

UNIVERSIDAD SAN FRANCISCO DE QUITO USFQ

Colegio de Ciencias Biológicas y Ambientales

**Análisis de tres métodos de evaluación de sostenibilidad
para la USFQ
Proyecto de investigación**

María Emilia Meneses Reyes

Biología

Trabajo de titulación presentado como requisito
para la obtención del título de
Licenciada en Biología

Quito, 19 de diciembre de 2017

UNIVERSIDAD SAN FRANCISCO DE QUITO USFQ
COLEGIO DE CIENCIAS BIOLÓGICAS Y AMBIENTALES

**HOJA DE CALIFICACIÓN
DE TRABAJO DE TITULACIÓN**

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María Emilia Meneses Reyes

Calificación:

Nombre del profesor, Título académico

Melanie Valencia , MPH

Firma del profesor

Quito, 19 de diciembre de 2017

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Firma del estudiante:

Nombres y apellidos:

María Emilia Meneses Reyes

Código:

00112246

Cédula de Identidad:

1714156542

Lugar y fecha:

Quito, 19 de diciembre de 2017

RESUMEN

La sustentabilidad y el desarrollo sostenible son dos factores que se están introduciendo en distintas instituciones para lograr, a nivel global, mantener las prácticas dentro de los límites planetarios. Las universidades son entes modelos en la sociedad, razón por la que comprenden un eje importante en el desarrollo de la sostenibilidad a nivel tanto local como regional. Para poder mejorar el desempeño sostenible de una universidad, es necesario evaluarla y conseguir una línea base a partir de la cual se pueda ejercer cambios positivos. En la presente investigación, se evaluó tres métodos de medición de sustentabilidad, y se los aplicó a la Universidad San Francisco de Quito. Cada método tiene un enfoque distinto de la sustentabilidad, razón por la que se puede evaluar la sustentabilidad de la universidad desde diversas perspectivas. Una vez realizadas las respectivas evaluaciones, fue factible distinguir varios puntos críticos en cuanto al nivel de sustentabilidad. Entre los principales factores que se deben mejorar son: presupuesto para sustentabilidad, aparatos energéticos e hidráulicos eficientes, programas de conservación y reciclaje de agua, desarrollo de políticas ambientales.

Palabras clave: Límites planetarios, Sustentabilidad, Métodos de evaluación, USFQ, Ecoeficiencia, Políticas ambientales

ABSTRACT

Sustainability and sustainable development are two factors that are being introduced in institutions in order to maintain their practices within planetary boundaries. Universities are role models in society; therefore, they are key for developing sustainability. In order to improve the sustainability performance, it was made a baseline. In the present report, there were evaluated three sustainability frameworks, which later assessed USFQ's performance. Each framework had a different sustainability approach; therefore the university was evaluated from many perspectives. Once the frameworks were applied, it was observed the sustainability performance of USFQ. Among the main factors that must improve are: sustainability budget, efficient appliances, water conservation and recycling programs, and development of sustainable planning.

Key Works: Planetary boundaries, sustainability, sustainability frameworks, USFQ, eco-efficiency, sustainable planning

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1 INTRODUCTION

Sustainable development, defined as development that meets the needs of the present generations without compromising the ability of future generations to meet their needs and aspirations” (Brundtland, 1987), is one of the major challenges that societies face today. The present economic and social systems are based in a consumer mentality, meaning that they want to satisfy all their needs in the present, without taking into account the needs of the future generations (Goodland, 1995). Behind this mentality, there are several results and interests that are fed by the same. For example, society, or the market, has the mentality of satisfying their needs as soon as possible. For satisfying their needs, natural resources must be used, such as forests, water, oil and minerals, among others. Also, in order to supply those needs, different industrial processes must be executed, which of course emit pollutants into the atmosphere, or contaminate water bodies (Goodland, 1995). According to Steffen and Rockstrom, when human activity has achieved the tipping or critical points, known as planetary boundaries, there will be a risk of abrupt and irreversible environmental change. Therefore, they wanted to establish a safe operating space for humanity for the international community, including all the relevant stakeholders. As long as those planetary boundaries are not crossed, humans are in a safe zone. Nevertheless, till 2017, two of those planetary boundaries have been crossed, and the other boundaries are in critical and endangered conditions (Steffen, 2012). As a consequence, if we do not make any drastic change in the present, future generations will receive all the consequences of our current mentality and social and economic systems (Goodland, 1995).

A concise and real alternative to the aforementioned problems is sustainable development. It definitely is not the panacea for the problem, but might be a significant tool, that if used correctly, might somehow mitigate or help reduce the consequences that have already began to arise from our actions. The idea of sustainable development has been thought and expressed in several conferences and in different years: Stockholm conference 1972, Environment and Development Conference in Rio de Janeiro 1992, Agenda 21, Sustainable Development Declaration of Johannesburg, among the principals (Bell, 2011), Nevertheless, the current definition of sustainable development being applied nowadays, is based in the Brundtland Report, released in 1987 after the United Nations World Commission on Environment and Development, created during the United Nations assembly in 1983 (Brundtland, 1987). The traditional development paradigm is based on social and economical growth, without taking into consideration environmental sustainability (Bell, 2011). Environmental sustainability refers to the insurance of human welfare by protecting the sources of raw material needed by humans, and ensuring that sinks for human wastes do not exceed (Carrying capacity) (Goodland, 1995). Therefore, sustainable development refers to the kind of development that takes into account the three types of sustainability, economical, social and environmental, and seeks overall a genuine human welfare. (Goodland, 1995)

In order to ensure the rethinking and practice of Sustainable Development in the world, there was an important meeting of the United Nations General Assembly in September 2015, which formally adopted the universal, integrated and transformative 2030 Agenda of Sustainable Development. This agenda comprises a set of 17 Sustainable Development Goals, which must be accomplished by all the countries in a period of time from 2016 to 2030. These goals are based in the three pillars of Sustainable Development, which are the economic, social and environmental capital. Among the goals proposed in the Agenda, there

are: ending poverty and hunger, improving health system, developing more sustainable cities, fighting and adapting to climate change, protecting oceans, rivers and forests. The present paper refers directly or indirectly to all the purposes previously mentioned, nevertheless, it will focus heavily in goal number 4, quality education. Within quality education, it will focus mainly in target 4,7, that mentions the following: “by 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture’s contribution to sustainable development (Kutesa, 2015).



Graph 1. Sustainable Development Goals (Kutesa, 2015)

Sustainable education pursuit is a key element for being able to achieve Sustainable Development. In fact, the United Nations established the period of 2005 to 2014 as the period of Sustainable Education, therefore, implementing the values, principles and practices of sustainability in the whole education system (Yarime, 2012). It is in the hands of universities to collaborate with a sustainable future, because they prepare a lot of pre-professionals who will be important actors in the transformation of society to a sustainable future. Therefore, universities have a moral responsibility to create internal environment of awareness, knowledge, skills and values essential to creating a real sustainable future. “Higher education can serve as a model of sustainability by fully integrating all aspects of campus life” (Cortese, 2003).

Sustainability, when applied to Higher Education Institutions, makes reference to the activities performed by it, which must be ecologically sound, economic viable and socially integrating and just, and will continue existing for the future generations (Araujo, 2016).

Students are influenced in many ways by their particular universities, taking into account factors such as the curricula, research, operation, and engagement activities with society, among others. All these factors can define the profile of the graduates, and as a matter of fact direct their mentality and future actions (Gomez, 2014). Other reasons why Higher Education is a key factor in Sustainable Development is the powerful impact of the image of universities on societies (serving as role models), the several professional researchers involved in the topic, the availability of high quality research facilities, and the real environmental impact cause by universities if they do not practice correctly sustainable development. As a matter of fact, universities have the opportunity of raising awareness of the sustainable practices through their scholarly and public discourse (Yarime, 2012). Therefore, taking into account the importance of universities leading with Sustainable Development, according to the mandate, the integrations of sustainability must be included among the areas of education, research, operations and assessment (Araujo, 2016).

In order to be a key influence of sustainable development, it is clear that universities and colleges must put it into practice. But it must be taken into account that applying sustainable development into all the areas of the campus is not a simple process, instead, it is a complex one, but if it is carried correctly, the results will be really beneficial and will have the sustainable impact in society that is the purpose of its application. For being able to track the sustainability process carried by the high education institutions, there are several tools, which collaborate assessing their progress, which are known as Sustainability assessment tool (SAT). An important characteristic related to sustainable development of these tools is that their creation signifies a radical innovation rethinking in the university, with their internal organization and operation as well as with the relation and interaction with the external stakeholders (Ferres et. al, 2008). The creation and implementation of the tools is very important because it influences many key areas of the university, such as administration, education and research, public engagement, and of course operations. Therefore, most of the SAT that have been created focus primarily in those areas of the universities,. Along history, there several SAT have been created, in different years and different countries. Examples of SAT created are AISHE, AUA, Green League, Green Plan, USAT, Green Metrics and STARS. Those frameworks tools main purpose is to assess sustainability in Higher Education Institutions (HEI), but they develop de assessment with different criteria, depth, indicators, and geographical specialization, among others (Gomez, 2014). In the present essay, three different SAT will be analyzed: Green Metrics, STARS and ARIUSA. These three assessment tools measure sustainability, but they vary in the accreditation form, the indicators they are based on, whether they are local or global, among other variables. Therefore, they will be analyzed and will evaluate Universidad San Francisco de Quito. In the following paragraphs, each SAT selected for the assessment comparison will be described.

STARS or sustainability Tracking, Assessment and Rating system is an initiative of AASHE (Association for Advancement of Sustainability in Higher Education). It is a voluntary, self-reporting framework for helping HEI to track and measure their sustainability progress. The main objective of this SAT is to provide a framework to understand, apply and measure sustainability in all the areas of higher education. Therefore, it enables comparisons inside and outside universities, along time, taking into account the same set of measurements among the whole community. It also creates incentives to continue with sustainable development inside and outside the institutions. It facilitates information to the community about the development of sustainability practices and performances inside institutions, and it builds an important, strong and influential sustainability community worldwide. The

applicant institutions earn points in order to achieve certain recognition in the accreditation system. The accreditation system is based on certain indicators and criteria of the Higher Education Institutions (HEI), such as Operations, Planning and Administration, Academics and Engagement. Therefore, STARS divides the assessment in 3 main categories, 17 sub-categories and covers a total of 67 indicators (AASHE, 2015)

Green Metrics, developed by Universitas Indonesia, is a reporting framework that measures campus sustainability efforts. It aims to portray sustainability programs and policies in universities around the world. The main objectives of this ranking is to be able to contribute in the academic discourse and conferences about greening universities worldwide, promote social change towards sustainability through the leadership of universities, being a tool for self-assessment on campus of HEI around the world, and finally to inform governments, national and international environmental agencies, and of course society about the programs and practices of sustainability pursued in HEIs (Green Metrics, 2016). The three main aspects of sustainable development are taken into account; these are Environment, Economics and Society. Inside the environmental aspect, natural resource use, environmental management, and pollution prevention are taken into account. In the social aspect there is education, community and social involvement. And finally in the economic aspect there is profit and cost saving. Therefore, in particular, the actual survey focuses in the specific aspects of: setting and infrastructure, energy and climate, waste, water, transportation and education. Within these general aspects, there are 34 indicators, which will be indicated and evaluated in the next sections. It is important to mention that this SAT has an extraordinary focus in eco-efficiency, but might fail in measuring other important area to sustainability (*Gomez, 2014*)

And the third assessment framework that will be evaluated is ARIUSA. ARIUSA (Alianza de Redes Iberoamericana de Universidades por la Sustentabilidad y el Ambiente), is a network of university environmental networks, whose purpose is to apply a survey for national and regional environmental diagnostics. Currently, ARIUSA includes 22 university networks, among which are located in Spain, Portugal, and 13 countries of Latin America and the Caribbean. The questions in the survey are related to government and environmental participation, teaching and environmental training, technology and environmental research, environmental projection and environmental management. The central objective of the assessment is to learn about the advances made in the institutional process of environmental commitment of universities in Latin America and the Caribbean. Therefore, the program wants to know the principal decisions taken in environmental or sustainability aspects that have been taken in the directive level of the universities. The survey has been written in a way that functions as a guide for HEI to assess their institutional environmental commitment, and from the identified weaknesses, to formulate plans of improvements towards sustainability (ARIUSA, 2015).

