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university ranking**

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### Abstract

The main aim of this contribution is to investigate the possibility to include sustainability among the performance features that can be taken into consideration by university rankings. To this aim we propose a set of well-defined sustainability indicators related to different aspects of sustainability. Today the mission of a University can hardly be reduced to simply teaching and research. A University should contribute to building a new and improved society, and as such, it must be a visionary center of sustainability, innovation, and excellence, disseminating values and the well-being of society. Within this framework, sustainability has to be integrated into everyday activities.

Within the University framework sustainability is often identified with environmental sciences; on the contrary, it is a pervasive interdisciplinary issue entailing a number of different issues. While one specific university ranking (The GreenMetric) has adopted a ranking criterion fully hinging on sustainability indicators, none of the main global rankings have so far addressed the issue. Both in terms of good practice assessments, and as an important signal to the society as a whole, the introduction of sustainability in global rankings could be an important addition to the existing metrics, and a significant dimension of comparison.

Among all different aspects of sustainability, those considered here are of three different kind: the environmental (or green) sustainability; the social sustainability; the relation with the local community. Within this framework, we propose a set of sustainable indicators, deeply rooted in the relevant scientific literature, easily measurable, and sufficiently flexible, to be selectively included in different rankings.

### Keywords

Sustainability indicators, university rankings

### JEL Codes

I23, I30, Q56

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# Sustainability indicators for university ranking

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## 1. Introduction

“What does it mean to Be a World-Class University?” With such an intriguing question Jamil Salmi introduced his 2009 book [Salmi 2009]. To date, after additional six years of heated debate, the answer to this question remains elusive but it is unlikely that it will come from the world of university rankings.

Yet, university rankings have attracted increasingly attention in the last decade mainly because they have given a well-defined framework to the tendency of monitoring, assessing, and defining key performance indicators that is pervading virtually any sector of society, the world of research making no exception in this.

On the other hand, part of the picture is still missing. Indeed, while sustainability has become a more and more relevant issue for the very same characterization of a “good” society, both from a green and a social point of view, it is still widely ignored in most of the university rankings.

The main aim of this contribution is to investigate the possibility to include sustainability among the performance features that can be taken into consideration by university rankings. To this aim we propose a set of well-defined sustainability indicators related to different aspects of sustainability.

Although bibliometrics – the measurement of the quality of the research - has been around for more than 60 years by now, only in the last ten years it managed to get into the headlines, thus triggering the attention of policy makers and university administrators.

The ranking published in 2003 by the Jian Tong University in Shanghai -- the Academic Ranking of World University (ARWU), often referred to as the Shanghai ranking, stirred the fire, immediately followed by the Quacquarelli-Symond (QS) ranking, at that time in a joint effort with Times of Higher Education. While ARWU had the well-defined objective of assessing the performance of Chinese Universities with respect to the top Universities in US, and was based on very few simple numerical indicators that could reasonably easily be reproduced, the QS ranking introduced the idea of the reputational survey among academics in the world, as a proxy for the prestige of the institution. This idea, albeit appealing, is clearly antithetical to the concept of openness, transparency, and accountability that was one of the key points in the Berlin Principle of the Ranking of Higher Education Institution [Rauhvargers 2011].

Rankings are expected to reflect the institutional performance but nowadays it is plain clear that often they also affect the political and strategical decisions of university administrators, perhaps not always pushing in proper directions. Universities, however, have always been evolving over time. For more than five centuries, starting from their original establishments in medieval times, their main role was on education; to this, the idea of research was added at the beginning of the nineteenth century. In addition to these two pillars, still representing fundamental tasks, a modern XXI century university, does much more than that, and accordingly university rankings have gradually refined their analyses to reflect that, by introducing subject rankings, star systems, age dependence and so on.

Today the mission of a University can hardly be reduced to simply teaching and research. A University should contribute to building a new and improved society, and as such, it must be a visionary center of sustainability, innovation, and excellence, disseminating values and the well-being of society. Within this framework, sustainability has to be integrated into everyday activities, and it is therefore imperative to produce a holistic and systemic approach to this topic.

Sustainability is a pervasive interdisciplinary issue, and it is therefore unavoidable in the assessment and evaluation of numerous other issues. Indeed, while within the University framework sustainability is often identified with environmental sciences, it is a relevant paradigm within a number of different issues, and

even students are being increasingly exposed to interdisciplinary or trans-disciplinary approaches involving this concept [UNESCO 2002]. Sustainability is such a crucial element in our lives that it is in fact surprising that university global rankings have so far failed to take it properly into account, mirroring similar existing rankings for the quality of life in cities [Marcer 2014], even considered, for instance, by Times of Higher Education [THE 2013]. University rankings should not only be regarded as a reputational race or a measure of the strive toward excellence [Hazelkorn 2011], but also (or rather) a way to encourage universities around the world to carry out a self-assessment in relation to several quality issues, including sustainability.

While one specific university ranking– The GreenMetric (see below) – has adopted a ranking criterion fully hinging on sustainability indicators, none of the main global rankings have so far addressed the issue. Both in terms of good practice assessments, and as an important signal to the society as a whole, the introduction of sustainability in global rankings could be an important addition to the existing metrics, and a significant dimension of comparison, with multiple and far reaching benefits not only for single universities but also for the entire higher educational system.

After 10 years of life, during which global rankings have undisputably, albeit with controversial benefits, changed the perception of the university system, time has probably come to address the capability of university rankings to widen their horizons to include additional aspects, such as sustainability, which are able to provide a better description and accountability of a university as a complex system.

With the aim of filling this gap, this contribution proposes a comprehensive set of indicators aimed at measuring how sustainable a university is.

Among all different aspects of sustainability, those considered here are of three different kind:

1. the environmental (or green) sustainability;
2. the social sustainability;
3. the relation with the local community.

Within this framework, we propose a set of sustainable indicators, deeply rooted in the relevant scientific literature, easily measurable, and sufficiently flexible, to be selectively included in different rankings.

In this respect, the introduction of sustainability indicators in existing global rankings could be an important way to encourage universities to promote new models of production and consumption and to stimulate people into adopting good practices.

The contribution is organized as follows. Section 2 reviews the history and the role of university rankings. Section 3 defines what sustainability means within the context of a university, while Section 4 reviews the main features of UI GreenMetric World University Ranking. Sections 5, 6, 7 and 8 include the core of our proposal. Finally, Section 9 provides some concluding remarks.

## 2. The role of university rankings

With the proliferation of league tables and university rankings, an increasingly higher number of criticisms have been raised on the serious methodological limitations of any ranking exercise.

