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Short communication

Composite indicators for a sustainable campus—Design rationale and methodology: The case of the Catholic Institute of Lille

Eric Olszak*

Law Faculty (FLD), C3RD-IDDR, Associate Fellow at CLERSE, Lille Catholic University, 60 Boulevard Vauban, BP 109-59106 Lille Cedex, France

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ABSTRACT

Having first appeared in the mid-1990s, policy actions for improving how sustainable development principles are put into practice on university campuses have been growing more and more. This has taken place mainly on North American campuses and has subsequently spread to a number of developed nations across the globe, bringing to light in each case an array of indicators used to cover all the components of this concept. The purpose of this article is firstly to define the major principles that Lille Catholic University holds in order to set up its own sustainable development indicators. Secondly, this article focuses on the formulae used for creating a composite indicator for a sustainable campus. Thirdly, it will try to highlight some of the possible actions that could be implemented on campus in order to improve the score of some of these indicators.

1. Introduction

Experiments for evaluating the performance of universities appear to have already been around for a number of years and are certainly not anything new. From the beginning of the 1960s, we have been able to see the development of a certain number of policy actions, mainly in the United States and Great Britain, which have set out to assess the efficiency of institutes of higher education and, first and foremost, that of universities. Measuring their effectiveness had to be carried out on two levels, firstly in focusing on the relations universities maintain with their external environment and secondly in highlighting the effectiveness of their internal operations (Yorke, 1987). In this sense, it is therefore not surprising that by the mid-1990s universities mainly in the United States and Canada were already using these policy actions for incorporating sustainable development principles into their development strategies before they were starting to be put into practice on European and Asian campuses. At the same time, this awareness for the environment on the part of universities has been influenced by policy actions brought about through the publication of declarations from international meetings on the environment. Through a rather exhaustive study, Wright (2001) brings to light these different declarations of intent of which certain appeared even before the Brundtland Commission (CMED, 1987). For instance, article 19 of the Stockholm Declaration of 1972, which followed up from the first United Nations conference on environmental issues, mentions the need to promote environmental education from the youngest age possible right up through one's adult years. A few years later, this first declaration, having somewhat taken on the shape of a charter, was replaced by the Tbilisi Declaration of 1977 which mentions more explicitly the duty universities have to incorporate environment-related material into their degree courses and "to better live this duty out together." From that time onward, other declarations, notably that of Talloires in 1990, have influenced institutional decision-making by reminding universities of their dominant role in the transmission of knowledge in general and, by extension, in the teaching of basic sustainable development principles. At the same time, a certain number of academic works have shed light on experiments carried out in North America and later in Europe and have focused on the reasons which have led universities to adopt such approaches, on the methodology used, on the difficulties they have encountered as well as on the indicators they have chosen (Keniry, 1995; Cortese, 1999; Van Weenen, 2000; Dahle and Neumayer, 2001; Shriberg, 2002; Cole, 2003; Uhl, 2004; Li et al., 2008; Klein-Banai and Theis, 2011). It would appear that universities make for an ideal place to implement sustainable development practices on account of the large space they often occupy within a specific area, their student population as well as the research projects carried out in their numerous faculties and adjoining laboratories. Lille Catholic University, which is made up of a vast number of institutes, has also adopted this type of approach in firmly choosing to set up a composite indicator for a sustainable campus.

* Tel.: +33 320134702.
E-mail address: eric.olszak@icl-lille.fr

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2. Designing a composite indicator for a sustainable campus at Lille Catholic University

2.1. Recognising the issue of sustainable development at Lille Catholic University

Lille Catholic University is a private higher education institutional federation made up on the one hand by both the Catholic Institute of Lille (ICL) and its six faculties and on the other hand by the schools of business, engineering and numerous others which cover a vast number of disciplines. At the same time, it receives some government subsides, which cover part of its operating expenses. Recognising the issue of sustainable development within its institutions has taken shape through a resolution adopted by the University Governing Council on the 21st of June, 2007. On this occasion, it was decided that the university should establish the Institute for Responsible and Sustainable Development (IDDR) for which there would be three basic tasks:

- Education (encouraging the teaching of sustainable development practices in the institutions).
- Research (carrying out cross-disciplinary research on sustainable development).
- Assessment and evaluation through mainly local group-based competitive bidding processes.