2 THEME DEVELOPMENT

2.1 *Green Metrics*

Green Metrics is a Sustainability Assessment Tool (SAT) that was born as an alternative to the standard SATs. Standard SAT generally assess sustainability of a university, and qualify it, for example with an A B C system. Green metrics goes beyond the process. It assesses sustainability in a ranking mode. First, they collect numeric data related to sustainable practices from all the universities participating. Then, this data is processed in order to get a single score, which is a reflection of the efforts made by all universities in order to achieve environmental friendly practices and policies. Once they have this score, all the universities are ranked. The ranking is well rounded, because it does not only take into account sustainability as a whole, rather it ranks between the different indicators and areas of sustainability. Therefore, GM is a comparison between the universities that are participating, taking into account their environmental practices and policies. The aim of GM as a ranking is to guide university leaders to act upon the results, therefore they will be able to apply eco –friendly policies and manage changes in behavior among the internal community and the institution as a whole. Apart from university leaders, this ranking aims to affect all stakeholders, as a matter of fact, they all help implement eco friendly practices and provide more resources and concern to topics such as global warming, energy and water conservation, recycling, green transport, among others. In order to obtain the score, universities are evaluated within six categories, which are: setting and infrastructure, energy and climate change, waste, water, transportation and education.

Each category has a different percentage in order to calculate the final score for sustainability assessment for each university and different indicators related to the category topic. For example, the percentages for the categories are as following: setting and infrastructure 15%, Energy and climate change 21%, 18 % waste, 10% water, 18 % transportation and 18 % education, adding a total of 10000 points distributed among the categories. The final score for each university is calculated taking into account the level of accomplishment for all the indicators and the percentage each category has in relation to the whole ranking. The aim of the ranking is to qualify the efforts made by the universities into sustainability development. Therefore, each category aims, in a different aspect of sustainability, to improve the practices and behavior of people and institution as a whole in consideration to eco friendly practices. In the following paragraphs, the objective of assessing each category will be described, and the indicators that are evaluated within each (Green Metrics, 2016).

The first category that is assessed in the ranking of Green Metrics is Settings and Infrastructure. The information collected in this section will offer basic information about the university policy applied to achieve a green environment. It also shows if the university campus deserves to be considered a green campus. As mentioned before, the goal of Green Metrics is to measure the efforts made by the university to achieve a certain level of sustainability, and to keep improving. Therefore, the aim of the present category is to encourage the universities to provide a larger space for green zones, protect the environment, as well as developing projects that provide sustainable energy. The indicators and criteria used to evaluate this category are the following: the ratio of open space area towards the total area, the ratio of open space area towards campus population, the area of the campus covered in forested vegetation, area on campus covered in planted vegetation, area on campus for water absorbance, and the university budget destined to sustainability effort. As mentioned

before, this category has a weight percentage of 15%, and a total of 1500 points distributed among the indicators presented. Indicators 1, 2 and 5 have a weight of 300 points, while indicators 4 and 6, 200 points. It is only necessary to provide the information in order to receive those points. For this category, in order to obtain the score, it is necessary to add the points reserved to each indicator, and that will be 15% of the final sustainability assessment score (Green Metrics, 2016). An example is shown in Graph 2. The following category is Energy and Climate Change.

No	Criteria and Indicators	Points	Score	Weighting
1	Setting and Infrastructure (SI)^s			15%
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 for water absorbance	300		
SI 6	University budget for sustainable effort	200		
	Total	1500		

Graph 2. Methods for measuring Indicators of Category 1 (Green Metrics, 2016)

The category of Energy and Climate Change has the highest weight in the final score, representing a 21% of it. The purpose of this category is to boost the effort of universities towards energy efficient appliances and buildings as well as the reduction of the carbon footprint provided by all the activities that are behind it, such as energy use, transport, among others. The main indicators and criteria inside this category are: energy efficient appliances usage, smart building implementation, renewable energy usage, ration of total electricity usage towards campus population, ration of renewable energy produce towards energy usage, element of green building implementation, greenhouse gas emission reduction program, and ration of total carbon footprint towards campus population. The total points provided by this category are 2100, and as mentioned before, the percentage of the total score of the present section is of 21%. The way in which they grade these indicators is reasonable and simple. According to the level of implementation of each indicator, they will multiply the points awarded to each indicator by the percentage of implementation (Green Metrics, 2016). In Graph 3 there is a practical example:

EC 5	The ratio of renewable energy produce towards energy usage	200
	None	0
	Less than 20%	0.15×200
	20% - 40%	0.25×200
	40% - 60%	0.50×200
	60% - 80%	0.75×200
	80% - 100%	200

Graph 3. Method for measuring indicators of Category 3 (Green Metrics, 2016)

The following category is Waste. The Waste Category is a really important factor concerning environmental sustainability, because the programs and attitudes of people towards the waste generated has a direct influence in the overall sustainability practices of the university. Therefore, this category has a weight percentage of 18% and a total of 1800 points. Among the indicators within this category are: Program to reduce the use of paper and plastic in campus, recycling program for university waste, toxic waste handled, organic waste treatment, inorganic waste treatment and sewerage disposal. The way in which they calculate the score of this section is similar to the method used in the Energy and Climate Change category. Therefore, they multiply the points of each indicator by the percentage of implementation of the indicator (Green Metrics, 2016).

The following category is Water, with a weight percentage of 10% and a total of 1000 points. The purpose of this category is to reduce the usage of water in the university buildings and develop awareness in the consumers. Therefore, the indicators within this category are: water conservation program, water recycling program, use of water efficient appliances and treated water consumed. The method of calculating the points is exactly as the one used in Categories 2 and 3. In Graph 4 there is the method used.

Water (WR)		300	10%
WR 1	Water conservation program∞	300	
	None		0
	Program in preparation (e.g. Feasibility Study and promotion)		0.15×300
	Program in initial implementation (e.g. initial measurement of potential water conserved)		0.25×300
	Implemented in Rain Harvesting System		0.25×300
	Implemented in Ground Water Tank		0.25×300
	Implemented in Lake or Pond		0.25×300

Graph 4. Method for measuring Indicators of Category 4 (Green Metrics, 2016)

Category 5 is Transportation, with a percentage weight of 18% and a total of 1800 points. The transport sector is an important source of emission of pollutants to the atmosphere, according to the United States Environmental Protection Agency; it represents a 14% of the total worldwide Greenhouse Gas emissions (2015). Therefore these category aims to reduce the emission of pollutants generated by the transport sector, and boost more ecological solutions such as the use of bicycles, shuttle service, pedestrian ways, among others. Therefore, the indicators measured in this category are: the ratio of vehicles that go to the campus daily, the ration of campus bus services towards campus population, the ration of bicycles towards campus population, parking area type, initiatives to decrease private vehicles, parking area reduction programs, campus bus services and bicycle and pedestrian policy on campus. The points awarded to each indicator are calculated in the same way as Categories 2,3 and 4 (Green Metrics, 2016).

The last category in the ranking is Education. It has a percentage weight of 18% and a total of 1800 points. Education is a really important issue concerning sustainability, because the present and future generations will be influenced by it, and the sustainability impacts will be evident if the proper concern has been imparted to students (Cortese, 2003). The indicators measured in the category are: the ration of sustainability courses towards total courses, the ration of sustainability research funding towards total research funding, sustainability publications, sustainability events, sustainability student organizations and sustainability website. The way in which the indicators are measured is the same as category 1, so the points are awarded for the sake of providing the information required (Green Metrics, 2016).

2.2 STARS

STARS is a sustainability framework intended not just to measure sustainability in all the sectors of Higher Education institutions, but also to provide comparisons among universities and their sustainability performance, create certain incentives in order to achieve greater levels of sustainability, facilitate the information about sustainable practices of universities to the public in general, and to create a strong sustainable community which will be responsible for the development of sustainability in society in the future. Therefore, STARS has purposes beyond just assessing sustainability, but it is a way in which sustainability will be settled in society through several channels (STARS, 2017). This is really important and transcendental because in order to make a real change and impact in the environment, one must not only focus on higher education institutions indoors, rather, the practices and information must be spread as wide as possible to citizens, societies, businesses and government (STARS, 2017).

STARS evaluates universities and HEI in four main categories: Academics, Engagement, Operations and Planning and Administration. It has a bonus category that is Innovation and Leadership. Each category is based in different criteria and has several indicators within; therefore, the number of points awarded to each category is different. Among the main considerations taken into account in order to award the respective points to the indicators are: to what extent does the accomplishment of the category assures that the university community will have the knowledge and skills to solve sustainability challenges? To what extent does the accomplishment of the category will there be a real and significant impact in environmental, social and economic issues? To what extent does the achievement of the category will help mitigate negative environmental and ecological impact? Therefore, taking into account the magnitude of the scope of each category, either in the environmental, social or environmental area, it receives a representative score depending of the impact of each category and indicator (STARS, 2017).

As mentioned before, the four categories assessed by STARS are Academics, Engagement, Operations, Planning and Administration, and Innovation and Leadership. Depending on the total number of points awarded to each category, the institution will receive a rating correspondent to the score. For example, the minimum score required to be taken into account is 25 points or higher, and if the institution got it, its rating will be Bronze. If the institution got 45 points, it has Silver rating, with 65 point, it will have a Gold rating, and finally with 85 or more, it will be a Platinum institution. Now that this issue has been clarified, the different indicators found in each category will be analyzed, the points they are awarded if accomplished, and the way in which those points are awarded respectively (STARS, 2017).

STARS Rating	Minimum score required
Bronze	25
Silver	45
Gold	65
Platinum	85

Graph 5. STARS rating (STARS, 2017)



Graph 6. STARS rating (STARS, 2017)

Before assessing the categories which evaluate sustainability, STARS has a section named Institutional Characteristics whose purpose is to put into context the university in order to later interpret the data provided based on the context. This section takes into account the Institutional Boundary, Operational Characteristics and Academics and Demographics. Institutional boundary refers to the characteristics of the main campus and of all the campus and properties owned by the university, such as institution type, institutional control and main features of the campuses. The section on Operational Characteristics has variables that provide information about the context in which the university operates. Examples of these characteristics are total superficial area, climate zone, locale, area for laboratories, area for health space institutes, area constructed with buildings, area for premises such as stores and restaurants, among others. Finally there is the section on Academics and Demographics, which includes aspects such as the number of academic schools inside university, number of enrolled students, number of faculty members working at university, among others. With all these variables, the rest of the assessment will be evaluated in a proper context according to these descriptions (STARS, 2017).

The first category assessed is Academics, which has two subcategories that are: Curriculum and Research. Curriculum weighs a total of 40 points available, while Research has 18 points available. Within Curriculum there are 8 indicators which are: Academic Courses, Learning Outcomes, Undergraduate Program, Graduate Program, Immersive Experience, Sustainability Literacy Assessment, Incentives for Developing Courses and Campus as a Living Laboratory. Research has three indicators that are Research, Scholarship Support for research and open access to research. The first indicator, Academic Courses, has a weight of 14 points, and refers to the number of sustainability courses and courses that include sustainability provided by the university. The evaluation of this section is relevant as the provision of information and skills will plant the idea of sustainability and students will probably apply it in their professional future. Undergraduate and graduate programs are indicators that assess universities if they have those programs exclusively related to sustainability, they are worth 3 points each. The indicator of immersive experience relates if there are opportunities to pursue internships or study abroad programs as the knowledge and skills of sustainability go deeper in the students (STARS, 2017). Other credit within this category is Campus as Living Laboratory, which has a total score of 4 points. This indicator evaluates those institutions that use their infrastructure and operations as living environmental laboratories, meaning that the community can learn and apply research about sustainability taking into account the example shown by the university. Therefore, Living Laboratories are

a type of concept in which academics and facilities management are mixed, in order to provide students with knowledge and skills to manage sustainability inside university and in their professional future. Within living laboratories, there are several areas where universities can apply the concept, such as air and climate, transportation, waste management, water, energy, among others (STARS, 2017).

ACADEMICS (AC)			
	AC 1	Academic Courses	14
	AC 2	Learning Outcomes*	8
	AC 3	Undergraduate Program*	3
Curriculum 40 points available	AC 4	Graduate Program*	3
	AC 5	Immersive Experience*	2
	AC 6	Sustainability Literacy Assessment	4
	AC 7	Incentives for Developing Courses	2
	AC 8	Campus as a Living Laboratory*	4
Research 18 points available	AC 9	Research and Scholarship*	12
	AC 10	Support for Research*	4
	AC 11	Open Access to Research*	2

Graph 7. STARS`table of credits, category Academics (STARS, 2017)

The second category is Engagement, which encompasses two subcategories: campus engagement and public engagement. The aim of this category is to recognize those universities that promote extracurricular activities related to sustainability; therefore students can deepen and broaden their knowledge and skills. Apart from students, the category attempts to recognize universities that enhance faculty people to be involved in a sustainable environment, through various methods such as trainings, tools, motivation, and knowledge, among others. The first one has 21 points available and the second 20 points. The indicators within these categories are shown in Graph 8. The first two indicators, Student Educator Program and Student Orientation, refer to a peer review program in sustainability in which students can explain about the topic, and the teaching of sustainability in the orientation speeches that are given to freshmen. The third indicator, student life, refers to the extra curricula programs organized, meaning those that have no relation with the academic aspect. Examples of these programs are conferences, student-run enterprises related to sustainability, sustainable investment funds, sustainability-focused programs where students can learn about sustainability, among others. Indicator 4 and 5, Outreach materials and publications and outreach campaigns refer to programs which enhance the interest and knowledge about sustainability, such as campaigns, sustainability information distributed outside classes, a website, Facebook page, among others. Indicators 7, 8 and 9 refer to the implementation of sustainability interest and knowledge to the faculty staff, through conferences, orientation, and events among others (STARS, 2017).