There is little doubt, however, that ever since the appearance of the first global university ranking in 2003, the institutional strategies and processes have witnessed a remarkable change. Every autumn, university administrators wait impatiently the last release of the most well-known global rankings to see whether they went up or down, ready to bring in the limelight any progress in any of them.

As schematically illustrated in Figure 1, we can roughly divide the “ranking age” into three different time zones. Before 2003 is the age of regional rankings. This includes for instance the US. News and World Report Best College Rankings (1983) that today ranks nearly 1800 colleges and universities, and the Center for Higher Education in Germany (1998) that today covers the German, Austrian and Dutch Universities. The second zone (2003-2010), is the age of league tables and global rankings. Unlike the previous cases, their coverage extends to the almost 18000 today world’s known universities. Because of this, they rely primarily on bibliometric indicators, reputational surveys, and other quantitative indicators that are easily accessible worldwide. This idea was challenged after 2010 with the establishment of the U-Multirank (and the companion U-Map) project, sponsored by the EU, thus opening the era of multi-dimensional rankings.

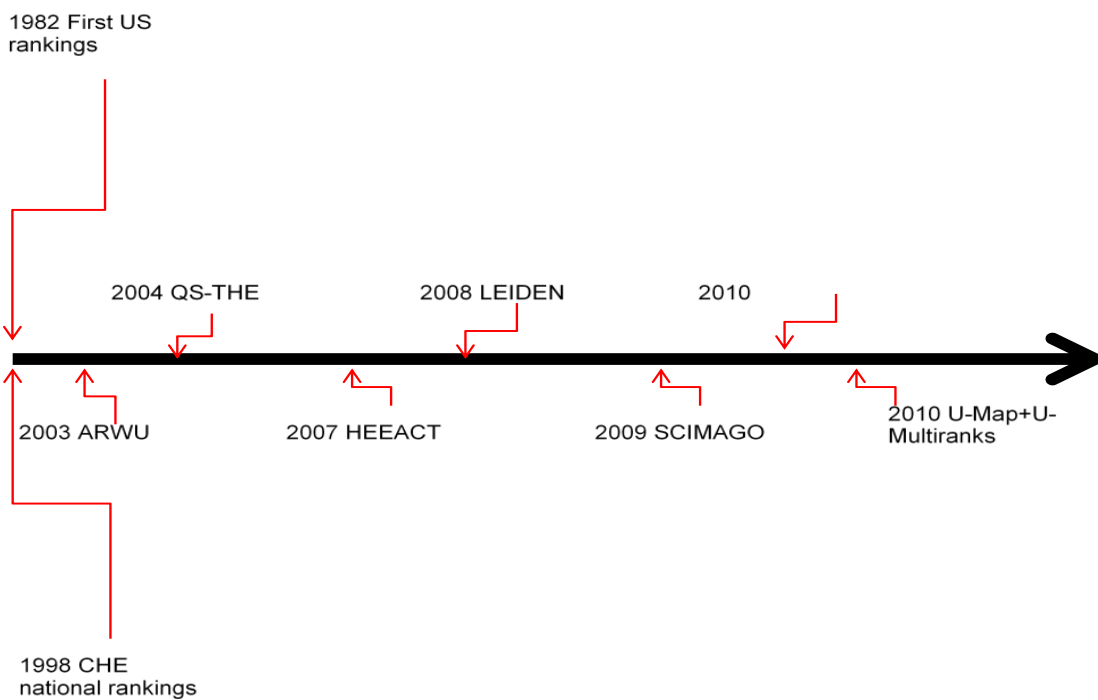
The drawbacks and shortcomings of different rankings have been discussed in some details in several studies and are by now well established [Hazelkorn 2011, Rauhvargers 2011, Rauhvargers 2013]. Many universities see such wild swings in their ranking from one year to the other that they cannot realistically reflect real changes in quality. Universities belonging to countries promoting a “World-class Universities” system (such as those in the U.S.), where the strive is to have few top-notch institutions, have a clear advantage with respect to universities belonging to countries promoting a “World-class system” based on a uniform distribution of good universities across their territories. Most European universities’ ratings suffer the presence of Research Centers where a significant fraction of the research is carried out. Non-English research languages and humanities have non-bibliometric traditions that are clearly not captured by rankings. The transparency of the data handling collecting and methodology is usually questionable, etc.

As a result, an increasingly higher number of concerns have been raised, asking that these bogus measures of scientific quality would not affect the strategic decisions taken by university administrators and funding agencies. In Europe, for instance, The European University Association (EUA) contributed to this debate through two specific publications [Rauhvargers 2011, Rauhvargers 2013] as well as by launching a specific project, the Rankings in Institutional Strategies and Processes (RISP) project [Hazelkorn et al 2014].

In general, university rankings suffer from two different, and somewhat incompatible, requests from their users. Students and policy makers would like to have something easy to read and to interpret that allow them to underpin what is good and what is not. “Who is number one?” is their most frequent query.

League tables, reducing many different proxies and indicators to a single one-dimensional list of decreasing scores, offer this possibility, and this explains why the rankings in this category are still very popular, notwithstanding their known shortcomings. The Academic Ranking of World University (ARWU), Quaquarelli-Symond (QS) ranking, the Times Higher Education (THE) ranking, the US News & World Report ranking, are among the most popular rankings belonging to this first category.

Fig. 1. The time span in evolution of the rankings age



University administrators, on the other hand, would rather know *why and on which basis* their score went up (or down) in that particular year and ranking, and this necessarily means to dwell deeply in the ranking methodologies. Multidimensional rankings hinging on the crucial idea that “There is no number one” since different universities perform differently for different indicators, are more suitable reference points for this second category of users, with U-Multirank being their ancestor and major player.

A final third category of rankings have been devised to address specific aspects of university performance. For instance, Webometric measures the web visibility and impact of the university main website, and Greenmetric addresses how the sustainability issues are dealt with in each university.

Table 1 summarizes some of the main known rankings outlined above.

