro et al., 2011). The initial study consisted purely of an environmental assessment, but it had the additional purpose of constituting the data-gathering phase for the development of such a standard. For that matter, special attention was put on gathering the disagreements in literature about what types of values to measure, understanding the context of a university and the idiosyncrasies when measuring different values, and defining the potential pitholes for future practitioners. The panorama could not look more challenging, with most studies calculating the environmental footprint "their way" as to measurements, system boundaries, etc.

This paper presents the results of different discussions that spawned after the initial assessment. They constitute the outcome of expert discussions, on which challenges are the most critical on university environmentalization from an LCA point of view, out of the experience both in the university's environmental management system and the development of a rigorous and representative environmental assessment of the institution, or of a campus.

2. State of the art

Environmental assessment has become a substantially rigorous discipline in the last decades. The environmental footprint (EF, Wackernagel & Rees, 1996) became at some point quite popular, mainly due to its easy interpretation without the need for further knowledge. It represents the productive land required to perform an activity or conduct a process, generally measured in global hectares (gha), a world average productive hectare. This makes it particularly useful to be compared with the total available capacity of the planet (Nourry, 2008)

It can be seen that the definition has a functional focus, requiring of an activity or process to be happening, and thus to have a function associated with it. However, as the EF became popular this requirement relaxed, and it is common to find studies that have as their focus a city, a person, etc. Entering into the function of such concepts would almost run into the discipline of philosophy, and is not in the scope of this paper, but it can be seen that the initial functional approach was bypassed by associating a city with all the actions that occur in a city, or a person to all the actions that the person performs along their life.

Another approach is that of LCA. Its longer development – since its first appearance in the 60's (Svodoba, 1995) – has granted it the acceptance and respect in the scientific community. This methodology is thoroughly described by its ISO standard (ISO, 2006), and is one of the most widespread ways of assessing environmental impacts. It is commonly used for alternative selection, policy-making, marketing, redesign, etc. ISO (2006) defines it as "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle". From the previous, one can infer the vast amounts of data that tend to be handled along this process. It also divides LCA into four processes: goal and scope definition, inventory analysis, impact assessment and interpretation.

When defining the suitability, or the type of study, that is being performed, the goal and scope definition becomes particularly critical. This stage of LCA includes very important decisions that have a strong influence in the final outcome, not to mention along the process. The so-called functional unit must be defined. The functional unit is the unit to which the whole assessment will be referred to, and must be expressed in functional terms. It represents the purpose or the function of the element under scrutiny, and is of great importance when comparing alternatives. Any difference between two objects in the study must be accounted for, and compensated, so that they end up having the same functional unit. This forces the practitioner not to focus so much on the way in which the solution is implemented, as much as the reason why that was done in the first place. Therefore, rather than assessing environmental impact per car, it would be relevant to assess environmental impact per kilometer driven, for a particular range of secondary functions that the car delivers.

Another important decision is that of the system boundaries. What to include in the analysis and what to disregard will obviously affect the results. The reasons for selecting or excluding elements tend to be relevance or variation (between the alternatives) rather than availability, although when unimportant, it could be a reason for exclusion.

It is also important to define in which way environmental impacts will be allocated to different streams, in case of doubt. Some processes may have more than one output, and their environmental impact needs to be distributed. In other cases, the whole life cycle may have different outputs, like in the case of recycling.

Selecting a clear strategy in the aforementioned items makes decisions further in the pipeline much more straightforward. This makes LCA a very suitable assessment alternative when such information is available. In case an Environmental Management System (EMS) is available, most information can be sourced from it. There are currently standards for this, such as the ISO 14000 family or the Eco-Management and Audit Scheme (EMAS). In the case of universities, a number of them already count with such a system.

Some institutions already exist to channel the efforts in delivering a more sustainable higher education, with the Association for the Advancement of Sustainability in Higher Education (AASHE) (Kinsley, 2009) or Carbon Trust, in its specific program Higher Education Carbon Management (HECM) standing out. One of the pioneers in their assessment as an institution, through environmental footprint, was the university of Redlands (Venetoulis, 2001) using EF methodology, followed by cases such as Middlebury school in Vermont (Hanley et al., 2003), Strathclyde (Statchan, 2005), Pennysylvania (TCCCBSES, 2007) and ever since cases such as Oregon University, Yale University, Santiago de Compostela, Cambridge, Navarra, Cranfield, Maribor, etc. (Mondéjar-Navarro et al., 2011).