The subcategory of public engagement refers to the recognition of those institutions that promote sustainable communities through public engagement, community partnership and service. The engagement with the community is really important because in order to make a real impact in sustainability topics, it is necessary to work with many actors such as governmental institutions, profit and nonprofit institutions (STARS, 2016). The first indicator community partnership recognizes those universities that have established campus community partnerships with other actors such as school districts, government agencies,

NGO, business with the purpose of advancing towards sustainability. Indicator 12, Continuing Educating, refers to the recognition of those universities that impart sustainability classes to the community, consequently they help spread the message of sustainability among society. Finally, indicator 14, Participation in Public Policy, refers to those institutions that promote sustainability through public policy advocacy, especially in the section of sustainability applied to higher education institutions (STARS, 2017).

ENGAGEMENT (EN)			
Campus Engagement 21 points available	EN 1	Student Educators Program	4
	EN 2	Student Orientation*	2
	EN 3	Student Life	2
	EN 4	Outreach Materials and Publications	2
	EN 5	Outreach Campaign	4
	EN 6	Assessing Sustainability Culture	1
	EN 7	Employee Educators Program	3
	EN 8	Employee Orientation	1
	EN 9	Staff Professional Development	2
Public Engagement 20 points available	EN 10	Community Partnerships	3
	EN 11	Inter-Campus Collaboration	3
	EN 12	Continuing Education*	5
	EN 13	Community Service*	5
	EN 14	Participation in Public Policy	2
	EN 15	Trademark Licensing*	2

Graph 8. STARS indicators, category Engagement (STARS, 2017)

The third category is Operations, which divides in 9 sub categories: air and climate, buildings, energy, food and dining, grounds, purchasing, transportation, waste and water. The first sub category, which weighs 10 points, takes into account those institutions that are measuring and reducing the emission of greenhouse gas and air pollutants. Therefore, indicator one recognizes those institutions that have measured and reduced Scope 1 and 2 of GHG emissions by the various methods, such as carbon offset. Scope 1 are considered those emissions that come from direct sources that are owned or controlled by the university such as stationary combustion, mobile combustion, fugitive emissions. Scope 2 refers to indirect emissions that are generated from consumption of energy from purchased electricity, steam, among others (STARS, 2017).

The second sub category is buildings. Buildings are an important source of resource consumption such as water and energy; therefore they are greatly responsible for the emissions of GHG to the atmosphere. According to the United States Environmental Protection Agency, buildings are responsible for the consumption of 38,9% of energy, 39% of the nation's total carbon dioxide emissions and 13% of the total water consumed in the USA, and worldwide they represent 6% of the total Greenhouse Gas emissions (2015). As a result, this category seeks to recognize those institutions that are improving the sustainability performance of their buildings. The main objective is to encourage universities to adopt and follow sustainable operations and maintenance framework, in order to conserve energy and water, minimize the impact in the surrounding area, reduce the generation of waste and of water consumption, and support those markets that offer environmental friendly materials that help the environment (STARS, 2017).

The next sub category is Energy. This category recognizes those institutions that have made an effort reducing energy consumptions through conservations and efficiency

programs, as well as they have implemented a process in which the energy source has changed to renewable energies such as solar, geothermal or hydropower. Energy consumption is a large source of GHG emissions. According to the United States Environmental Protection Agency, 29% of the Greenhouse Gas emissions are attributed to the electricity sector, representing around 1,8 million metric tons CO₂ equivalent in the year 2015 (2016). Therefore, the reduction of it will signify an important environmental and economic impact in the total wellbeing of the region (STARS, 2017).

The fifth sub category, Food and Dining, refers to the whole food system and the transparency and good practices that are behind it. Thus, it takes into account the production of food, such as the use of fertilizers and pesticides, the particular treatment that is given to animals, the transportation from the place where food is produced towards the university campus, and finally the management of the waste generated by the food system. A proper food system has positives impacts such as guarantee of human and animal well-being, decrease of GHG emissions due to transport and a correct waste management (STARS, 2017).

The next category, Grounds, seeks to promote the use of grounds in a sustainable manner, as a way that it will be minimized toxic chemicals while conserving biodiversity and resources on campus. Category 6 is Purchasing, and focuses in the power that institutions have at the moment of purchasing, so they recognize the products and the market that institutions are buying, if those markets are ecological and socially positive. The indicators in which the category is based are: sustainable procurement, electronics purchasing, cleaning and janitorial purchasing and paper office purchasing (STARS, 2017).

The next subcategory is transport, and it recognizes those institutions that are moving towards a more sustainable transport system. It is known that the transport system signifies a great negative impact for the environment, from the extraction of oil, the steps to process it, and then the use of automobiles that use gasoline. According to the United States Environmental Protection Agency, about 27% of national emissions of GHG are directly correlated with the transport sector, representing around 1700 million metric tons CO₂ equivalent (2016). All the system produces tons of GHG; therefore, a sustainable system will help lighten at least some of those effects. Among the indicators, it is taken into account those institutions that promote the use of efficient and clean fuel vehicles, the split car system for students and teachers, and the incentive of sustainable transport and campaigns to reduce air pollution for the transport system (STARS, 2017).

The next sub category is waste, and it takes into account the improvement of a zero waste state, which emphasizes reducing, reusing, recycling and composting. They evaluate the management of minimizing and correct treatment of hazardous wastes, recycling of electronic wastes, diverting of construction and demolition wastes, and in general the reduction of wastes at a whole university level (STARS, 2017).

Finally, the last subcategory is Water. There are recognized those institutions that conserve and protect water as a resource, as well as have programs in order to reduce the use of water and recycle it (STARS, 2017).

OPERATIONS (OP)			
Air & Climate 11 points available	OP 1	Greenhouse Gas Emissions	10
	OP 2	Outdoor Air Quality	1
Buildings 8 points available	OP 3	Building Operations and Maintenance*	5
	OP 4	Building Design and Construction*	3
Energy 10 points available	OP 5	Building Energy Consumption	6
	OP 6	Clean and Renewable Energy	4
Food & Dining 8 points available	OP 7	Food and Beverage Purchasing*	6
	OP 8	Sustainable Dining*	2
Grounds 3-4 points available	OP 9	Landscape Management*	2
	OP 10	Biodiversity*	1-2
Purchasing 6 points available	OP 11	Sustainable Procurement	3
	OP 12	Electronics Purchasing	1
	OP 13	Cleaning and Janitorial Purchasing	1
	OP 14	Office Paper Purchasing	1
Transportation 7 points available	OP 15	Campus Fleet*	1
	OP 16	Student Commute Modal Split*	2
	OP 17	Employee Commute Modal Split	2
	OP 18	Support for Sustainable Transportation	2
Waste 10 points available	OP 19	Waste Minimization and Diversion	8
	OP 20	Construction and Demolition Waste Diversion*	1
	OP 21	Hazardous Waste Management	1
Water 6-8 points available	OP 22	Water Use	4-6
	OP 23	Rainwater Management	2

Graph 9. STARS indicators, category Operations (STARS, 2017)

The last category is Planning and administration, which divides in 4 sub categories, which are coordination and planning, diversity and affordability, investment and finance, and wellbeing and work. The first sub category, coordination and planning, recognizes those institutions that are institutionalizing sustainability by cooperating with resources to sustainability coordination, developing plans to move towards sustainability and engaging university staff, students and stakeholders in governance aspects. The first indicator, sustainability coordination, recognizes institutions that have an active sustainability office that coordinates sustainability work in campus, such as organization and implementation of sustainable initiatives. The second objective, sustainability planning, recognizes universities that have a determined plan to move towards sustainability, establishing goals and objectives, which must be measurable. The second category, Diversity and Affordability, recognizes those institutions that are improving and advancing in diversity and affordability inside the campus. The third category is investment and finance, which recognizes institutions that make investment decisions to promote sustainability. Those investments have a local and global scope. Institutions that have transparent and democratic investment processes tend to promote accountability and engagement in the campus and the community in general. Positive investing supports socially and environmentally responsible practices, as well as the development of sustainable products and services (STARS, 2016). The last category is Wellbeing and work, which recognizes those institutions that have incorporated sustainability inside the human resources programs and policies executed in the campus site (STARS, 2017).

PLANNING & ADMINISTRATION (PA)			
Coordination & Planning 8 points available	PA 1	Sustainability Coordination	1
	PA 2	Sustainability Planning	4
	PA 3	Participatory Governance	3
Diversity & Affordability 10 points available	PA 4	Diversity and Equity Coordination	2
	PA 5	Assessing Diversity and Equity	1
	PA 6	Support for Underrepresented Groups	3
	PA 7	Affordability and Access	4
Investment & Finance 7 points available	PA 8	Committee on Investor Responsibility*	2
	PA 9	Sustainable Investment*	4
	PA 10	Investment Disclosure*	1
Wellbeing & Work 7 points available	PA 11	Employee Compensation	3
	PA 12	Assessing Employee Satisfaction	1
	PA 13	Wellness Program	1
	PA 14	Workplace Health and Safety	2

Graph 10. STARS indicators, category Planning and administration (STARS, 2017)

2.3 ARIUSA

ARIUSA is the framework developed in Latin America, and it has the purpose of assessing sustainability in universities and colleges around Latin America. Once they receive the information about sustainability, the responsible will hand back to each university the results of their particular assessment, compared with the respective averages at a regional and national level. Based on the results, each university will be able to reformulate and improve their sustainability plan and their environmental performance.

The categories in which the framework assesses the universities are: governance and environmental participation, teaching and environmental training, research and environmental technology, environmental projection and environmental management. In each category there are 5 indicators, which will be shown in the next paragraphs.

The first category is governance and environmental participation. This category deals with environmental policies inside campus and the coordination of sustainability by a sustainability office. The indicators are as follows:

- Is there a document that defines the policy developed in the university in terms of environment and sustainability?
- Is there an office dedicated exclusively to environmental or sustainability topics?
- Does the office respond to a plan, environmental project or institutional environmental system?
- Does the office have its own budget for making activities or investments in the topic?
- Were teachers, students or administrative staff involved in the design of the environmental policy?

The second category is teaching and environmental training. Basically, in this category, the instrument intends to measure the level at which sustainability is applied in the academic curriculum. The following questions are the indicators:

- In the environmental policy, is there a mention of the activities made by the academic staff?
- Is sustainability incorporated in the academic curriculums of different careers?
- Have there been defined explicitly basic skills of sustainability in some careers?
- Is there any undergraduate program specific about environment and sustainability?
- Is there any graduate program specific about environment and sustainability?

The third category is research and environmental technology. The main topic in this category is precisely research about environment and sustainability and the technology used to meet the indicator.

- Is there an environmental policy that mentions research and technology for research?
- Is there any research group specific about environment and sustainability formally constituted?
- Is there any strategy for fomenting the realization of research about environment and sustainability?
- Are sustainability and environmental criteria taken into account in the approval of research programs and technology transfer?
- Are there strategies to encourage the use of the institution and its facilities in order to perform environmental and sustainability research?

The fourth category is extension and environmental projection. This category deals with the bondages created between the university and external community, such as governments and business.

- Is there a socio environmental responsibility plan that has been approved by a regulatory organ inside the university?
- In the last 5 years, have there been projects developed to contribute to the problem solving of environmental difficulties in communities?
- In the last five years, have there been programs developed to collaborate with governments in order to implement environmental public policy?
- In the last 5 years, have there been projects developed for linking the business sector in sustainability aspects?
- Is there a college association for the sake of the environment and sustainability?

The last category is environmental management. It takes into account the environmental part of sustainability; the indicators are about resource efficiency.