By the end of its first year of existence, this institute, which can be described as "cross-disciplinary" in nature, set up the specific objective of carrying out a comprehensive evaluation of progress made in the area of sustainable development at the level of the university as a whole. This task was given to the author of this article for whom research primarily focuses on designing sustainable development indicators relating to other issues.

2.2. Steps for developing composite indicators and constraints in choosing them

Taking into account the initiative of the Conference of French University Presidents that led to the 3rd of July, 2008 adoption of the charter for sustainable development (referring to the special issue of the Officiel de la Recherche et du Supérieur (ORS), 2009), Lille Catholic University set out from 2010 on a project to develop a tool to measure its performance with respect to sustainable development. This task was entrusted to IDDR, which established a working group, as early as September 2010, consisting respectively of permanent members of IDDR, research teachers and administrative staff representing the ICL institutions and representatives of the student associations. Right from the first meetings, the group was confronted with several fundamental choices: opt for a top-down or a bottom-up approach, develop a trend chart or a composite indicator, determine the desired number of indicators and select the coefficients.

With regard to the method choice for developing indicators, the top-down approach had the advantage of being able to use working frameworks drawn up by government agencies or officials or by universities having already experimented with this approach. Sustainable development philosophy has led us to firmly opt for a bottom-up approach based on gathering opinions of staff and students at the university. As for the choice of indicators, it was decided to quickly abandon developing any specific trend chart, a method more so widely used by English-speaking universities, and instead develop a composite indicator for showing a single figure rather than a multitude of data. In terms of a benchmarking approach, the use of a composite indicator allows for an easier comparison of a university both in time and space. In each of their works, Boulanger (2004) and Boutaud (2010) give an interesting perspective to the relevance of favouring this method. In the same way, we can consider that, as a general rule, a trend chart allows us to fully grasp a concept but fails to provide us with aggregate data while the use of a composite indicator shows the opposite features. On this basis, we were confronted with three major obstacles in designing a sustainable campus composite indicator. Firstly, we had to determine the adequate number of indicators which would allow for a comprehensive measurement of the concept, then we had to calculate the indicators or unweighted "indices" before finally accurately defining the weight of the coefficients. With regard to the first obstacle, it was decided that the number of indicators would be limited to a maximum of 30. This new figure proved to be compatible with the somewhat opposing objectives in that it allowed for an exhaustive study while still giving an overall picture of the situation. On that basis, after numerous discussions it was decided that each indicator would have the following features which were initially outlined in the works of Shriberg, who was mentioned earlier in this article. An indicator should therefore be:

- Compatible with the principles of sustainable development.
- Measurable.
- Readily available.
- Comprehensible to all stakeholders at the university.

Table 1 shows the method choice for developing each indicator. In the present instance, it enables the indicators to be classified in relation to each sustainable development pillar. It also involves arranging them in order according to the main sustainable development components and specifying how they are measured and applied.

Behind these four features, it was also decided that each sustainable development component, as defined in the Brundtland Commission, would have the same weight relative to the total number of indicators, that being 10 indicators for each pillar. In designing this working framework, it appeared that its applicability across Lille Catholic University as a whole would be impossible because of the fact that there are numerous institutions of which the majority function relatively independently from one another. In light of this, we have restricted our study unit and our choice of

Table 1
Setting up a working framework for sustainable campus indicators.

Indicator number	Indicator name
Sustainable development component	Sustainable development pillar to which the indicator refers
Sustainable campus domain	For example: natural energy and resources; supplies and waste management; movements; layouts, construction and green open space; economic life of the institution; teaching and research; student life; sustainable development training; diversity, health and social life; governance and stakeholder relations
Definition	Indicator formula
Significance and relevance as it pertains to sustainable development	Significance of indicator variability and reasoning behind indicator choice
Measurement and applicability	Possible measurement problems and relevant university branch likely to head up the measurements
Scope at the University	Defining the scope (i.e. at the level of the university as a whole or on an institutional scale)
Sub-indicators	Relevant sub-indicators
Application limitations	Highlighting certain application limitations for such an indicator
Possible indicator change and clear objectives	Upward or downward change of the indicator if it does not hold; defining a specific objective relative to the initial state

Table 2
Formulae for each indicator of sustainable campus unweighted indices relative to environmental care.