Tab. 1. Typology of the most widely known rankings

Ranking	Tipology	Link
Academic Ranking of World University (ARWU Shanghai)	Global Ranking bibliometric only	<a href="http://www.shanghairanking.com/ARWU2011.html">http://www.shanghairanking.com/ARWU2011.html</a>
Quacquarelli Symonds (QS)	Global Ranking with data request	<a href="http://www.topuniversities.com/university-rankings/world-university-rankings">http://www.topuniversities.com/university-rankings/world-university-rankings</a>
Times Higher Education (THE)	Global Ranking with data request	<a href="http://www.timeshighereducation.co.uk/world-university-rankings/">http://www.timeshighereducation.co.uk/world-university-rankings/</a>
SCImago (SJR)	Global Ranking bibliometric only	<a href="http://www.scimagoir.com/">http://www.scimagoir.com/</a>
Leiden Ranking	Global Ranking bibliometric only	<a href="http://www.leidenranking.com/ranking.aspx">http://www.leidenranking.com/ranking.aspx</a>
HEEACT (Taiwan)	Global Ranking solo bibliometrico	<a href="http://ranking.heeact.edu.tw/en-us/2010/homepage/">http://ranking.heeact.edu.tw/en-us/2010/homepage/</a>
Webometrics	Global Ranking bibliometric only	<a href="http://www.webometrics.info/">http://www.webometrics.info/</a>
Global Research Benchmarking (GRBS)	Benchmarking	<a href="http://www.researchbenchmarking.org/web/guest/home">http://www.researchbenchmarking.org/web/guest/home</a>
UI Green Metric	Specific Ranking	<a href="http://greenmetric.ui.ac.id/">http://greenmetric.ui.ac.id/</a>

While the crude simplicity of one-dimensional league tables is at the basis of their success, the appearance of multi-dimensional rankings, such as the U-Multirank, has progressively found more and more followers, thus exerting an increasing pressure on the traditional “rankers”. This is one of the main reasons why essentially all global rankings have now additional tables for subjects, for regional areas, for ages etc.

Yet, quality in higher education institutions is a complex subject that can hardly be reduced to a small number of simple indicators, especially when it comes to issues where a clear-cut measure is missing. Therefore, many such issues are usually left out by the traditional rankings, in spite of their importance and far reaching consequences.

So why should we bother with sustainability?

There are many arguments that can be raised *against* this inclusion. Rankings are expected to reflect institutional performances, and not to stimulate good practices; improvements in rankings should be based on a better quality of research and not on the number of solar panels present in the campus, etc.

However, there are also many arguments *in favor* of this inclusion. In the present Chapter, we will make an attempt to address all these arguments within a unified framework.



### 3. Sustainability in university

Sustainability is for its nature an interdisciplinary and multifaceted issue. As argued in the previous sections, it is now becoming a dimension which is more and more relevant for universities and campuses, involving also different aspects in this context.

The most important universities in the world have already decided to take part in the big challenge of shaping the world for the future generations, implementing strategies and actions to protect the environment, spread human rights and promote sustainable development both locally and globally. Indeed, an increasing number of universities are committing to develop and maintain an environment that enhances human health and fosters the transition toward sustainability. It is fundamental that universities take a leading role among society about sustainability: universities need to be visionary centers of sustainability, innovation and excellence, in order to promulgate and activate the best values and health for society (see for example La Porta *et al.* (2008) and Mio (2013)).

In the last decades Higher Education Institutions (HEIs) received many inputs in terms of adoption of a sustainable approach and creation of awareness. The RIO+20 was just one of the occasions where HEIs - with the support of UNEP, UNESCO, UN Global Compact and UN PRME - committed globally to achieve some important goals regarding: teaching sustainable development concepts, research on sustainable issues, greening universities campuses, support to sustainability efforts in the communities where the universities reside (United Nations (2012)). If it's true that "what you measure is what you get", sustainability should become a core topic in the evaluation criteria of universities. Higher education has a crucial role to play in addressing these challenges and in supporting the paradigm of sustainability, and in many cases universities are leaders in this change.

This role is recognized by the civil society, and even the scientific contributions and the literature on this theme are increasing (see for example Logdson and Wood (2002), Spence and Schmidpeter (2003), Hassel *et al.* (2005)). Furthermore, international networks of universities are promoting this approach, giving tools and guidelines to help their members to integrate sustainability inside the organizations, both within their mission and within their processes.

For this reason, ranking systems, too, should include sustainability as a metric to give a real picture of what a university is and what a university does. Moreover, the introduction of sustainability indicators in global existing rankings could contribute to promote good practices and to bring benefits to the entire higher educational system. Indeed, not only rankings can give relevance to the universities deciding to take a step towards a more sustainable future, but they can also be an important tool to bring changes in the academic culture of the institutions, playing a big role in setting and sharing best practices within and outside universities. Furthermore, rankings have other positive features and effects; for example, they contribute to enhance the transparency of the institutions and to give a clear information to stakeholders.

Accountability is an essential requirement/element in university, in terms of rendering a fair picture and providing a general overview of what an institution is doing in relation to the goals that have been set, or legitimate expectations that others may have about services and processes.

The stakeholders' engagement is an important process in order to set strategy, objectives and targets. An institution such as a university has several categories of stakeholders often having antithetical expectations. An interesting example of this is the contrast between the needs of the local community and the international openness. Characterizing a university with a strong orientation to internationalization, and therefore investing resources and making efforts in this direction, may appear contradictory with the

request of being part of the local community. A University choosing to recruit non-native researchers to widen their international horizons, may face the problem of not giving sufficient perspectives to its own students, on which a significant investment was made. Conversely, if it invests on local researchers, it can be alleged of being self-referential.

Reaching a balance among different objectives, raising the awareness about sustainability, building competencies for the future: these are all additional challenges for HEIs in addition to their main goals of the creation and the dissemination of the culture. This mission relies on several delicate issues starting from the definition of what culture is, or what culture means.

Sustainability is both a short and a long term objective at the same time, but it is also an operative action that must be implemented day by day. Sustainability is not an extemporary action, but rather something that should be integrated, not only into organizations or campuses, but also within teaching and research. We need a new generation of students with strong competencies allowing them to face the challenges of the future and to convert what they have learned into proper actions and behaviors. This is an example of a long term target, because the impact of education on sustainability will be only visible after many years.

In order to build a pro-active community, it is necessary to start now from student education to respect the environment, to be sensitive to the issues of social inclusion and civil rights, and to respect all the resources of our planet.

To this aim, sustainability should not only be permeating the strategy of an institution; it should also contaminate all its activities, promote the institution to undertake initiatives for energy savings, reduction of water consumption, and so on.

Implementing sustainability in universities translates into teaching inspired by sustainability, doing research on sustainability and rethinking many activities in a more sustainable way. Unquestionably teaching and research are the core activities of an academic institution, but many actions have a great influence on both these two activities. And this is even more visible when dealing with sustainability. For instance, if a university is committed to saving energy, it will be easier for it to inspire awareness among its students about the sustainability topics.

A university asking its staff and students to recycle without having implemented a clear recycling policy itself, would not be credible and its promotional actions would be weakened by this drawback.