- Are there programs involved with the efficient use of water?
- Are there programs involved with the efficient use of energy?
- Are there programs involved with the correct management of hazardous wastes?
- Are there programs involved with the management of green zones and biodiversity?
- Does the urban planning of the institution includes environmental and sustainability criteria? (ARIUSA, 2013)

3 RESULTS

David Orr was a highly recognized environmental educator who proposed ways in which higher education institutions can collaborate with the development and practice of sustainability in the society. According to Orr, education plays a really important role in the development of Sustainability (Orr, 1991). Therefore, he establishes certain assignments and advices for campus in order to be more sustainable. The first proposal is to engage the whole campus into a dialogue about the way in which university conducts the business as educators. This dialogue should be about aspects such as the type of graduates the university develops, whether they are world aware responsible people, or just worried about being efficient and gain money, without a sustainable mentality (Orr, 1991). This proposal also questions if the university represents a sustainable regional economy and contributes to the development of sustainability inside and outside campus, or it is an extra negative weight to society and the environment. The second proposal mentioned by Orr is the evaluation and assessment of resources flow inside campus. Some of the resources examined should be food, energy, water, and waste. The objective is to evaluate the use of resources in the campus, and be able to measure their impact in the environment, through the carbon footprint or the waste they represent. Once they have a baseline, universities will be able to develop programs to reduce the use of resources, such as recycling, development of efficient appliance, reducing the use of toxic substances, alternative use of energies, among others. The third proposal refers to the influence of universities as business investors, so it is important the type of business universities are working with or buying material from, depending on the responsibility those business have in regard to sustainability as a whole. Finally, the fourth proposal made by Orr is related to the curriculum and education. According to Orr, all students from a sustainable university should have an important knowledge and awareness about environmental and sustainability topics, no matter the major they are studying. Therefore, among the basic knowledge that should be imparted is: laws of thermodynamics, carrying capacity, energetics, environments ethics (Orr, 1991).

Sustainability is a multi-faceted, complex and broad concept, which takes into account several variables, processes and definitions (Bell, 2011). Therefore, in order to being able to assess sustainability in HEI, this complex nature of sustainability must be taken into account and rescue the core factors and principles of sustainability, those which will have the highest impact and weight in society as a whole. The concepts previously mentioned by Orr, cover and take into account the majority of significant trends and practices of sustainability; therefore they can be applied to sustainability assessment. As a matter of fact, most SAT (Sustainability Assessment Tool), if not all are based in those proposals made by Orr (Cortese, 2003).. The criterion predicted by Orr has been restructured in 4 categories to assess sustainability in HEI, and one extra category has been added too. The 4 categories, which are based in Orr`s advices are: Education, Operations, Research and Outreach Services (Orr, 1991). A category that has been implemented due to its importance and relevance is Governance (Yarime, 2012). In the next paragraphs it will be explained the meaning and scope of each.

Orr defined education as an important variable to achieve sustainability in the HEI, and Cortese described it as a relevant area when assessing sustainability in the campus (2003). The area of education refers to the inclusion of environmental and sustainability courses in the curriculum of all the majors imparted by the university. The objective is to

align the educational knowledge acquired by students along the major with the principles of sustainability. Therefore, it is intended to give students the knowledge and skills to address and solve environmentally sustainable problems in a local, regional and global scale, over short and medium time periods (Araujo, 2016). Also, by interconnecting and expanding across the knowledge areas, students will be able to develop a systemic and correlated mindset, which will help them resolve problems in a way that takes into account all the variables, including environmental and sustainable ones. As a result, instead of considering challenges in an independent and separate way, they will analyze them as connected and as complex system, resulting in a correct and efficient search for solving problems that affect both societies and the environment in a positive way. Among the content that education should include are ways to preserve and restore cultural and biological diversity, carrying capacity of the systems, sustainable use of resources, sustainable agriculture, thus students will learn how to live and work with nature's interest instead of its core capital (Cortese, 2003).

A second area assessed in the SAT is Research. Research is the means by which the HEI involves in investigations about sustainable development and environmental matters. This area is important for many factors. First, it gives students the opportunity to apply all the theory they have learned and put it in practice. It is known that we retain new information, skills or values once we put them in practice, approximately 80%, compared to the 20% we learn when studying theory only. Therefore, in order to increase student's retention of knowledge, it is extremely important to practice research (Cortese, 2003). Another reason research is important is because as human race, we are still investigating and understanding several questions, in this case related to sustainability and environment. Therefore, it is extremely relevant to keep investigating about ways to keep sustainable development moving forward in societies, which are the more efficient ways to attain it, how to help reduce the carrying capacity of Earth, among others. Furthermore, research is a very important component to help universities and societies move forward towards a more environmental friendly future, which practices sustainable development at its best (Cortese, 2003).

The third area taken into account by the SAT evaluation is Operations. The operations area refers to the operational processes that occur in the campus, as well as the resources that are used in them and the direct/indirect, intermediate/final emissions produced on those processes. It is really important and honest from the HEI to correlate its daily operations with its curriculum, therefore, the operations, planning and facility design must be tied to the sustainable vision of the HEI. As a matter of fact, this area assesses different variables such as Green House Gas emissions, Building design and construction, Green Building designs, development of green energy, efficiency of water appliances and its respective consumption, sustainable dining, organic, inorganic and hazardous waste management, landscape management, purchasing, transportation, among others (STARS, 2016). Apart from the great impact that implies a sustainable campus in the physical operation, the fact that students and staff can beneficiate and learn from it is relevant as well. Therefore, the operations from a sustainable campus will fit with the opportunities for teaching, research and learning. The campus operations will be an example by itself of sustainability. Students will be engaged in the development and understanding of the "university's metabolism" of materials, goods, services, transportations, and the environmental and social footprint that is promoted in society. Sustainable operation in the campus is not only important by the physical impacts it has, but it is also effective in building a strong sense of collaboration and community through the institution (Coarse, 2003).

The fourth area suggested by Cortese is Outreach services. The aim of this area is to involve institutions in promoting sustainable communities through public engagement, community partnerships and services. In order to achieve sustainability, it is really important to engage the community. The engagement would be with multiple sectors of the community, such as governmental organizations, non-profit and for profit sectors, other HEI, among others. There are two important ways in which institutions can get involved and engaged with society, through economic and social-public manners (Cortese, 2003). Higher education institutions are important pillars in the economy, therefore, it is up to them to develop and engage community in a sustainable development from which everyone can benefit. They have an fundamental role in the community, consequently it is relevant to which providers they buy from, with which entities they make business, if these have a green philosophy in their operations or not, for example. If institutions would make business and contracts with clients dealing with sustainable preferable products and services, they would be modeling sustainability in a remarkable way. Therefore, according to Tetreova, the importance that universities give to the different stakeholders and providers, define the strategy of management they have towards the stakeholders. Therefore, the importance they give to sustainable stakeholders define their strategy and sustainable approach (2010). The other method by which institutions can engage with society is by inter-campus collaborations, compromise with external networks and organizations, and giving advice in public policy that can lead to sustainable development (STARS, 2017).

The last area assessed in the SAT is governance. Although governance is not included in Orr`s nor Cortese`s proposals, it is an important area that has a relevant influence in achieving sustainability in the campus. The area of governance has questions and indicators that assess the administrative structure and policy directions of the Higher Educations Institutions. Therefore, its aim is to promote sustainability in the institution and it achieves it by including the evaluation of visions and policies that are imposed on the HEI regarding working conditions, including employment and payment. Other issues considered in the governance area are policy creation, strategies, planning, initiatives, visions and financial aspects such as investment, budget and funding (Yarime, 2012).

As mentioned before, sustainability is a complex and multi-facet process; therefore it must be approached and assessed from several perspectives, such as governance of the institution, operations and resource use, education, curriculum and research as complex systems and outreach services. Once all these perspectives have been assessed and put into practice, sustainability will be established in the HEI, and will be modified and improved along time.

Table 1. Sustainability Assessment tools analyzed

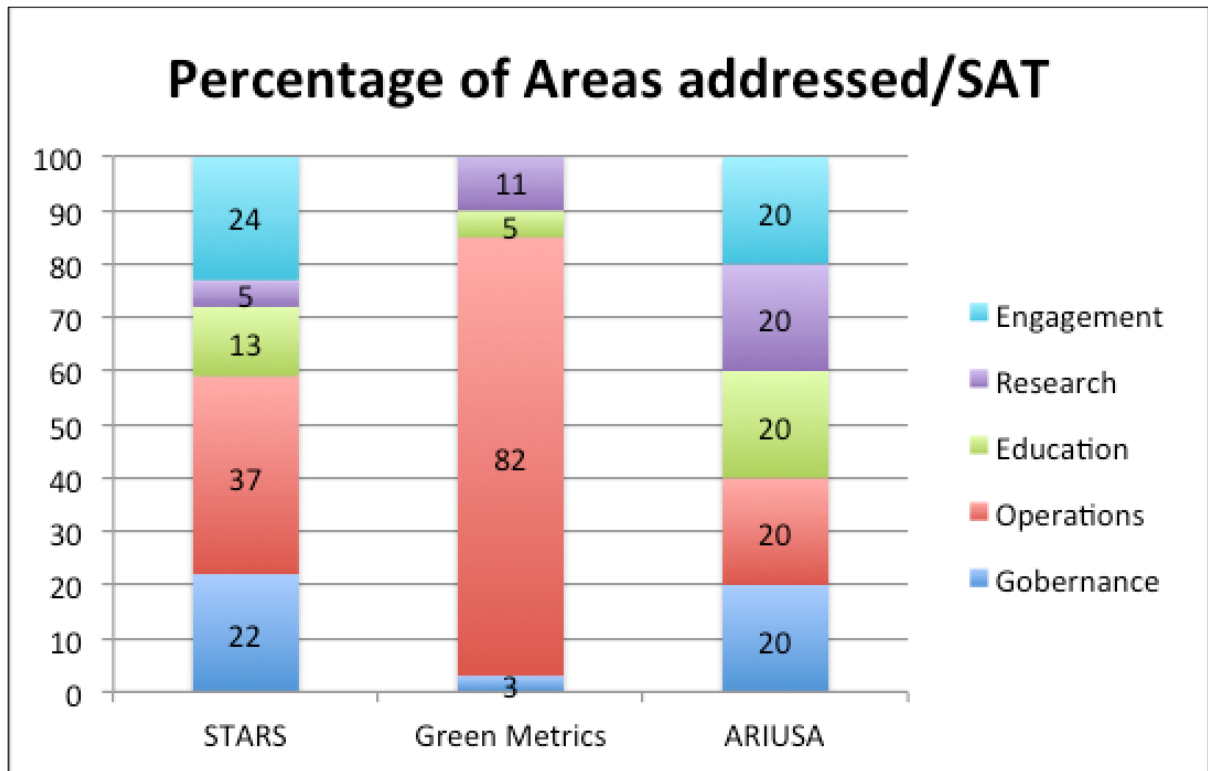
No.	Sustainability Assessment Tool	Organization for Development	Year
1	STARS	AASHE	2016
2	Green Metrics	University of Indonesia	2017
3	ARIUSA	ARIUSA	2013

Table 2. Number on indicators per category in each SAT

Assessment tool	Governance	Operations	Education	Research	Outreach	Total # of indicators
STARS	14	23	8	3	15	63
Green Metrics	1	31	2	4	0	38
ARIUSA	5	5	5	5	5	25

Table 3. Percentage of areas addressed in each SAT

Area	STARS (%)	Green Metrics (%)	ARIUSA (%)
Governance	22	3	20
Operations	37	82	20
Education	13	5	20
Research	5	11	20
Outreach	24	0	20
Total	100	100	100