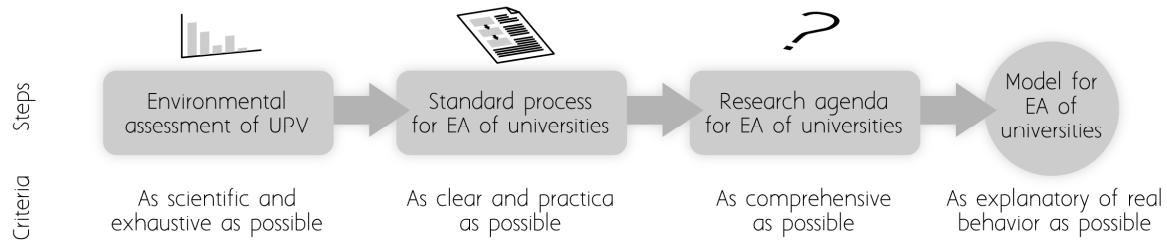
3. Methodological approach

The project was carried out in several phases. The first one consisted of carrying out a complete inventory of environmental aspects for the university. This would allow the calculation of the environmental impacts according to Life Cycle Assessment, Environmental footprint and carbon footprint. Advantages and disadvantages were mapped, as well as difficulties found in the process. The results of this assessment were presented by Torregrosa López et al (2010).

A second stage consisted of generating a draft methodology for the calculation of the environmental impact of universities. Carbon footprint (CF) was chosen as the main representation of the impact, although concepts from the other two reference methodologies were included. This approach has been proposed in Mondéjar-Navarro et al. (2010). A stepwise approach for this process was brought forward, pointing out the most scientifically relevant way to solve the difficulties in this process. Since LCA seems to be the most mature way of assessing, it was taken as reference pattern. EF and CF were performed having the structural background and knowledge of LCA, building an approach that takes the best – for the problem at hand – out of those three approaches.

In a third step, strategies for studying those difficulties were pointed out, as well as the case for other universities. It is in this point that the present paper is located, presenting the preliminary conclusions and research agenda spawning from the study.