Sustainable campus indicators	Unweighted index formulae
CO_2 emissions within the institution over a year	Determine a minimum and a maximum CO_2 total amount. Any value which is greater than the maximum total amount will be given a mark of 0 while any value lower than the minimum total amount will be given a mark of 100. 100 − [(observed value − min value)/(max value − min value) × 100]. Index: 46
Water consumption within the institution over a year	Same formula used for CO_2 emissions. Index: 52
Energy consumption within the institution over a year	Same formula used for CO_2 emissions and water consumption but energy consumption is expressed in terms of its TOE. Index: 43
Portion of renewable energy used	Total percentage. Index: 5
Paper consumption within the institution over a year	Same formula used for CO_2 emissions but show here the amount of kilos of paper used. Index: 60
Portion of environmentally-friendly products used	Total percentage. Index: 25
Amount of waste within the institution over a year	Same formula used for CO_2 emissions but show here the amount of waste in kilos. Index: 40
Portion of Staff members not using their vehicle to get to work	Total percentage. Index: 43
Portion of HEQ certified property	Total percentage. Index: 5
Portion of green open space	If we consider a campus as being made up of no more that 50% of green open space, then multiply this percentage by 2 to give it a score out of 100. Index: 30

Unweighted indices corresponding to indicators in Table 3 are also calculated according to international or national norms. The maximum percentage set for certain indicators can vary.

Table 3
Formulae for each indicator of sustainable campus unweighted indices relative to economic effectiveness.

Sustainable campus indicators	Unweighted index formulae
Portion of fair trade issued supplies used	It would appear difficult to maintain 100% of one's supplies fair trade. 50% seems to be a reasonable buffer percentage. On this basis, multiply the percentage by 2 in order to obtain a score out of 100. Index: 10
Annual percentage change in student population	It is generally acknowledged that the average of a stable population has an upper bound of +10% and a greatest lower bound of −10%. In this way, a nil annual change corresponds to a mark of 50. +10% and above corresponds to 100, and −10% and below corresponds to 0. Index: 52
Overall success rate for students	Total percentage. Index: 83
Rate of degree-holding students finding work after 6 months	Total percentage. Index: 72
Net income percentage change	A nil annual change in net income makes up the average. Any increase of 10% or greater is given a mark of 100. Any decrease below 10% is given a mark of 0. Confidential.
Portion of government funding in revenues	With the status of an association, the Catholic Institute of Lille can receive up to 50% in government subsidies. However, 50% is considered the upper limit. On this basis, multiply the percentage by 2 in order to obtain a score out of 100. Confidential
Adaptability indicator (number of staff members able to occupy at least two positions within the institution)	Total percentage. Confidential
Portion of scholarship students	It is estimated that the maximum percentage of scholarship students will never go beyond 50% of the total student population. Multiply the percentage by 2 in order to obtain a score out of 100. Index: 33
Number of annual international scientific publications	Percentage with respect to the total number of publications. Index: 30
Portion of higher doctorate research teachers	We can look upon higher doctorate research teachers as representing half of the total number of research teachers. We therefore multiply the percentage by 2 in order to obtain a score out of 100. Index: 12

Formulae for each indicator of sustainable campus unweighted indices relative to social equity are based on the methodology used in Tables 2 and 3 and follow international or national norms.

indicators to only encompass the six faculties at the Catholic Institute of Lille even though our indicators can easily be applied to another institution of the university.

3. Sustainable campus indicators held by Lille Catholic University and synthetic index formulae

After defining the selection criteria for choosing indices, we can now distinguish them from the three pillars of sustainable development and subsequently report on their formulae. This information is presented in Tables 2–4.