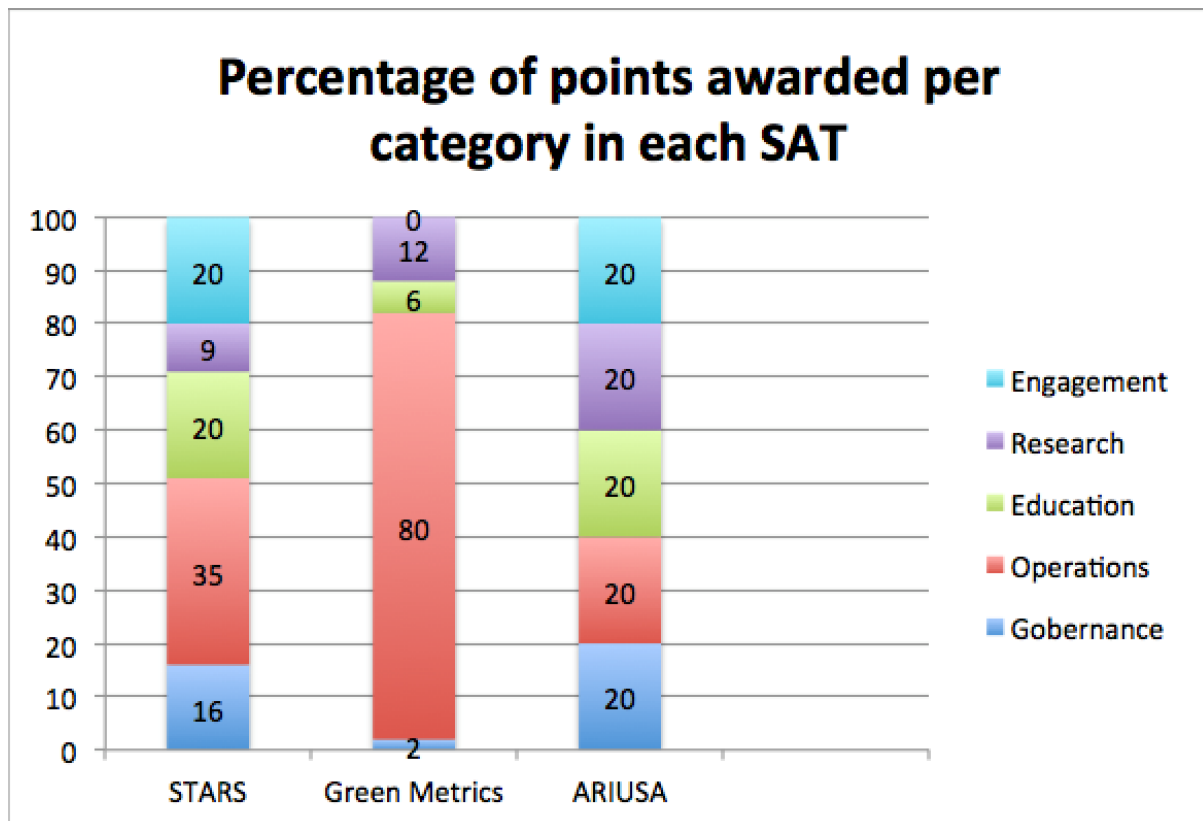
Graph 11. Percentage of areas addressed per SAT

Table 4. Total points awarded per category in each SAT

Area	STARS	Green Metrics	ARIUSA
Governance	32	200	5
Operations	72	8000	5
Education	40	600	5
Research	18	1200	5
Outreach	41	0	5
Total	203	10000	25

Table 5. Percentage of points awarded per category in each SAT

Area	STARS (%)	Green Metrics (%)	ARIUSA (%)
Governance	16	2	20
Operations	35	80	20
Education	20	6	20
Research	9	12	20
Outreach	20	0	20
Total	100	100	100



Graph 12. Percentage of points awarded per category in each SAT

The three sustainability frameworks discussed previously, Green Metrics, STARS and ARIUSA were applied and assessed in Universidad San Francisco de Quito. Although the three SAT assess sustainability, they have different categories, indicators and scores for each, therefore the results per se will not be the same, but the core results will be similar, in terms of sustainability practices of the university. In the following paragraphs, the results obtained in each SAT will be described and compared, deepening in the good sustainability practices and those that require improvements inside the university campus.

3.1 Green Metrics

Green Metrics assessed Universidad San Francisco de Quito in the present year 2017; the submission of the data required was the 31st of October, and the final results and ranking position will be handed in December. As it was discussed before, Green Metrics has 6 categories, which are: Settings and Infrastructure, Energy and Climate Change, Waste, Water, Transportation and Education. For the present comparison, it will be taken into account the 5 last categories, and one indicator from the first category. In Setting and Infrastructure, they inquire about the university budget for sustainability efforts, and the value is 7 % of the total budget. In the category of Energy and Climate, there are 6 indicators. The first one refers to energy efficient appliances usage and replacing conventional appliances, the answer to this indicator was a percentage of 20% to 40%. The main efficient appliances that have replaced conventional ones are the LED luminaires, which covers the majority of electric installations in the library, chancellery and the kitchen. The second indicator is about smart building implementation, but USFQ has no implementation at all. The third indicator refers to renewable energy produced in the campus. The university has less than 20% energy produced by a solar panel, which produces around 167 kWh yearly. The next indicator is about Green House Emission Reduction Program, and although there are several ideas in preparation about the indicator, still there are no implemented projects yet. The last indicator is the Carbon footprint, which is 6428,48 tons of CO₂, and the major source for this footprint is the ground transport, estimated to be 59,4% of the final result (USFQ, 2017).

The third category is waste. Basically, the indicators inquired about policies to reduce plastic and paper in the campus, recycling campaigns, inorganic, organic and hazardous waste management, and finally sewerage disposal. In relation to the policies to reduce plastic and paper, there are the campaigns of "the use of tumbler" and "print when you need". The tumbler policy refers to the discount of 10% you get if you buy coffee with a tumbler, therefore the amount of plastic can be reduced in campus. The recycling program has an extension of 50% in the campus, there are classified paper, dashboard and plastic bottles, which are sold to a company that recycle those. Hazardous waste management is completely contained, inventoried and handled. There are several sources of this toxic waste, such as microbiology and molecular biology labs, chemistry labs, odontology clinic and veterinary clinic. All those have a similar process, which is containing and classifying the wastes for later delivering to the environmental manager. The organic waste treatment is totally composted and used externally, because the wastes remaining from the restaurants and coffee shop are taken to a farm where it becomes animal feed for pigs. The inorganic waste management is partially recycled, because there are several containers in the campus that are specific for batteries, small electronics, medicines, light bulbs, that are taken by a specific

environmental manager. Finally, the sewerage disposal is null, due that it is disposed untreated into waterways (USFQ, 2017).

The next category is water. The indicators were water conservation program implementation, water recycling program implementation, water efficient appliances usage and piped water consumed. Of all the indicators, there were only applied the efficient appliances and the piped water. The total of piped water consumed was 100%. The efficient appliances refer to some urinary and sinks which consume less water than what is considered as normal. Therefore they are the only appliances in the whole campus that have efficiency. In relation to programs for water conservation and recycling there are no implemented programs on campus (USFQ, 2017).

The next category is transportation. Among the indicators required were: number of cars entering the university, number of shuttles operating daily, transportation program designed to limit or decrease parking area on campus over the last 3 years, transportation initiative to limit or decrease private vehicles on campus. The number of cars owned by the university is 2. The number of cars entering daily the university is approximately 3547 (Salazar, 2015). University has one bus that works as shuttle service, which goes from USFQ to "Hospital de los Valles". It has to travel a distance of 2,8 km back and forth, and it makes the trip 15 times a day. The program for decreasing parking area on campus has made a decrease of 10 to 30%, by closing the entrance to the 3th and 6th floor to students, leaving them only de 4th and 5th floor. The transportation initiatives to decrease private vehicles on the campus has also been addressed with the program "autocompartido" (autocompartido.com.ec), a program were the community shares car with those people who have similar routes from their house to the university (USFQ, 2017).

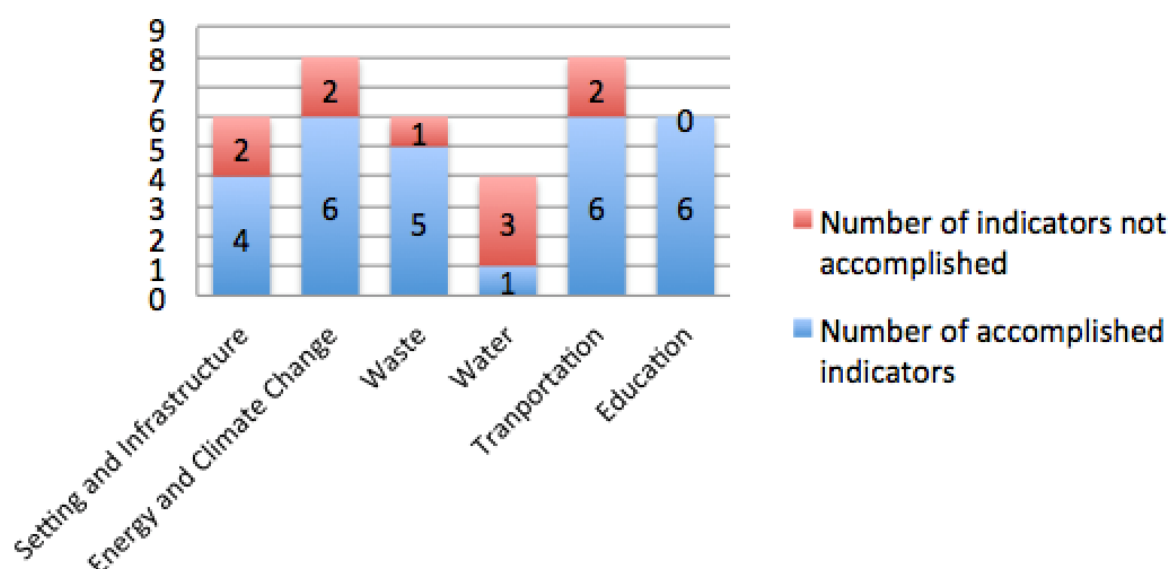
The last category is Education. The indicators are the following: number of courses related to environment and sustainability offered, total number of courses offered, total research funds dedicated to environmental and sustainability research, total research funds, number of scholarly publication on environment and sustainability published, number of events related to environment and sustainability, number of student organizations related to environment and sustainability, and the existence of a university-run sustainability website. The total number of courses offered related to environment and sustainability has been a total of 91 in the year 2017. And the total number of courses is of 6270 in the year 2017. The total research funds dedicated to environmental and sustainability research is of \$129143, and the total research funds is \$ 5218744, the number of scholarly publications on environment and sustainability published is 263, and the university-run sustainability website is ois.usfq.edu.ec (USFQ, 2017).

The evaluation and fact file from Green Metrics assessment just arrived in December 2017, therefore, it can be assured that the final score, taking into account all the indicators previously mentioned, is 4481 points out of 10000. This means that 44,81% of the indicators were accomplished. In the next sections, it will be detailed information about the percentage and scores per area accomplished according to Green Metrics (Green Metrics, 2017).

Table 6. Number of indicators accomplished per area in Green Metrics

	# OF INDICATORS ACCOMPLISHED	TOTAL NUMBER OF INDICATORS
SETTING AND INFRASTRUCTURE	4	6
ENERGY AND CLIMATE CHANGE	6	8
WASTE	5	6
WATER	1	4
TRANSPORTATION	6	8
EDUCATION	6	6

Green Metrics assessing USFQ



Graph 13. Number of indicators accomplished per area in Green Metrics

3.2 ARIUSA

As previously mentioned, ARIUSA is divided into 5 categories that are: government and environmental participation, teaching and environmental training, research and environmental technology, environmental projection and environmental management. Within each category, there are 5 indicators, which were assessed in Universidad San Francisco de Quito and the results are shown in the following paragraphs.

The first category assessed was government and environmental participation. Within the category, the first indicator evaluates if there is a document defining a policy in the institution related to environment and sustainability. Indeed there is an internal policy about environment and sustainability, whose aim is to develop and provide sustainable strategies that allow the growth and development of USFQ in harmony with society, environment and economy. The second indicator inquires if there is an administrative or technique office that is dedicated exclusively to environmental and sustainability topics. In USFQ there is an office called "Oficina de Innovación y Sustentabilidad". The office is in charge of promoting an integral work between the academic sector, public and private business, internal and external community, in order to create shared values in topics of environment and sustainability. The office promotes several projects and programs that range from sustainability courses, research projects and development of sustainable strategies such as alternative energies. Among the projects developed the office are: efficiency programs for use of water and electricity, e-waste recycling and "autocompartido". The third indicator evaluates if the office is part of a plan or environmental project inside the institution. The fourth indicator is if the Office has a stable budget to operate and make projects, and the answer is yes. The final indicator is about the involvement of the community in the creation of the environmental policy (USFQ-Oficina de Innovación y Sustentabilidad, 2017). The community has been involved in policy creation; for example, teachers were great support, as well as the students calculating the carbon footprint and the GOBE. GOBE is the government council that is the link between the university and the students, which has been supportive in the development and divulgation of environmental initiatives and programs (USFQ-GOBE, 2017).

The second category is teaching and environmental training. The first indicator is whether the environmental policies have a mention of the activities of the teachers. This mention is found in the mission of the Environmental School, and refers to the leading of academic and research programs from the teachers that contribute to the knowledge of biodiversity, skills for resolving environmental problems and contribute to sustainable development in human societies. The second indicator refers to the incorporation of sustainability courses within the curriculum. There are a total of 91 courses related to environment and sustainability within the general curriculum. The third indicator inquires about classes that impart sustainable skills apart from theory. USFQ offers one class related to skills and capacities of sustainability, it is Design Thinking and PISA. Design thinking is a methodology for creating innovative strategies, that through the process of innovation and transformation, will be able to provide products, services and solutions for the client (USFQ-Oficina de Innovación y Sustentabilidad, 2017). As a result, the course provides the necessary skills for complex problem solving, from the understanding of the problem, creation of a set of solutions and the implementation of those. The other course offered, PISA, also provides information and skills of design thinking, but in this case they are applied to social innovation. Practical work has been done with the communities of San Cristobal, Galápagos (USFQ-Oficina de Innovación y Sustentabilidad, 2017). The fourth and fifth indicators are about the existence of under and graduate programs related to environment and sustainability. The undergraduate program has several careers, such as Biology, Biotechnology, Environmental Engineering and Environmental Management. The graduate programs are Ecology and Microbiology (Colegio de Ciencias Biológicas y Ambientales, 2017).