For all these reasons, university rankings should encourage universities around the world to carry out a self-assessment in relation to several quality issues, including sustainability.

A system of indicators plays a central role in a strategic and organizational approach to sustainability, because it allows universities to address choices, behaviors, activities and to monitor the corresponding processes.

Nowadays there are a number of different metrics, illustrated in the previous sections, to measure the efficiency, efficacy and quality of universities. And yet, none of the main global rankings have so far addressed the issue of sustainability, both in terms of good practice assessments and as an important signal to the society as a whole. Nor are even available rankings particularly focused on sustainability, the only exception being the UI GreenMetric World University Ranking. As we will see below, however, GreenMetric considers only the environmental dimension of sustainability, while we argue that sustainability is composed by at least three dimensions: the environmental, social and economic dimension.

Recently, a special impulse has been given to the third mission of the University, thus indirectly promoting institutional self-assessments on sustainable issues. This might pave the way toward the inclusion of

sustainability in all the main university activities - teaching, research but also organizational processes - giving additional reasons to include it in the definition of university rankings.

#### 4. A first ranking on sustainability: UI GreenMetric World University Ranking

The “Universitas Indonesia” was the first to decide to analyze how universities implement sustainability in their operations and for this reason it established the “UI GreenMetric World University Ranking”. Over the years the GreenMetric ranking has witnessed a growing participation by universities all over the world.

Universitas Indonesia developed this ranking in 2010 that was the first based on information provided by the universities on criteria aimed to demonstrate their commitment to become greener and more sustainable, using proxies such as green areas, energy efficiency, water use, transportation and so on.

At the very beginning, the ranking was especially focused on the sustainability of buildings and other environmental aspects, and it was difficult to compare universities of different types, such as those inside European city centers, with large university campuses characteristics of the US system.

Thanks to the feedbacks, comments and suggestions received by the first participants, Greenmetric ranking has been improved in the following years, and it takes now into account a larger number of indicators, thus providing a better measure of how the universities are committed to reduce their impact on the environment and to help promoting the awareness of the importance of sustainability issues.

The analysis carried out by GreenMetric is actually divided into six categories: setting and infrastructure, energy and climate change, waste, water, transportation, education (see Table 2).

*Tab. 2. Indicators and categories of 2015 UI GreenMetric World University Ranking*

No.	Categories and Indicators	Points	Weighting
<b>1.</b>	<b>Setting and Infrastructure (SI)</b>		<b>15%</b>
SI 1	The ratio of open space area towards total area	300	
SI 2	The ratio of open space area towards campus population	300	
SI 3	Area on campus covered in forested vegetation	200	
SI 4	Area on campus covered in planted vegetation	200	
SI 5	Area on campus covered in non-retentive surfaces	300	
SI 6	University budget for sustainable effort	200	
	<b>Total</b>	<b>1,500</b>	
<b>2.</b>	<b>Energy and Climate Change (EC)</b>		<b>21%</b>
EC 1a	Energy efficient appliances usage	200	
EC 1b	Smart building program implementation	100	
EC 2	Renewable energy usage policy	300	
EC 3	The ratio of total electricity usage towards campus population	200	
EC 4	Energy conservation program	300	
EC 5	Element of green building implementation	300	
EC 6	Climate change adaptation and mitigation program	300	

EC 7a	Greenhouse gas emission reduction policy	100	
EC 7b	Carbon footprint policy	100	
EC 7c	The ratio of total carbon footprint towards campus population	200	
	<b>Total</b>	<b>2,100</b>	
<b>3.</b>	<b>Waste (WS)</b>		<b>18%</b>
WS 1	Recycling program for university waste	300	
WS 2	Toxic waste recycling	300	
WS 3	Organic waste treatment (garbage)	300	
WS 4	Inorganic waste treatment (rubbish)	300	
WS 5	Sewerage disposal	300	
WS 6	Policy to reduce the use of paper and plastic in campus	300	
	<b>Total</b>	<b>1,800</b>	
<b>4.</b>	<b>Water (WR)</b>		<b>10%</b>
WR 1	Water conservation program	300	
WR 2	Water recycling program	300	
WR 3	The use of water efficient appliances	200	
WR 4	Treated water consumed	200	
	<b>Total</b>	<b>1,000</b>	
<b>5.</b>	<b>Transportation (TR)</b>		<b>18%</b>
TR 1	The ratio of vehicles (cars and motorcycles) towards campus population	200	
TR 2	The ratio of shuttle bus services towards campus population	200	
TR 3	The ratio of bicycles found towards campus population	200	
TR 4	Transportation policy on limiting vehicles on campus	300	
TR 5	Transportation policy on limiting parking space on campus	300	
TR 6	Campus bus services	300	
TR 7	Bicycle and pedestrian policy on campus	300	
	<b>Total</b>	<b>1,800</b>	
<b>6.</b>	<b>Education (ED)</b>		<b>18%</b>
ED 1	The ratio of sustainability courses towards total courses	300	
ED 2	The ratio of sustainability research funding towards total research funding	300	
ED 3	Sustainability publications	300	
ED 4	Sustainability events	300	
ED 5	Sustainability organizations (student)	300	
ED 6	Sustainability website	300	
	<b>Total</b>	<b>1,800</b>	
<b>TOTAL</b>		<b>10,000</b>	

GreenMetric is a convenient tool able to appreciate the efforts and the results of the environmental actions undertaken by universities. The indicators are clearly defined and there is an acceptable degree of transparency and openness. This notwithstanding, some critical points remain to be solved in order for GreenMetric to be an effective tool for University assessment.

The first problem hinges upon the differences stemming from the variety of contexts wherein universities are placed, that can hardly be reduced to a single measure applicable to all organizations. Consider water,

for instance. There is clearly a huge variety of water scarcity issues across the world and it would be quite unfair to compare organizations located where water is scarce with those where it is not.

This is a severe drawback, as the environmental indicators (in the proposed form) fail to account for the context, the characteristics of the country where the university is settled. And this bias generates an unfair evaluation about the capability of the university to tackle the crucial issues. A set of indicators on environment cannot be uninfluenced by the context where an institution is located.

It is clear that universities located in areas where the water scarcity is a big problem must address their efforts to this issue. To cope with this problem, GreenMetric attempts a normalization among universities by implementing a segmentation based on the climate zone, but it faces difficulties in providing the correct weight to the proposed action.