3.1. Indicators by sustainable campus development pillars and formulae for unweighted indices

In the present instance, indicators in Table 2 first require the determination of a minimum and a maximum so as to be calculated. The two values draw from international norms when they exist or, if need be, from norms fixed by the authorities of the country in which the university campus is situated. In addition, the maximum values of certain indicators have a ceiling of 50%; hence the necessity to double them to calculate the unweighted indices.

3.2. Synthetic index formulae

Some studies, such as those from Cole (2003) and from Rodrigues et al. (2009), touch on this methodology in explaining a very simple formula that we can define in the following way:

Sustainable Campus Synthetic Index = $\Sigma\alpha i$ Ii where αi represents the weighting coefficient of the simple indices Ii and where i represents the simple indicator for a sustainable campus.

At this stage in the presentation of our methodology, it is useful to point out that we wished to have an index along a graduated scale 0–100. With each unweighted index being calculated against 100, multiplying by the coefficients must hold within the threshold limit. Under these conditions, each weighting coefficient will be attributed a number between 0 and 1. There are three possible solutions when faced with choosing the weighting coefficients:

- Call upon experts who will be able to define the weighting coefficients.
- Set up a participant-based approach which aims at asking staff members what they think about the choice of coefficients.
- Choose to assign identical weighting coefficients.

The first choice certainly draws from a top-down approach. At Lille Catholic University, this choice could have meant issuing a tender invitation to a consulting firm specialising in this type of

Table 4
Formulae for each indicator of sustainable campus unweighted indices relative to social equity.

Sustainable campus indicators	Unweighted index formulae
Student University medical consultations	With regard to this indicator, it is estimated that a student consults a doctor an average of once a year (excluding compulsory yearly medical examination). On this basis, the average is equal to the number of students present at ICL. We divide this number by 50, which represents 1 average point. If the total number of consultations is lower than this figure, then the institution is given a mark between 50 and 100, and if this figure is greater, then the institution is given a mark between 0 and 50. Index: 60
Proportion of students involved with environmental and humanitarian associations	It is an acknowledged fact that not all students are involved in such associations. We consider a figure of 50% to be the upper limit. Multiply this figure by 2 in order to give a score out of 100. Index: 22.
Proportion of students staying in University residence	Considering that the campus is located in an urban environment, a limit of 50% makes for an acceptable upper bound. Carry out the same procedure used for the previous index. Index: 18
Proportion of courses dealing with sustainable development and CSR	It does not appear realistic to imagine that 50% of courses are geared towards sustainable development. On this basis, 10% of the total number of courses is used for the maximum limit, and 0.1% of the total number of courses is used for an index point. Index: 40
Number of hours of sustainable development and CSR training spent on personnel	It is estimated that a staff member will carry out on average 30 h of training per year. We therefore multiply the number of staff members by 30, and we then find the ratio between the number of hours spent on sustainable development and CSR training and the figure obtained in order to reach a total percentage. Index: 4
Proportion of international students	A figure of 20% is considered to be the maximum limit. 0.2% can therefore be used as an index point. Index: 24
Number of sick days per person	It is estimated that a staff member will take a maximum of 20 days off for reasons of illness. Therefore, multiply the number of staff members by 20 in order to get the maximum number of days of absence. Divide this number by 100. The figure obtained represents 1 index point. Confidential
Portion of workers with a disability	Workers with a disability account for 6% of the total population in France. This threshold value therefore represents a mark of 100 and 0.06% represents 1 index point. Confidential
Indicator of income dispersion per capita	A standard deviation of 30% makes up an average. We can allow for a variability between ±10% from this average. Within this range, each case of 0.2% variability corresponds to an index point. Confidential
Number of hours for stakeholder meetings	If we take 200 work days as a reference point and consider that on average we organise 3 h of meeting time per day, then we get a maximum total equal to 600 h. For totals greater than this, institutions are given a mark of 100, and 6 h is used to represent an index point. Index: 66

Having shown the formulae for each indicator, we are now ready to put the final touch on our synthetic index by determining the weighting coefficients.