The third category is research and environmental technology. The first indicator inquires if there is any mention in the environmental policy to research and technology transfer. There is a mention, which says that the university has the purpose of leading academic and research programs to contribute with the knowledge of biodiversity, solving

environmental problems and contributing the sustainable development of communities. The second indicator is about the existence of formally constituted groups for environmental and sustainability purposes. There are several groups such as: Aquatic Ecology lab, Microbiology Institute, Applied Ecology Institute, Ground Zoology Lab, UNIGIS, Plant Biotechnology Lab, Galapagos Science Center and the Geography Center (Colegio de Ciencias Biológicas y Ambientales, 2017). The third indicator is whether there are incentives to promote research in environment and sustainability. The answer is no. The fourth indicator is if criteria of environmental impact are considered in the approval of research or transference of technology projects? The answer is yes through link with the community projects that will be explained in the indicators from category 4. Finally the fifth indicator is if there are strategies to incentive the use of the campus installations in order to make research? The answer is yes; the OIS is in charge of those incentives (USFQ-Oficina de Innovación y Sustentabilidad, 2017).

The fourth category is Environmental projection. The first indicator is if programs of sustainability or environment solving problems in the communities have been developed in the past 5 years. There have been several programs, such as PISA and ecological bathrooms. PISA was already discussed in Category 2. The project of the ecological bathrooms was born after the great earthquake in April 2016. As a proposal, the careers of environmental and civic engineering of USFQ, with the support of OIS, they developed this program to build ecological bathrooms in the long term as an opportunity to train the community about methodologies of building and being able to optimize the use of materials and cost. Also giving the opportunity to develop entrepreneurship in the community (USFQ-Oficina de Innovación y Sustentabilidad, 2017). The second indicator is if there have been projects in collaborations with governments for the implementation of environmental politics the last 5 years. There have been several projects and agreements between USFQ and governments. For example, there is the "Convenio Marco de Cooperación Interinstitucional" among the Galapagos National Park Direction and USFQ. The purpose of the agreement is to promote the scientific cooperation for research, education and training in areas of scientific research and environmental monitoring programs (Firma del Convenio USFQ-DNPG, 2014). There is a similar agreement with the government of Alausi, Chimborazo. The third indicator is if in the past 5 years, there have been programs with the business sector about environment or sustainability. There have been developed several projects with the business sector. For example, there is KIKINTA, a project developed with Cervecería Nacional and other partnerships such as Habitat III Village, Novopan, CONQUITO and USFQ. KIKINTA is an architectural proposal of re-evaluation of natural spaces not consolidated in the city supported by economic and technological sustainability; basically, it is a program that intends to adapt organic agriculture to the cities, and by doing so it solves the problem of soil degradation, rescues endemic plant species and promotes sustainable land management (Proyecto Hábitat III Village-Kikinita: centro de interpretación de agricultura urbana, 2015). Another program with the Banco de Guayaquil was about the development and implementation of a program of Social Environmental responsibility with the community. The last indicator is if the university participates in international or national university networks. In fact, since July 2016, USFQ is part of GUPES. GUPES is the Global Universities Partnership on Environment for Sustainability, whose purpose is to involve environmental and sustainability concerns into the curriculum, research, operations and community engagement in the universities (Global Universities Partnership on Environment for Sustainability, 2016).

The last category is Environmental Management. The first indicator requests if there is a program dealing with water efficiency in the university. In the university there are several urinary and sinks that are considered efficient, because they consume less water than the "normal" use. Still, the path to water efficient is still long and complex in the university.

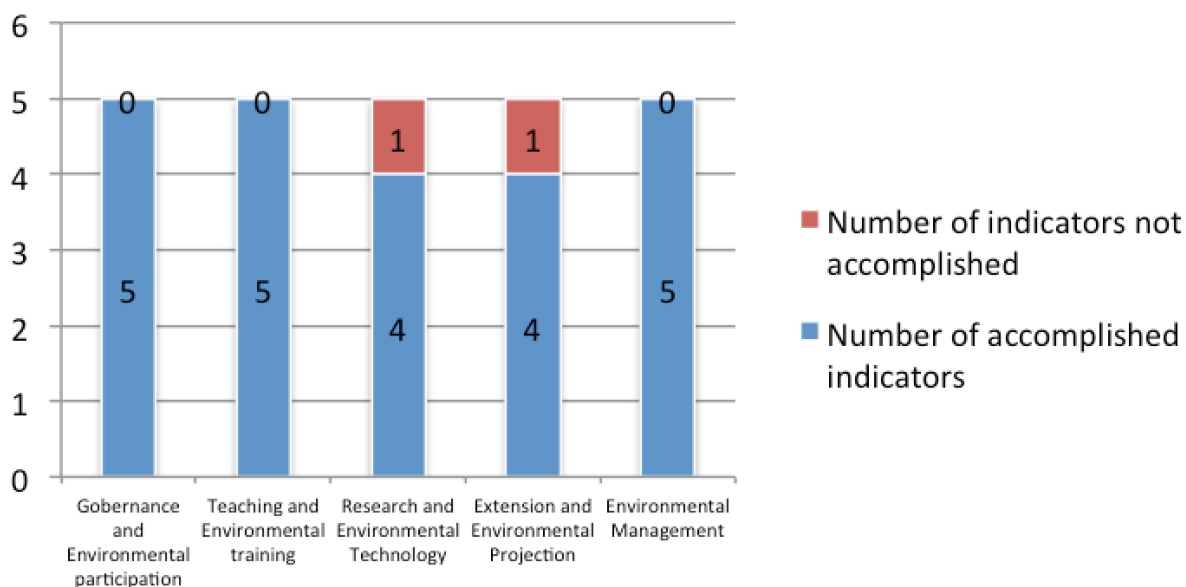
The second indicator is if there is a program dealing with energy efficiency in the campus. There are some examples of energy efficiency. For example, almost all the light bulbs from the kitchen, chancellery and library have been changed to LED technology, which is an important step towards efficiency. There is also a solar panel, but it produces just 167 kWh yearly. The third indicator is if there is a program about the management of solid wastes. Indeed, solid wastes are managed in the best possible way, having organic, inorganic and hazardous waste their own management process. The specific processes were already described in the Green Metrics results. The fourth indicator is about a program about management of green zones and biodiversity. There are several programs managing these aspects, such as GAIAS, Tiputini and Tueri. GAIAS refers to the campus in Galápagos and the several hectares belonged and managed by the university. Tiputini is an environmental research center that belongs to USFQ, and there are also several hectares that are managed by it. Finally Tueri is a fund that helps wildlife; therefore it deals with in situ conservation strategies. (INSTITUTO DE CONSERVACIÓN DE FAUNA SILVESTRE, 2017). The last indicator asks whether the urban planning of the institution includes environmental and sustainability criteria. USFQ does include the criteria, and has included it with the support of "Empresa Pública Metropolitana de Movilidad y Obras públicas" (USFQ-Oficina de Innovación y Sustentabilidad, 2017).

In the following graph and table, it can be seen the number of indicators that are accomplished per area in USFQ.

Table 7. Number of indicators accomplished per area in ARIUSA

	# OF INDICATORS ACCOMPLISHED	TOTAL INDICATORS/AREA
GOVERNMENT AND ENVIRONMENTAL PARTICIPATION	5	5
TEACHING AND ENVIRONMENTAL TRAINING	5	5
RESEARCH AND ENVIRONMENTAL TECHNOLOGY	4	5
EXTENSION AND ENVIRONMENTAL PROJECTION	4	5
ENVIRONMENTAL MANAGEMENT	5	5

ARIUSA assessing USFQ



Graph 14. Number of indicators accomplished per area in ARIUSA

3.3 STARS

This framework has 5 categories and 18 subcategories. The categories, as mentioned previously are: academics, engagement, operations, planning and administration and the bonus category innovation and leadership. As some of the indicators have already been mentioned over the last two frameworks, the ones that repeat will only be mentioned in the present paragraphs, rather than proved with more details.

In the Academics section, the university accomplishes the first five indicators of curriculum, academic courses, learning outcomes, undergraduate program, graduate program and immersive experience. The next two indicators, sustainability literacy assessment and incentives for developing courses are not accomplished. The next indicator, campus as a living laboratory, does accomplish in the university. Among the areas where university is a Living Campus are: air and climate, energy, food and dining, grounds, transportation, waste, coordination and planning, diversity and affordability and public engagement. In the research subcategory the first indicator, research and scholarship, is accomplished, but the next two, support for research and open access to research, and are not.

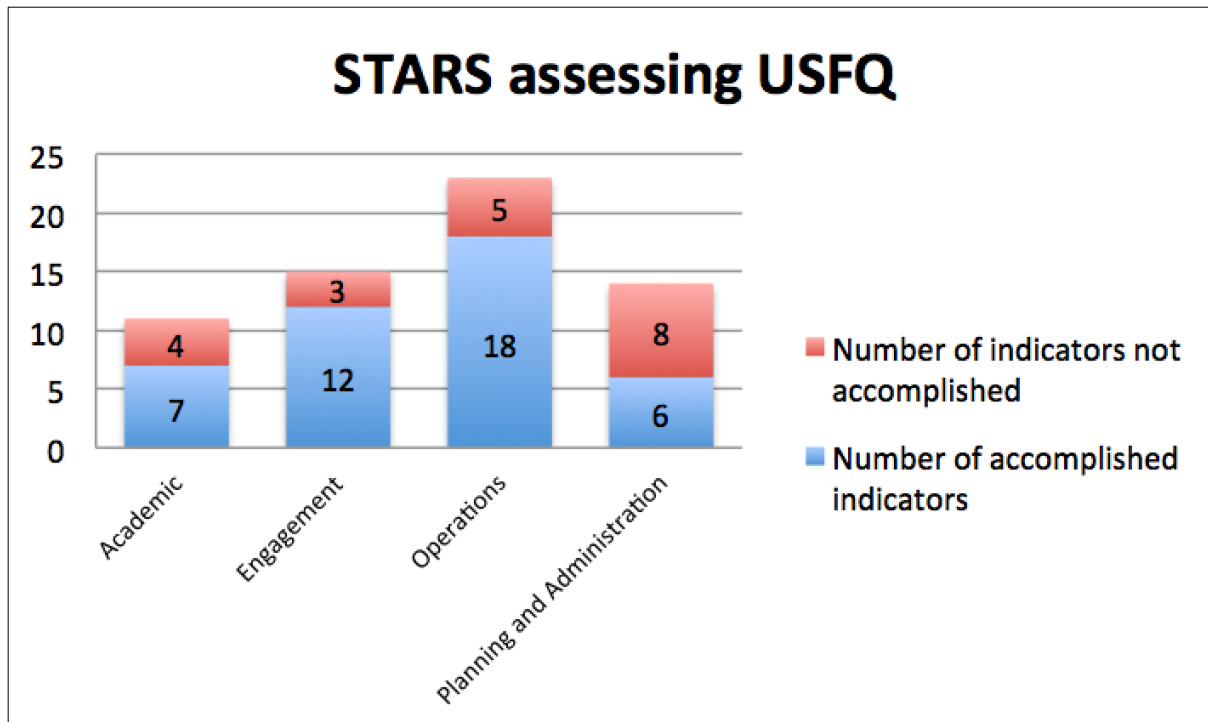
In the category of Engagement, there are two subcategories: campus and public engagement. In campus engagement, 7 of the 9 indicators are accomplished. The institution organizes ongoing peer to peer sustainability education programs for students, it enhances sustainability in the orientation program, there are co-curricular sustainability programs such as the clubs mentioned earlier, institution produces outreach materials and publications, and it leads sustainability related outreach campaigns for students or employees. The university

also covers sustainability in the employee orientation, and make the staff participate in professional development opportunities related somehow to sustainability in the campus. The indicators that are not covered are assessing sustainability culture and employee educators program, described earlier. In the public engagement subcategory, 5 of the 6 indicators are accomplished. As mentioned before, the university has partnerships with the community, other institutions and colleges, as well as participation in public policy. The university has a continuing education program, "Escuela de empresas", where there are addressed sustainability topics, (Entérate sobre la acreditación IACET, 2017), and have a great impact in community service, through the program of PASEC (Programa de Aprendizaje y Servicio, 2017). The indicator that is not accomplished is Trademark Licensing.