Universities located in city centers could be penalized by some indicators, because of the severe constraints in the implementation of actions to reduce the environmental impact through building restorations or the establishment of green spaces. For instance, in some historical cities there are no possibilities to build new and green buildings or to install solar panels, because making this kind of interventions involves important structural works in buildings that are protected by artistic restrictions. Moreover, the environmental impact can vary greatly from a climate zone to the other and this influences considerably the amount of Kw/h consumed. A similar consideration can be done also for the indicator “percentage of area covered in vegetation”, that in some scarcely populated countries is easily larger than in countries with a high population density per square kilometer, let alone the presence of a forest inside the campus.

Another weakness of GreenMetric is the absence of indicators related to the social dimension of sustainability, as well as the lack of consideration of the issue of how to engage the community in the university institution. Indeed, there are no indicators measuring the social impact and cohesion of universities, in spite of its undisputable effect on the community, even at the economical level. Another issue that should be considered is the importance of cooperation, the attitude to work with other interested parties. It is often more important to contribute to a common project rather than to be able to set up a standalone initiative.

The economic situation of a country has also a relevant impact on the achievable results of an institution. Universities in countries characterized by a low GDP per capita face clear difficulties in achieving targets that are considered basic for institutions operating in other contexts.

The cultural situation is another important element to consider and geographical areas do exist where some fundamental rights are not recognized by law or de facto. Universities in these countries have to face challenges that are completely different from those faced by universities located in developed countries.

Finally, a further issue stems from the reliability of data. Often rankings ask institutions to provide - and in some cases even to build- data without verifying their accuracy, and this can favor an unfair competition among institutions. This problem is not new, but it can be only solved by accompanying the ranking with a process of assurance.

All in all, the UI GreenMetric World University Ranking has the merit of being the first to draw the attention on the commitment of the universities to sustainability, and to propose indicators that increase the awareness of this subject, not only about its complexity, but also about its importance.

It is then important to build upon this milestone in order to have a more accurate general scheme allowing to monitor the actions and the progresses of the universities in this framework.

## 5. A new model for sustainability indicators

In the strive toward this goal, we now propose on proposing a system of measurable sustainability indicators. These indicators are similar in spirit to those appearing in Greenmetric, but are meant to be part of a global ranking. In addition, these indicators aim to measure all three aspect of sustainability, mentioned in previous section:

1. the environmental sustainability;
2. the social sustainability;
3. the relation with the local community.

This system of indicators can be used on its own, as a specialized multi-dimensional ranking specifically directed to measure the sustainability of the university in its various aspects, or it can be integrated in a global university ranking that measures all the different aspects of the university performance by aggregating the various information using appropriate weights. We will neglect the issue of possible aggregation methodologies and that of the choice of the weights, at the present stage, although such issues would not pose any fundamental difficulty.

The flexibility of our system of indicators make it easy to be incorporated within a multi-dimensional ranking such as U-Multirank.

When dealing with performance indicators, we can consider different typologies of indicators: scenario indicators, input indicators, activity indicators, output and outcome indicators (see e.g. Chiara Mio (2013)). When applied to university institutions, scenario indicators aim at representing the context of reference; input indicators take into account the various resources that a university uses for its activity; activity indicators consider the volume of the various activities, while output indicators measure the results of the activities carried out; finally, outcome indicators express the impact on stakeholders produced by the university actions.

As a matter of principle, the performance of a university should be evaluated mainly through outcome indicators. However, it is often easier to consider indicators pertaining to the other typologies and use them as proxies of outcome indicators, when these are difficult to compute. This is especially true for the sustainability issues, for which the definition of a quantitative measure often proves difficult.

Along these lines, for example, we will identify some environmental indicators that are input indicators (e.g. electricity usage) and others pertaining to the category of the activity indicators (for example, the carbon policy aiming to reducing the greenhouse gas emissions) while the main indicators of the environmental dimension are represented by input and output indicators that refer to an “environmental balance” of the organization.

As for the social sustainability dimension, for example, we focus on indicators highlighting social sustainability issues that refer to social services, integration, human rights, gender integration, policies towards international students and the university human resources.

As regards the relation with the local community, we are interested in studying indicators that refer to the connections with external and internal stakeholders, such as the local community, students and the human resources.

As argued in the previous sections, sustainability issues cannot be considered without an appropriate reference to the environmental and social context of the institution. For this reason, many of the sustainability indicators that we propose are normalized by the average values registered in the country.

For example, waste and water management can heavily depend on the environmental policy of the country in which the university is located; analogously, the features and the number of people with disability may differ according to the country. With regard to this, sometimes even the definition of a social phenomenon may have different nuances depending on the country, and in this sense, the comparison to the national average value is essential.

Within this framework, some indicators are computed as a ratio of the value observed for the university to the average national value, i.e. we measure the results obtained by the university in relation to the average outcomes of the country. Essentially, this translates into a proxy of whether and how a university manages to operate better than the country in which it is embedded, with a rewarding mechanism to promote the adoption of good practices more effectively than their national systems.

Other indicators aim at measuring the efforts undertaken or the results obtained in relation to the university size. In these cases, the size is measured, depending on the circumstances, by the number of full time equivalent (FTE) students, or the number of FTE employees (academic and administrative staff), or the total amount of the expenditures, research funds etc.

Of course, all the data will be related to the reference period considered, usually a year.

We have argued that sustainability involves various dimensions. In general, for each dimension, we first investigate whether it is tackled by the university and then we measure the efforts made and the results obtained.

The first question, therefore, is whether or not the university adopt a proper sustainability policy promoting good practices, with a binary yes or no answer.

Further issues lead to indicators trying to quantitatively measure the sustainability results obtained. To this aim, the indicators are carefully selected to evaluate, at least partly, multifaceted phenomena which are often difficult to seize and even more difficult to quantify.

## 6. Environmental indicators

The environmental problems brought about by the climate change, and the thread of a worsening of its effects in the future, are by now undeniable. Tackling these problems is a demanding challenge that cannot be ignored and will permeate the efforts of all the countries in the world in the next years. This has clearly been recognized during the 2015 United Nations Climate Change Conference (COP21) recently held in Paris.

On the other hand, the climate change is mainly affected by the huge amount of greenhouse gas emissions released in the atmosphere by the human activities all over the world. With the aim to reduce the impact of climate change, the COP21 Paris Conference gave rise to a global agreement (the so called Paris agreement) that should be adopted by all the main countries.

In response to this effort, the environmental sustainability issues have become crucial, and will be more and more in the spotlight in the next years. The main institutions of each country will necessarily have to control their environmental impact in order to reduce the overall greenhouse gas emissions, and every effort that push in this direction will need to be made.

For this reason the first set of indicators that we introduce to measure sustainability in universities concern the environmental sustainability issues.