work, but it was dropped in light of IDDR not yet having enough in financial means. The second approach refers to the experiment attempted in the Communauté d'Agglomération d'Hénin-Carvin, an agglomeration community located in northern France. This experiment led to the creation of a participatory indicator for economic welfare or PIEW. This type of bottom-up approach required interviewing community residents and then designating coefficients for each item concerned based on the number of responses received. A description of this work can be found in Lipovac and Zuindeau's study (2008). The bottom-up approach already carried out in choosing indicators was at first the solution selected through a survey conducted with both students and teaching and administrative staff. An analysis of the responses reveals weighting discrepancies which are quite low compared to the various indicators among both students and teachers; these discrepancies do not exceed 2.5%. Given these insignificant differences and after some group discussion, it was decided to opt for the third choice, even though it may have appeared questionable at first glance; the fact remains that, since the Brundtland Commission, we must consider each sustainable development pillar as holding equal importance. From this standpoint, each should be assigned a weighting factor equal to 1/3. Following this analysis, each of the 30 indicators can be considered to be just as important as the other with regard to the issue of sustainable development. Therefore, this entails a weighting coefficient equal to 0.033333 for each unweighted indices corresponding to an indicator, as shown here in the following calculation:

$$\text{Sustainable Campus Synthetic Index}: \ 30 \times 0.03333 \times \text{unweighted index} = 100$$

Using this formula, we find for the year 2011 a sustainable campus composite indicator equal to 40.12. This can be divided respectively for each of the pillars in the following manner:

- Environmental care: 11.62 by 33.33
- Economic effectiveness: 15.38 by 33.33
- Social equity: 13.12 by 33.33

It should also be noted that for confidentiality reasons, six of the 30 indicators do not appear as unweighted indices. However, the author, having knowledge of the data necessary for their calculation, was able to provide an overall index.

4. Action plan for improving the score of certain indicators

Observing the composite indicator results and its three components shows that the Catholic Institute of Lille is required to make an effort in the coming years with regard to the issue of sustainable development. At the same time, we need to put this average result into perspective by highlighting the fact that ICL did not really get involved in activities geared towards sustainable development until 2008. Previously, this issue and the activities that arose from it were mostly unknown to most staff and students. Similarly, if we carefully observe the weight of each pillar, we find that the environmental pillar is the one that the Catholic Institute of Lille must mainly focus its activities on. With this in mind, a partnership agreement was signed between ASG (the Academic Services Group) and IDDR in May 2011 even before all the results leading to composite indicator development were known, but this left some gaps with regard to the environmental pillar. The main elements of this agreement were as follows:

- Put together and display a policy for "Sustainable Services."

- Carry out a diagnosis of existing practices; ensure consistency, enrich, enhance and display good practice.
- Extend the "Quality Approach" to integrate sustainable development objectives within ASG; switch from ISO 9001 to ISO 26000.
- Make implementation commitments through a "Sustainable Services Charter" which will then be adapted for each activity.
- Deliver technical solutions for reducing environmental and social impact (types of paint, flooring, lighting, waste recycling sector, etc.).
- Systematically try to find ways of lowering consumption in the areas of energy/fluids, purchasing, waste, etc.

5. Conclusions

Different attempts to measure sustainable development at universities through the use of existing means have for the most part been inadequate in that they only take one sustainable development pillar into consideration; this primarily being the environment pillar. To compensate for these defaults, the majority of mainly North American universities, but also those in Asia and Europe, have tried to design trend charts often made up of a large number of indicators in order to present an exhaustive outline of sustainable development (cf infra). These methods prove to be by no means insignificant in that they allow universities to measure their efforts and weak points with regard to this issue at hand. However, they also prove to have a certain number of limitations when trying to determine an overall figure which could be used for benchmarking with other similar institutions. On this basis, designing a composite indicator could offer a possible solution. The difficulty here would be firstly in choosing indicators which would be especially representative of one of the aspects of sustainable development, then in defining their adequate number before finally choosing the weighting coefficients. With regard to these coefficients, there do not appear to be any ideal answers at present. This choice involves a certain amount of subjectivity that academic works have yet to resolve. At the same time, the experiment carried out at the Catholic Institute of Lille also shows the difficulties that can be encountered on a daily basis in trying to measure sustainable development; one of the tracks that should be explored more is that of developing a sustainable development information system prior to calculating the synthetic index.

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