The next category is Operations, that has 9 subcategories, which are: air and climate, buildings, energy, food and dining, grounds, transportation, waste and water. From the sub category of air and climate, both indicators: green house emission and outdoor quality are accomplished and mentioned earlier. From sub category 2, buildings, neither is accomplished, because green buildings are not part of the campus. Sub category 3, energy, both indicators are partially accomplished, building energy consumption and clean and renewable energy. From sub category 4, food and dining, neither of the indicators are indicated, because the purchase of food is based in the price rather than the ecological footprint. . In sub category 5, grounds both indicators are accomplished, biodiversity and landscape management. From the next sub category, purchasing, information still has to be recollected. But from the 4 indicators, 2 are certainly accomplished; these are sustainable procurement and electronics purchasing. In the transport and waste subcategories, all the indicators are accomplished, and the evidence is shown in the Green Metric analysis framework. The last subcategory, water, accomplishes one indicator, water use, but does not accomplish the rainwater management indicator.

Finally, the last category assessed is Planning and administration. Within this category, there are 4 subcategories, which are: coordination and planning, diversity and affordability, investment and finance, and wellbeing and work. In coordination and planning, the first indicator, of sustainability coordination, is accomplished by the presence of the "oficina de innovación y sustentabilidad" mentioned earlier. The indicator of sustainability planning has not been accomplished, because the university has not formally adopted plans that include measurable sustainability objectives. The third indicator, participatory governance, has been partially accomplished. The institution has adopted a framework for engaging internal stakeholders (students, faculty, staff) in governance, but has not adopted a framework for engaging external stakeholders. The evidence for this indicator was mentioned in the ARIUSA assessment analysis. The next sub category, diversity and affordability, accomplishes all the indicators that are diversity and equity coordination, assessing diversity and equity, support for underrepresented groups and affordability and access. All of the indicators are accomplished based on the work of the "Programa de Diversidad étnica", which has the main objective of reaching minorities, such as indigenous and afro-Ecuadorian people who have low resources but have academic merits and the aim of overcoming their circumstances and contributing to the scientific, social, economic and cultural development in the Ecuadorian society (Diversidad Etnica, 2017).

The final score for USFQ assessed by STARS is 58 out of 203 points; it reaches a rating of silver.



Graph 15. Number on indicators accomplished per area in STARS

3.4 Summary assessment of USFQ with the SATs

Universidad San Francisco de Quito has already been assessed with the three SATs previously mentioned, Green Metrics, STARS and ARIUSA, and the results were observed in the past sections. In the following paragraphs, it will be compared and evaluated the results obtained by the three SATs, and the alignments for doing so will be based in the categories mentioned by Cortese and Orr referring to sustainability, that are: Education, Research, Operations, Outreach Services, and an extra one added that is Governance.

As Orr and Cortese have mentioned, education has a really important role in the development of sustainability in HEI, therefore, this category was present in the three SATs that assessed USFQ in the present paper (Cortese, 2003). Evaluating the curriculum program, it was concluded that in the year 2017, there have been a total of 91 courses related to environment and sustainability, out of a total of 6270 courses imparted from all the departments. Therefore, the courses related to environment and sustainability represents only a 1,45% of the total offer. Despite the number of environmental and sustainability courses being extremely low, it must be taken into consideration, according to Orr, to impart those classes or even include in courses from all the under graduate programs principles such as the law of thermodynamics, basic principles of ecology, carrying capacity, least-cost, end-use

analysis, limit of technology, sustainable agriculture and forestry, environmental ethics, among others (1991).

Other indicator that evaluated USFQ's education program, was whether there is an immersive experience, referring to programs that impart sustainability in a practical way, teaching skills and knowledge in order to being able to solve sustainable problems in the real world. There is one course that is PISA. According to Cortese, knowledge is retained in a 80% if it is taught in a practical way, therefore, it is extremely important to increase the number of courses imparting immersive experiences, and facilitate the register of students to those courses (2003). Another way to impart practical knowledge is through living labs, an indicator in the SAT. Living labs refer to those Institutions that use their infrastructure and operations as environments for multidisciplinary learning and applied research. In USFQ there have been several projects, but the campus should be seized with projects from students and teachers, and this way sustainability will be imparted in a practical and efficient way. Among the campus serving as living labs, there are many areas where projects can be applied such as: air and climate, building, energy, food and dining, grounds, purchasing, transportation, waste, water, diversity and affordability, investment, public engagement, among others (STARS, 2016).

The next area discussed by Orr and Cortese is Research (2003). Research is an important part of sustainability; therefore it was included in the three SATs that evaluated USFQ. There were several indicators in this section. For example, one indicator inquired the total research funds dedicated to environmental and sustainability research that turns out to be \$129143. This value represents a 2,47% of the total research funds. There it can be observed that the percentage is significantly small. The SATs question about the formally formed research groups inside the university, and there are several such as: Aquatic Ecology lab, Microbiology Institute, Applied Ecology Institute, Ground Zoology Lab, UNIGIS, Plant Biotechnology Lab, Galapagos Science Center and the Geography Center. These groups are very important for the development of sustainability in the research area, therefore research indeed is practiced although the budget is not a significant quantity relative to the total budget. Although there are several groups doing research, according to the indicators, there is no real incentive to promote research in sustainability and environment (ARIUSA, 2015). Another indicator from the SATs is Open access to research. This indicator refers to an institution that has formally adopted open access policies to scholar articles, but that is not the case of USFQ (STARS, 2016).

The next area proposed is Operations. Inside operations are several categories that were evaluated, such as air quality and emissions, buildings, energy, grounds, transportation, waste, water, among others. Related to air quality, USFQ accomplishes the indicator because it has conducted a greenhouse gas emissions inventory that includes Scopes 1, 2 and 3. An important result from those inventories is that the vast majority of emissions are from the ground transportation system, approximately 59,4%. In the building section, the indicator was not accomplished because they required for green buildings, and none of USFQ's buildings have that efficient technology. In the energy section, there have been improvements but there is still a long path to overcome. Efficient appliances have replaced conventional appliances in a range of 20 to 40%. (Green Metrics, 2017).

The next area proposed by Cortese and Orr is Outreach services (Cortese, 2003). Among the indicators presented were if whether there is a linkage between the university and the community, the business sector, governments and with other HEI. There has been a great bondage with the community through various activities, such as PISA, ecological bathroom, and PASEC. With the business sector there have also been implemented various

programs, for example with Cervercería Nacional, the KIKINITA project and with Banco de Guayaquil. With the public sector there has been implemented bondage with small governments such as the one with Galapagos, where it was signed the "Convenio Marco de Cooperación Interinstitucional" between the Galapagos National Park Direction and USFQ. About bondage with other universities and institutions, it is important to remark that USFQ is part of the GUPES, and it has made several agreements to work together with international universities such as the University of Indonesia, University of Massachussets, Carnegie Mellon University, among others.

Finally, the last category assessed by the SATs is Governance. There were three important categories in this section, which are: coordination and planning, diversity and affordability and investment and finance. In the coordination and planning, it was mentioned that USFQ has the Sustainability office, which is in charge of promoting an integral work between Academy, public and private business, internal and external community, in order to create shared value in topics of environment and sustainability. The indicator about sustainability planning does not accomplish, because the institutions has not formally adopted plans that include measurable sustainability objectives. And in Participatory Governance, the institutions has adopted a framework for engaging internal stakeholders in the governance, but not external stakeholders in the institution`s governance. The category of Diversity and Affordability accomplishes totally the indicators, through the Program of Diversidad Etnica. Finally, in investment and analysis, no indicator was accomplished because USFQ makes no investment at all (STARS, 2016).

As it was mentioned before, Green Metrics rankings assessment was filed in October 2017, and the results were received in December 2017. Therefore, now will be displayed the results in the different areas evaluated in the SAT. There can be observed the number of points earned in each category, which is based in the percentage of indicators that were accomplished. According to the results, the areas that have the best performance are Waste, with 69,50% accomplished and Transportation, with 67,39% accomplished. The areas that still have to improve are: Education with 26% of accomplished indicators, Setting and infrastructure with 31,47%, and Water with 32% of accomplished indicators. The total score was 4481 points out of 10000, meaning 44,81% of the total indicators were fully accomplished in the Green Metris assessment.

Category	Point	Maximum Point	Percentage
Setting and Infrastructure (SI)	472	1500	31.47 %
Energy and Climate Change (EC)	757	2100	36.05 %
Waste (WS)	1,251	1800	69.50 %
Water (WR)	320	1000	32.00 %
Transportation (TR)	1,213	1800	67.39 %
Education (ED)	468	1800	26.00 %
Total Score	4,481	10000	44.81 %

Graph 16. Actual score accomplished per category in Green Metrics (Green Metrics, 2017)

4 CONCLUSIONS

As important as the practice and culture of sustainability in a HEI, is the quality of the assessment of sustainability (Yarime, 2012). In the present report, three assessment tools were evaluated, Green Metrics, STARS and ARIUSA. Each one has different scopes and methodologies in order to evaluate sustainability in the universities, reflecting the approach of sustainability they aim to achieve. Regardless of the assessment tool and the sustainability approach it has, every SAT has three primary purposes which are: the first one is the understanding of which level of sustainability is being achieved by the university as a baseline per se, the second one, is the identification of the level of performance of the different areas and develop strategies in order to improve them, and the last one seek the development of a culture committed to sustainability (Yarime, 2012). Those ideals can be achieved by developing the following characteristics for every SAT: first, identify important issues to work on, second: being calculable and comparable, third: move beyond eco efficiency, fourth: measure processes and motivations, and fifth: stress comprehensibility (Shiberg, 2002). With this information, it can be reflected about the three sustainability assessments used in the paper.

The first assessment tool evaluated was Green Metrics. This tool identifies important issues, but not necessarily in an integral and holistic way. According to Shiberg, a SAT has to address appropriate sustainability related issues such as the social, economic and environmental efforts (2002). Green Metrics focuses mainly in the environmental efforts, giving the social and economic efforts very little influence along the assessment. Therefore, as the second parameter mentions, Green Metrics measures exclusively eco-efficiency instead of true sustainability. This eco-efficiency measurement is clear in the assessment, because the indicators stress on the use of resources, environmental performance, regulatory compliance, instead of sustainability indicators that stress in the performance and interaction of environmental, social and economic impacts. The main difference between the eco-efficient and sustainable improvement is the mindset of change, in the first one, this is just incremental change, while the second improvement involves a comprehensive and systemic change, as well as incremental efficiency, for achieving sustainability. The next aspect according to Shiberg is if it measures processes and motivations. Sustainability is a complex process that takes time to be achieved; therefore, it is very important to take into account this long-lasting nature. In order to do so, the indicators must inquire about mission, rewards, incentives, so there can be infer dynamic processes and motivations such as the direction, strategy and comprehensiveness (Shiberg, 2002). Green Metrics does not measure this processes and motivations; therefore it does not measure sustainability as a dynamic nor complex process, instead, it measures eco-efficiency in the institutions (Araujo, 2016).

The next assessment tool evaluated was ARIUSA. The present assessment tool does identify important issues, and its indicators are the proof of this because they measure the efforts and effects addressed in the social, economic and environmental areas. Therefore, the SAT identifies issues with broad effects and influence, enhancing an integral sustainability assessment. An important characteristic of the SATs is that it has to be calculable and comparable in order to measure status, progress, priorities and direction. This is a flaw in

ARIUSA, because it is flexible enough to capture the complexities and differences of the organization, but still is not specific enough to be calculable and comparable. Therefore, the ability to calculate the progress towards sustainability is a limiting point in the present assessment. By the indicators, it can be observed that ARIUSA enhances sustainability in an integral way, not taking just into account the efficient use of resources, therefore, it moves beyond eco efficiency. ARIUSA is probably, among the three assessment tools, the one that focuses the most in a significant way in the measurement of processes and motivations. The indicators indeed question about the decision-making process, long-term programs, mission, and vision, among others (Shiberg, 2002). In order to achieve sustainability change, ARIUSA not only pursues the “what” question, but also the “why” and the how. This aspect is really important because the why and how are related to governance, and this is a key factor for achieving sustainability inside the institutions (ARIUSA, 2016). A break point in the present assessment is that it does not enhances comprehensibility, meaning that the true purpose of the indicator might get lost due to the confusing and complex narration of the assessment as a whole (Shiberg, 2002).