Figure 1: Structure of the project

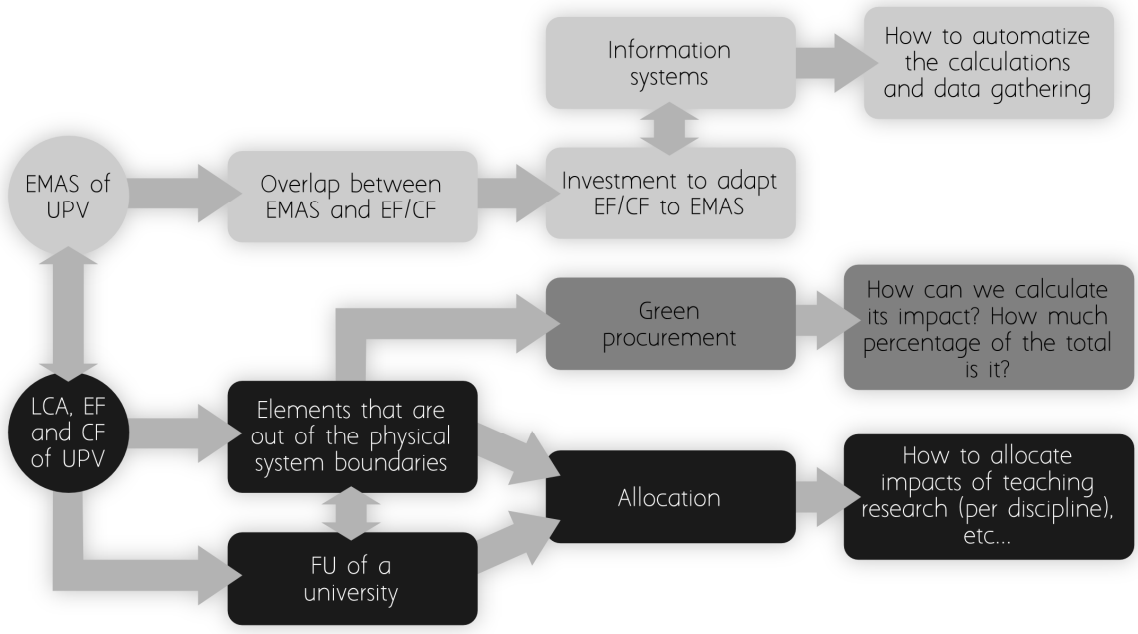


For this third step, a panel session was carried out, including the people involved in the environmental assessment of the university, those involved in the environmental management system, and a group of experts in environmental aspects and assessment. The sessions was facilitated to ensure that the discussion headed towards research items that had been solved along the process, and those questions that were still open for discussion and further research. The process was thoroughly documented and a research agenda was developed for the successive years in an effort to build a consistent model on environmental behavior of universities. The results of that panel are presented in this paper, together with some of the annotations that were made along the second stage, whilst developing a standardized approach to conduction a CF, EF or LCA of a university.

4. Results and discussion

One of the first topics to be brought up when assessing the tasks performed in developing a guideline for environmental assessment of universities was the magnitude of the problem that it had unraveled. Whilst trying to standardize the procedure to carry it out, with a basis of LCA, it had been seen that this was just the tip of the iceberg. It seemed like the process is probably not the most important item to standardize! For that matter, this panel session focused on the different decisions that strongly influence the assessment, are required to be specified for an LCA, and differ strongly from study to study. Different topics were brought up and clustered as shown in Figure 2.

Figure 2: Research agenda developed with the panel discussion

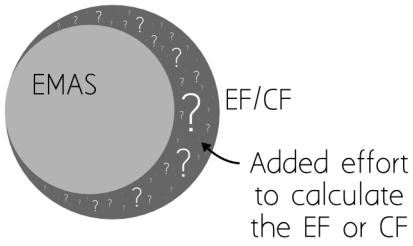


In regards to the methodology, ISO (2006) strongly emphasizes a set of methodological decisions that need to be considered before even starting the information compilation. Different studies were assessed as to these items, and there was seen that consensus was rare.

In regards to organization and information management, the first topic to be brought up was the overlap between the current EMAS – representative of many other EMAS or EMS systems in general – and the assessment that had been done. Figure 3 shows how this

could be important. It was presumed before the study that most information would be accounted for in the EMAS, since both systems aim at monitoring the environment performance of an institution. In this case, however, it was preliminarily seen that some strong differences could create the need for further assessment. The definition of system boundaries on EMAS and in LCA is generally quite different, EMAS being based on the capability of influencing and LCA on the consequence of a particular function.

Figure 3: Overlap between the environmental management system and the requirements for environmental footprinting or carbon footprinting



The question brought up was how big this additional area could be, and how much the EMAS should be extended to account for everything. This could have advantages for the EMAS (more visibility on environmental impacts, and possibility of effecting a greater set of aspects), and also disadvantages (more region of responsibility, lack of mechanisms for gathering the information systematically, etc.). A consequence of this proposal would be the study of information systems, and what sort of reporting scheme or research approach could systematize this process, in an effort to minimize the efforts needed for LCA.

Another whole line of work would deal with methodological aspects of LCA that come into play when assessing a university. The key methodological items that differed between previous studies, and were potential points of conflict, seemed to be the system boundaries, the way of operating with the functional unit, and the way in which allocation was considered, if it was.

System boundaries themselves were not strictly speaking a point of conflict for previous studies, although it seemed like selection of the items to consider was made out of contingency rather than methodology. In many case, available – inside – information was used, rather than considering the requirements of having a university performing. Furthermore, universities have plenty of services that substitute others in a city, like many times cafeterias, sports facilities, etc. They also entail a series of transportation trips that need to be accounted for if the study aims at being comprehensive. These decisions can be critical for the results, and the relevance and requirement of each one of them should be taken into account.