Most of the issues considered in this respect are analogous to those tackled by the UI GreenMetric World University Ranking.

Nevertheless, as a rule, we try to focus on the most relevant aspects of the phenomena that we wish to measure, those having a greater impact on sustainability. Moreover, as discussed in the previous sections, we try to relate the measure to the value registered in the country in which the university is located.

In addition, we try to take into account the fact that the surroundings may sometimes pose binding constraints hindering more serious efforts in favor of environmental sustainability. A simple example is given by the historical buildings protected by artistic restrictions, as commonly found in many of the oldest European universities, another by the university campuses situated in the center of a crowded city which leave little room for wide green parks.

Actually, a praiseworthy behavior from a “green” point of view is not only the choice to build a campus in a green region with sustainable techniques (solar panels to produce energy internally, properly insulated to minimize the heat dispersion, etc.) but also the choice to avoid the construction of new buildings by recovering historical buildings, even if this means dealing with many constraints affecting the possibility of applying modern techniques for energy saving.

As a consequence of the diverse underlying philosophy, the system of environmental indicators that we propose in this section come out different.

The environmental indicators proposed can be grouped into 6 categories as follows, according to the environmental issues tackled:

1. impact on climate change;
2. energy consumption;
3. waste management;
4. water consumption;
5. transportation;
6. education to environmental sustainability.

These indicators will be further discussed below.

### 6.1. Impact on climate change

A first set of indicators analyze the direct and indirect impact of the university activities on the environment.

To this aim, we investigate if the university implements proper policies (carbon policy, energy certifications, CO<sub>2</sub> measurement). In addition, we also consider a measure of the greenhouse emissions due to the CO<sub>2</sub> directly and indirectly produced.

The consumption is computed per FTE student; here the number of students is used to determine the size of the university.



<b>1.1. Carbon policy: is a proper carbon policy adopted? (yes/no)</b>
<b>1.2. Energy certifications: has the university obtained one or more energy certifications? (yes/no)</b>
<b>1.3. Greenhouse emissions: are the CO<sub>2</sub> emissions measured? (yes/no)</b>
<b>1.4. Greenhouse emissions per capita: total CO<sub>2</sub> emissions divided by the number of FTE students</b>

Note that:

- The carbon policy indicator 1.1 entails the adoption of a policy aimed at monitoring the electrical and thermal consumptions.
- Indicator 1.4 is meaningful only when the CO<sub>2</sub> emissions are measured, i.e. when the answer to indicator 1.3 is “yes”.

## 6.2. Energy consumption

A second set of indicators measure the energy consumed and how sustainable the university is about the energy management.

<b>1.5. Sustainable management of buildings: percentage of buildings (measured in cubic meters) managed in an energy sustainable way on the overall extension of the university buildings not subject to legal restrictions</b>
<b>1.6. Energy consumed per capita: total number of Kw/h per FTE student</b>
<b>1.7. Sustainable energy: percentage of energy consumed that is internally produced in a sustainable way</b>
<b>1.8. Sustainable energy: percentage of energy consumed that is externally produced in a sustainable way</b>

Note that:

- The sustainable management of buildings measured by indicator 1.5 may consider different ways to reduce the electrical and thermal consumptions. It excludes from the computations the buildings that are subject to legal constraints such as territorial or artistic restrictions, since these restrictions often seriously hinder the implementation of a green energy policy.
- Indicator 1.8 measures the energy consumed that is bought from companies that guarantee that it is produced in a sustainable way, using sustainable sources.

## 6.3. Waste management

Waste management is an important environmental issue for its high impact on the “environmental consumption” of all human activities, so it is no surprise that we consider several sustainability indicators for this issue.

As previously mentioned, we try to relate the waste recycled to the national “habits” on the matter (see indicator 1.10).

As for the consumption of plastic and paper, we inquire whether the university adopts a proper policy to minimize their consumption.

In addition, we evaluate the purchases of goods and services made considering environmental criteria.

<b>1.9. Waste production per capita: total weight of the waste produced, divided by the number of FTE students</b>
<b>1.10. Unrecycled waste: per capita unrecycled waste produced in the university, divided by the per capita unrecycled waste recorded in the country</b>
<b>1.11. Internal waste recycle: percentage of waste recycled internally on the total waste produced</b>
<b>1.12. External waste recycle: percentage of waste recycled externally through a proper separate collection on the total waste produced</b>
<b>1.13. Recycle of toxic waste: percentage of toxic waste which is properly treated on the overall toxic waste produced</b>
<b>1.14. Sewage disposal: percentage of sewage which is properly treated</b>
<b>1.15. Plastic consumption: does the university implement a proper policy to reduce the consumption of plastic? (yes/no)</b>
<b>1.16. Paper consumption: does the university implement a proper policy to reduce the consumption of paper? (yes/no)</b>
<b>1.17. Green purchases: percentage of the value of the purchases of goods and services made taking environmental criteria into consideration on the total amount of purchases</b>

Note that:

- We compute the waste produced by the university per FTE student (indicator 1.9) while the unrecycled waste is compared to the national average value, thus taking into account the level of the development of the waste recycle activity in the country in which the university is located (indicator 1.10).
- We distinguish between internal and external recycle (indicators 1.11 and 1.12), but we do not separate the treatment of organic and inorganic waste.
- The recycle of toxic waste (indicator 1.13) may range from 0% (not treated at all) to 100% (all treated); it may also allow the answer “No toxic waste is produced”.
- Also the sewage disposal (indicator 1.14) may range from 0% (not treated at all) to 100% (all treated).

#### 6.4. Water consumption

As previously pointed out, the water consumption may be an important element, mainly for countries in which water is not abundant. For this reason, the water consumption is compared to the national average value in the country in which the university is located.

<b>1.18. Does the university adopt a proper policy to reduce the water consumption? (yes/no)</b>
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**1.19. Water consumed per capita: total consumption of water, divided by the number of FTE students**

**1.20. Comparison of the water consumption to the country level: per capita water consumption in the university, divided by the per capita water consumption recorded in the country**

## 6.5. Transportation

Transportation for a large number of people, such as students and workers going every day to the university, may have considerable impact on pollution. The policy undertaken with regard to transportation is therefore particularly relevant.

Sometimes, the particular location of the university may affect transportation beyond the university possibilities. For example, there are cities in which bicycles are forbidden by laws (Venice is one such city), so if one measures only the number of bicycles, then all the universities in these cities would be classified as not sustainable in spite of their efforts.