Figure 4: Examples of items to include or not in the system boundaries of a university

And what would be such performance? Functional units would bring an answer to this question in a conventional LCA. This seems like a troublesome question for a university, especially from the point of view of measuring this performance. Most studies fell back to one of the several missions attributed to university, without further mention of the topic. Others

evaded the topic altogether. Some discussion on the topic brought the panel to the point that it is probably a case of unclear – or non-uniform – understanding of what purpose the university serves. Further study on this topic would be needed.

Discussion the previous two items, the topic of allocation was often bumped into. With a rather obscure meaning when it comes to universities, several cases and strategies would be needed to study, especially when it comes to additional services in the university. The fact of putting a cafeteria inside the university does not add to the environmental impact of research or lecturing, but is rather a side effect of people being in the place. If the food there has a higher environmental impact than that outside the university, consequentialist approaches would argue that the extra environmental impact be attributed to these effects – if they were not studying or researching, they would not have that extra impact. If the impact is lower, the credit may be given to the university, since it is compensating this way for other impacts. Of course, this matter is not trivial, but rather open for further discussion, thus opening another line of further research and consideration, aligned with the previous two.

A more exact understanding of how these impacts are allocated would also allow for an allocation of environmental impacts into the different functions that a university has, or even among different disciplines. For example: how much of the university's environmental impact is due to research, and how much to lecturing? What disciplines have a higher environmental impact per result? Or per lecture? All these questions require a deep understanding of how allocation is performed, but with a competent database and rigorous research, it would be possible to perform such allocation.

It has been seen that potential lines spawned from organizational and methodological approaches. However, a potential research line was considered from the intersection between the two: green procurement and the effect in the university's environmental performance. On one hand, how to include this, and how to facilitate the assessment and decision-making, would be relevant from the organizational perspective, since otherwise it is difficult to go beyond good intentions. On the other hand, green procurement challenges the concept of system boundaries, since it is an inside activity that normally accounts as infrastructure when assessing. How can this be calculated in an LCA of a university? Should the products be compared with other alternative average products? Or are other universities expecting to benchmark themselves with such an assessment expected to assess all their infrastructure and equipment? This matter obviously raises more questions than answers, and has the potential for becoming a research line with impacts in university performance and in the LCA discipline in general.

5. Conclusions and further research

It has been seen that the area of environmental assessment of universities still holds many incognite, of which the answer could improve not only our understanding about university's environmental performance, but also the robustness of environmental assessment in general. The research agenda is currently being developed by the authors in a systematic way.

The first step in this path, and particularly in its methodological part, is to analyze and prioritize the different decision items mentioned on section 4. For that, a systematic analysis of all available studies is currently being performed, to understand how they have specifically dealt with each of the issues – even if not stated in the text. That will open the door for research in all the methodological topics, i.e. functional units, system boundaries and allocation. A complete understanding of how each of those concepts apply to universities will make it possible to study the further follow-up questions. As to the organizational part of the research agenda, it is currently being targeted as a potential goal of the EMAS, as well as constituting one of the lines to follow in parallel.

Apart from each one of the lines in the research agenda exposed before, it is important to understand the bigger picture in which the lines are positioned: a deeper understanding of the university's environmental performance, and that of each one of its activities, will allow for a much better decision-making when prioritizing environmental policies or taking decisions in the EMAS. It should thus be possible to allocate resources in a much more efficient way. After the presented agenda is completed, it should be possible to model the university's environmental performance, and its role and effects in society. Furthermore, this understanding would open the possibility for real benchmarking between universities as to their environmental performance, with sharing of best practices all over the world.

One limit to this model, of great importance in the discussion, is the role of university in society. Many authors – mostly not from an environmental background – have spoken about this topic, but the definition still tends to be quite broad. This matter has been found to have an effect on all decisions and calculations, stronger the broader the concept that is being analyzed. This will surely be one of the greatest challenges in fulfilling the objectives mentioned in this paper, although probably one of the most motivating. After all, what is it really, the purpose of universities?

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