If cars increase the pollution, then what we need to measure is the availability and the use of more sustainable means of transport, such as walking, biking and public transportation (trains and buses). By considering this more general approach, all special cases due to the specificities of the university would be automatically included. If you are forbidden to use the bicycle, you can nonetheless walk or use a public transportation.

**1.21. Transportation policy: is there a policy to reduce the impact of transport on the pollution? (yes/no)**

**1.22. Ecological transport of employees: percentage of employees who use an ecological means of transport, such as public transportation, biking, or walking to reach the campus and travel inside the campus**

**1.23. Ecological transport of students: percentage of students who use an ecological means of transport, such as public transportation, biking, or walking to reach the campus and travel inside the campus**

## 6.6. Education to environmental sustainability

The educational efforts on environmental sustainability issues, towards students or the general public, as well as the research carried out on these issues, are taken into account with the following indicators.

**1.24. Does the university implement special measures in order to educate the students towards and become aware of environmental sustainability issues? (yes/no)**

**1.25. Events on environmental sustainability: number of scholarly or public events organized by the university aimed at increasing the awareness of environmental sustainability issues, divided by the number of FTE students**

**1.26. Research projects on environmental sustainability: number of research projects on**

<b>environmental sustainability issues carried out in the university, divided by the number of FTE students</b>
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<b>1.27. Research funds: percentage of the total research funds devoted to the research projects on environmental sustainability issues</b>
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## 7. Social sustainability indicators

As argued in Section 3, sustainability is a multi-focal issue and in recent years several models and definitions of this concept have been studied by scholars and considered by governments. It is widely accepted that a sustainable development involves three different aspects, related to environment, economics and social issues.

Indeed, sustainability does not only mean taking care of the well-being of our planet, but has also to do with the cultures and the communities that characterize human environment.

For instance, the Agenda proposed by the United Nations *“Transforming our world: the 2030 Agenda for Sustainable Development”* clearly affirms the need for a global “plan of action for people, planet and prosperity” (United Nations 2015)).

It is often assumed that social sustainability is linked to actions promoting social justice. On the other hand, while stating once again the relevance of these issues, the 2030 Agenda for Sustainable Development clearly states the importance also of other social issues. Some of these issues are aimed at ending poverty in all its forms (for instance, goals 1 and 2 of the 2030 Agenda), but other goals are directly or indirectly connected with the objectives of Higher Education Institutions. Among these ones, we may cite goal 4 (“Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”), goal 5 (“Achieve gender equality and empower all women and girls”) and goal 16 (“Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels”).

Hence, here we are going to consider a wide definition of social sustainability that, besides the social justice, encompasses also other human needs that are influenced by different cultures, conventions and social norms and that may vary across countries.

Many studies have addressed the concept of environmental sustainability, and in this field many indicators have been developed accordingly. On the other hand, much less attention has been devoted so far to the social dimension of sustainability, and therefore there is a need for a more rigorous approach for social sustainability. In our opinion, it is important that scholars try to develop proper social sustainability models, to help identifying the key goals of a social sustainability policy, determining the best path to achieve these goals and defining suitable indicators to measure the level of achievement of these goals.

The universities can and should play an important role in this framework, as they have an immediate impact on the present and above all the future generations. Social sustainability relates to the way the University interacts with the community in which it is located and influences the well-being of its students, faculty and staff. The University needs to be a center of innovations in sustainability practices, with the aim to improve social cohesion and promote the cultural growth of the territory.

Universities have also the key role in society to educate young people to sustainability issues and to teach them the importance to strive to make their lifestyle more sustainable. And this can be done also by showing a firsthand example of what a sustainable lifestyle is.

As we have argued in the previous sections, both the sustainability issues considered and the worth given to sustainability differ very much among countries (on this, see also the “Declaration” in the 2030 Agenda). Naturally, this is reflected in the approach to sustainability undertaken by the various universities. There are universities, mainly in Western and Northern Europe, that put emphasis on sustainability, but there are also universities that do not consider sustainability issues at all.

For this reason, some of the social sustainability indicators that we propose compare the efforts made and the results obtained by a Higher Education Institution to the average value registered in the country in which it is located. In this way, we take into account the situation of the country and the social context in which the university works, and recognize the existence of different models and tools with which a university complies.

The social sustainability indicators that we propose in order to assess the social sustainability of universities take account of three dimensions of social sustainability:

1. provisions for the basic needs of people with disability;
2. actions that reduce social bias and promote equity;
3. the promotion of the well-being and a safe and secure environment for employees;
4. the education to social sustainability.

### 7.1. Provisions for people with disability

When taking into account the provisions for people with disability, it is important to consider both physical and mental impairment and to note that disability can include a wide range of issues and conditions.

Universities are committed to break down any barriers preventing people with disabilities from participating to the life of the institution, to provide employments to qualified workers with disabilities and to help students with documented disabilities. This is what we need to measure.

<b>2.1. Is there a service for students with disability in the university? (yes/no)</b>
<b>2.2. Students with disability: percentage of FTE students with a documented disability, divided by the percentage of people with disabilities in the country</b>
<b>2.3. Services for students with disability: amount of funding resources devoted to provide services for people with disability, divided by the total income from tuition fees</b>
<b>2.4. Workers with disability: percentage of university members (faculty, technical and - administrative staff) with a documented disability, divided by the percentage of people with disabilities in the country</b>

Note that:

- We consider the percentage of people with disabilities in the country as a benchmark (indicator 2.1).
- In indicator 2.2 we may refer to a wide variety of services to assist people with disability and to ensure the rights of students with disability to higher education.

## 7.2. Overcoming social discrimination

When discussing social sustainability in a complex organization like a university, we have to consider personal issues, like income and employment, as well as community and interpersonal issues like democracy, gender and racial equity and the policy toward international students.

<b>2.5. Financial aid: total amount of financial aids granted (such as scholarships and total or partial tax relieves for university tuition fees), divided by the total income for tuition fees paid by students</b>
<b>2.6. Incoming international students: percentage of FTE incoming international students on the total number of FTE students</b>
<b>2.7. Total amount of funds devoted to international students with respect to the total income for tuition fees relative to international students</b>
<b>2.8. Is there an Office (ethical committee or similar) for Diversity, Equity and Inclusion in the university? (yes/no)</b>
<b>2.9. Total amount paid by the university for actions against discrimination with respect to the total income for tuition fees paid by students</b>
<b>2.10. Purchases respecting human rights: percentage of the value of the purchases of goods and services from suppliers that adopt a proper policy to ensure the respect of human rights on the total amount of purchases</b>

Note that:

- In indicator 2.5 we refer to activities that promote the right to attain a high level of education for deserving students lacking financial resources. We consider the financial aids granted on the basis of academic merit and/or financial needs.
- In indicator 2.6 we consider both enrolled international student and non-degree seeking students.
- Indicator 2.7 computes funding devoted to actions that support international students, namely financial aids such as exemptions or reductions of tuition fees, and to welcome actions. We consider the total amount devoted to FTE international students with respect to the total income for tuition fees relative to international students (full student rate multiplied by the number of FTE international students).
- In indicator 2.9 we refer to discriminations on the basis of race, color, religion, gender identity and national origin. Note that we consider the number and the importance of the initiatives with respect to the size of the institution.
- Indicator 2.10 identifies suppliers that contribute, for example, to the effective abolition of child labor and ensure the respect of labor rights in general.

## 7.3. Employment and labor practices

A University committed to sustainability should enhance the institution's human capital and in particular should undertake and support actions that reduce the gender bias, promote gender equality and favors the career progressions of women.

<b>2.11. Female staff: percentage of female administrative and technical staff</b>
<b>2.12. Female faculty: percentage of female faculty</b>
<b>2.13. Female in governance: percentage of women that are members of the university governing bodies</b>
<b>2.14. Career progressions: percentage of staff carrier progressions with respect to the total number of employees per year</b>
<b>2.15. Training: average training time per FTE employee in administrative and technical staff</b>

All these indicators are evaluated per FTE worker.

#### 7.4. Education for social sustainability

A University committed to sustainability should educate students to understand and avoid discriminations and social inequalities.

<b>1.1. Student education for social sustainability: does the university implement special measures in order to educate the students towards and become aware of social sustainability issues? (yes/no)</b>
<b>1.2. Events promoting social sustainability: number of scholarly or public events organized by the university aimed at increasing the awareness of social sustainability issues, divided by the number of FTE students</b>

### 8. Indicators for the relation with the local community

Higher Education has become highly relevant in the processes of social and economic development of a region, and the regional engagement is now considered an important part of the mission of a University (the “third mission”).

Indeed, even if the importance of the regional engagement of universities has only recently being fully recognized, there is a growing interest in favor of universities’ engagement with their own communities in many regions across the world; for a discussion of the centrality of community engagement of universities and its composite nature see for example Fitzgerald *et al.* (2012).

There are many ways in which universities can contribute to the development of a strategy for regional growth and sustainable development and the debate on how to consider and evaluate the activities of community engagement is far from being settled.

In the first place, the university’s social, civic and regional engagement can improve teaching and give students the opportunities to serve while they are learning. In the second place, it can significantly improve the conditions of local communities and enable researchers to influence the social changes.

With regard to this, we are interested in studying indicators that consider the actions in favor of external and internal stakeholders, such as students, the university human resources and the local community.

Global university rankings play an important role in recognizing excellence and quality of universities and should pay attention to the different missions of higher education, such as the engagement with the local community. Currently, global rankings consider research reputation and productivity, while paying little attention to other key missions. There are universities whose focus is on education and on the social and civic engagement rather than research, and therefore it seems appropriate to incorporate also indicators of regional engagement into the overall rankings.

On the other hand, U-Multirank considers five performance dimensions to compare institutional performance, and the regional engagement is one of the areas considered. Among the indicators we propose in the following list, therefore, we find also some of the indicators of U-Multirank.

We may group the indicators that study the relation with the local community in three:

1. the relationship of the university research with industry and with the local community;
2. the connections of the students to the local labor market;
3. the initiatives in favor of the local community.

### 8.1. Research relationship with industry and local environment

<b>3.1. External research revenues: percentage of external research revenues that comes from regional sources, such as industry or private organizations</b>
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<b>3.2. Research projects with local organizations: percentage of research projects carried out in cooperation with local organizations or industries on the total number of research projects</b>
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Note that indicator 3.1 evaluates the external research income while indicator 3.2 considers the number of external projects.

### 8.2. Connections of students to the local labor market

<b>3.3. Local internships: percentage of students who do an internship in a company or organization located in the region on the total number of students internships</b>
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<b>3.4. Graduates' first job: percentage of (bachelor and master) graduates who find their first job in the region where the university is located on the total number of graduates, computed in a reference period of 1, 3 and 5 years</b>
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### 8.3. Initiatives for the local community

<b>3.5. Initiatives for the local community: total number of social and cultural initiatives in favor of the local community, divided by the number of FTE students.</b>
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## 9. Concluding remarks

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”: this definition, given by Brundtland Report (1987), is the best-known definition of sustainable development.

In the recent years, many organizations have started to consider sustainability issues and environmental and social factors, and now sustainability is a key factor for evaluating companies. There are widely used indices, such as the Dow Jones Sustainability Indices, that track the performance of companies in terms of economic, environmental and social criteria.

It is important to note that sustainability is an interdisciplinary issue and that it cannot be considered as isolated; quite on the contrary, it is necessary to integrate it with the assessment and the evaluation of the other pertinent issues. From another point of view, sustainability issues cannot be ignored when evaluating the performance of a company.

Focusing on university institutions, they not only have a direct environmental and social impact on society, but they also have a social responsibility and a central role in the diffusion of the principles of sustainable development. Hence, the role of universities with respect to sustainability is especially important. And this is true not only for the impact of sustainability on teaching and research, but also for the strong link with the social and economic environment. When evaluating the performance of a university, therefore, it would be of paramount importance to be able to consider, besides the impact of educational and research activities, that of sustainability.

Sustainability is an issue involving our investment in future generations. As such, it should be cherished in all issues related to our society. Universities throughout the world are working harder and harder to make their campuses and their buildings more sustainable, but so far there is no way to measure the impact of all these actions. UI World GreenMetric University Ranking was launched in 2010 as a first step to cope with this problem, and an attempt to provide a useful tool to assess the outcome of these endeavors. While certainly successful in this respect, with the implementation of a robust and well devised set of measurable indicators for the impact on the environment, GreenMetric has however fallen short in other important aspects. A sustainable University is not only a Green University. It means to have a holistic approach combining environmental indicators such as waste management, energy consumption and carbon policy, with social sustainability indicators assessing the attempts to overcome social discriminations, to favor gender balance, to implement good practices in labor and good employer practices, as well as to stimulate student involvement in the campus and university life. This Chapter is, to the best of our knowledge, the first attempt in proposing such a holistic approach not as a specialized ranking, as in the case of GreenMetric, but as a part of a general philosophy of ranking, as one of the many aspects involved in such a complex organism named University.

It is often said that rankings are here to stay. So is sustainability. Let them be combined as a strive toward a better society for future generations.

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