The last assessment tool evaluated was STARS. This SAT, as well as ARIUSA, identifies the important issues mentioned above, therefore, it measures and enhances the practice of sustainability in an integral, systemic and holistic way. STARS indicators are indeed calculable and comparable; therefore, the assessment is able to calculate the progress towards sustainability, through ways that measure the status, progress, priorities and direction of the institution (Shiberg, 2002). STARS moves beyond eco-efficiency, therefore it measures true sustainability by stressing issues in the environmental, social and economic spheres. As a result of this, STARS takes into account both approaches, the eco-efficiency and the systemic vision of the spheres mentioned above. The measurement of processes and motivations is also implied in the present SAT, so it inquires about the process oriented outcomes, the dynamic processes, and the present impacts of the institution. And finally, STARS does stress comprehensibility, specifically to the broad range of stakeholders that attain to the SAT assessing their institutions (Araujo, 2016).

	Green Metrics	ARIUSA	STARS
Identifies important factors			
Countable and Comparable			
Transcends eco efficiency			
Measures processes and motivations			
Is comprehensible			

Graph 17. Shieberg`s assumptions accomplished per SAT

Although there is no assessment tool that is the panacea for sustainability assessment, in the present paper, it can be concluded that STARS is the more integral tool, which takes into account the most important areas related to sustainability, and aims to improve the practice of sustainability in a long term through various methods. This is a really important outcome, because as it was mentioned before, the quality of the assessment tool is as important as the practice and development of sustainability in the institutions (Yarime, 2012).

After evaluating the assessments previously described, it can be concluded that there is still a long path in order to make USFQ a sustainable university. Yet, the silver lining of the assessments is that the sustainability break points of the university can be identified work can begin to ameliorate those. It is clear that sustainability is not an issue that can be worked and solved in short term; instead, it is an issue that must be constantly improved, through several perspectives, in a long term (www.dlsweb.rmit.edu.au, 2017). Sustainability cannot be solved just by improving energy or water efficiency, or by creating outreach engagement solely; instead, it must be worked from several areas, in a holistic way, taking into account the relations and interactions among all the components. The system that is composed by various components that interact with each other is referred as a complex system. Therefore, sustainability is indeed a complex system and must be worked and understood taking that into consideration. As a result, the fact of working in just one area does not solve the problem as a whole. The real solution, according to complex systems, is to approach the problem from several edges and areas, taking into account their interaction. In the sustainability debate, all the areas must be improved and taken into account in order to achieve a real positive result (Sterman, 2000).

In order to improve, it is important to have a baseline about the sustainable performance. This is precisely the objective of the three assessments. Once USFQ got the results from Green Metrics, it will be feasible to improve the areas that, according to the assessment, need work. Among the areas that need more improvement in USFQ are Transportation, Water, Energy and Education. In the following paragraphs, it will be proposed ways to improve the sustainability level based on the results from Green Metrics and the other SATs evaluated previously.

According to the assessments evaluated in USFQ, it has to improve several areas. A really important area, but not the only one, is sustainable investment and university budget for sustainability effort. This is a critical area, because budget is very necessary in order to achieve sustainable improvements, and generally, at least in Ecuador, is not the main priority for universities (STARS assessment, 2017). Therefore, it must be proposed a way in which capital is handed for sustainable projects, which can surely pay back, taking into account that USFQ does not have endowment.

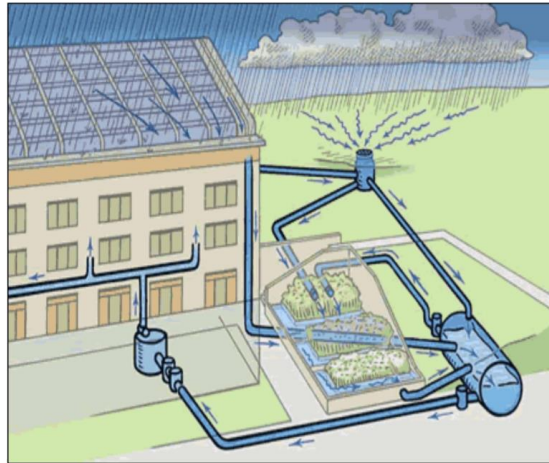
An interesting approach for solving this problem are the Green Revolving Loan Funds. The functioning of these green loans is simple and beneficial for all parts. Basically, a specific sum of money is granted to the fund, which finances sustainability projects which as a result, generate quantifiable monetary savings and returns. Those monetary gains are later reinvested in the fund and other sustainable projects until they are paid off. There are three types of green revolving funds: efficiency funds, innovation and engagement funds, and hybrid funds. Efficiency funds are those where capital is provided for resource efficiency, such as water and energy programs. Therefore, while the resource use is significantly reduced, money is saved. The payback period for this type of projects tends to be short. The purpose of Innovation and engagement funds is to engage the community in these projects. The third type is hybrid funds, which tend to reduce the use of natural resources, savings in costs, and engaging and educating the community as well as outreach goals. These funds can be administered by finance, sustainability or administrative departments. Examples of projects financed by these funds are: investing on efficient technology for reducing the consumption of water and electricity, improving the rates of recycling in the university, and the introduction of programs intending to modify students behavior and become more aware about sustainability in the campus and in their home and work life (Diebolt, 2007).

Universidad San Francisco, according to the sustainability assessments applied, needs the hybrid type of fund, involving efficient use of resources and community engagement. In the efficient use of resources, there are several break points that need to be improved, such as energy efficient appliances, renewable energy produced, water conservation, among others. In the community engagement area, there are also several projects that must be implemented concerning assessing sustainability culture, employee educators program, participatory governance, strategies to promote investigation, environmental courses and student organizations and events. In the following paragraphs, it will be discussed and proposed solutions and programs that could be solved with the Green Revolving Fund (STARS assessment, 2017).

Energy efficient appliances have been partially applied to USFQ's installations. As it was mentioned in the assessments, the library, chancellery and kitchen have replaced their regular light bulbs with LED light bulbs. This has involved a great efficiency in terms of kWh used (75%), its subsequent money save and decreased CO₂ emissions (Airis, 2017). Therefore, a simple way to achieve energy efficiency is by changing all the light bulbs to LED lighting. This can be the first step in order to collaborate sustainability inside the campus.

The renewable energy produced in campus is extremely low, being 167 kWh yearly, quantity produced by the solar panel. Clean energies are a really important factor to take into account if the university wants to decrease CO₂ production. Therefore, although they are still expensive, solar energy could be the most suitable energy for the campus. There is plenty of space to place the solar panels, such as the roofs of the buildings. Therefore, although the investment is high, the energy efficiency will increase, and there will be a great amount of avoided CO₂ production.

Water efficiency appliances, water conservation and water recycling are a significant break point in USFQ sustainability. In the installation of water efficiency appliances, it will reduce significantly the quantity of water used per flush. If efficient installations are placed, taking into account the efficient water standards, it could be saved approximately 74,4 liters per flush of all the installations, such as urinaries, toilets and sinks. For the conservation and recycling program, there are several activities that can be done, although they take time and money. For example, based in the program made by Yale University, they installed a rainwater harvesting system, which will be repaid in 10 years and will save up to 500.000 gallons of potable water annually. The water recollected is used for toilet flush and plant irrigation. In the image below in can be seen how the system works (Graph 18). Water audit is also recommended in order to prevent wastewater around the campus installations. Finally, it is also really important to create awareness of water conservation in the students and the university faculty and staff, through campaigns and conferences (Deval, et.al, 2008).



Rainwater Harvesting System at Yale University: Stormwater from roof and the ground collects in tank at upper right, which empties into pond, where it is cleansed and diverted into larger harvesting tank. The water in harvesting tank is pumped to another tank for use inside and back into the pond. Illustration: Gregory Nemeec.

Graph 18. Rainwater Harvesting System Example (Deval, et.al, 2008)

An important issue that is currently in research phase in USFQ is the sewerage disposal, which is currently disposed untreated to waterways. It is very important to implement a process for treatment for those waters; otherwise, they can cause serious pollution and affect human and ecological health. The regular process for treating sewerage waters is composed of a preliminary treatment and three treatments. The preliminary, first and second treatment aim to remove large solid materials, settleable solids by sedimentation, and reduce the BOD exerted by reducing organic matter respectively. That is a standard process. The innovative process proposed for the treatment of sewerage waters in USFQ is for the tertiary process (Ochoa-Herrera, 2017). The purpose of the process is to remove ammonia, nitrate and phosphate. There are chemical and biological ways to do so. According to studies, biological processes are very effective and cheaper than the former ones. The biological way is implemented by the use of microalgae cultures. Microalgae use inorganic nitrogen and phosphorous for their growth, at the same time they treat the water. Algae also remove heavy metals and toxic organic compounds; therefore they do not cause secondary pollution, as do the chemical methods. Apart from removing nitrogen and phosphorous, algae can remove coliform bacterial from the wastewater (Abedel, et.al, 2012). This process of water sewerage treatment is extremely important, and should be among the first activities worked in USFQ.

One last activity that has been partially taken into account in USFQ is the efficient use of paper. Even though an important change in the way students hand in their homework, through D2L, has been executed, or the e-books handed in the classes, there is still a lot of pristine paper used in the campus. The Xerox, that is the in campus print station, utilize solely pristine paper, which is not recycled nor reused. Therefore, that is not an efficient use of paper. There have been adopted in other universities policies related to this issue that could be implemented in USFQ. For example, in the Ohio State University, they adopt a policy that ensures that the copy paper used in campus has at least 30% of recycled materials in it. Also, the University of Vermont, is beginning to switch to 100% post-consumer recycled, chlorine-free paper for the copies and prints they have to make. The change to recycled paper would

be an important step to take in USFQ and would have very positive consequences for the environment (Deval, et.al, 2008).

There is a transition point between the resource efficiency use and the community engagement in the practice of sustainability in USFQ. That transition is the use of the university as a living lab with the purpose of co-producing knowledge in the community. Living labs are a kind of experimental governance, where the stakeholders apply technology and inquiry about process to address the challenges promoted by climate change and urban sustainability (Evans, et al, 2015). Thus, experiments are executed in the universities installations and then in the outer world. Due to the fact that research needs monitoring and learning, it is a great way to connect students to applied research. Consequently, it is a way that brings together researchers, students, external stakeholders, environmental consultants, and also, it creates knowledge about sustainability technologies and services, in the facilities of the university. More specifically, the sustainability labs deal with issues such as building design, green infrastructure and low carbon technologies. As a result for students, they can learn skills and get knowledge of the real world that will prepare them for the competitive job market (Evans, et al, 2015). Examples of projects that could be designed in USFQ are: analyzing the viability of applying clean and renewable energies in the campus, analyzing a smart growth model for the campus, creation of budget for water conservation and recycling strategies, evaluation of species living in the campus for the pest management program, carbon offset opportunities taking into account the campus emissions, among others (STARS, 2015).

The engagement of the community is really important for achieving sustainability, and is an area the Green Revolving Loan Fund considers a transcendental part in the hybrid projects. According to the assessments for USFQ, there are several break points in this area. Among the main ones are: quality of environmental courses, assessing sustainability culture and sustainability planning. In the following paragraphs programs to solve these issues in the University will be described.

In the Education section, some break points, as well as some sustainable achievements were found. According to Orr, it is very important that all students receive throughout their career environmental and sustainable concepts such as: the laws of thermodynamics, basic principles of ecology, carrying capacity, energetics, least-cost, end-use analysis, sustainable agriculture and forestry, steady-state economics and environmental ethics. These courses give the students a wider perspective of the relation of the environment and sustainable aspects with their respective careers (Orr, 1991). It is very important that the environment and sustainable courses would not be just theory, instead, they must show the way in which these topics are related to the whole education and information system, and teach ways in which students and future professionals can make the impacts in the environment positive, or at least not negative. Environment and sustainability skills cannot only be taught in theory, they must also be practical. In USFQ there are few courses that deal with this, PISA and design thinking. The courses are very complete and useful, however, they reach few students; hence, the knowledge is not spread throughout the community (ARIUSA assessment, 2017). There are several procedures to teach sustainability skills. For example, there are the Eco-Reps at Tufts University. Eco-Reps is a hybrid between regular courses and internships, and has the purpose of increasing student awareness of environmental issues and promoting green campus initiatives. Eco-reps impart a weekly class that offers topics such as recycling and waste prevention, climate change, water resources, food and the environment, population and consumption. This modality is really efficient and

transcendental because knowledge is better acquired by practical teaching than theoretical ones (Deval, et.al, 2008). This type of imparting knowledge modality is very important for the students of USFQ, so they can relate sustainability and be able to deal with real world problems in the future. Therefore, since the first semester 2017/2018, there has began to impart those Eco-Reps courses, being currently scrutinized about their operation and results.

Education is a two-way deal; students don't just receive the knowledge and information, but they also use it for empowering and participating in sustainability development programs. According to Lyons et al., the participation of people in development programs is a chain. First, students must receive training in usefully transferable skills, this will cause them to empower in a personal, project and community level. Once they are fully empowered, they will be able to contribute to the development of sustainable development projects, and as a consequence, will contribute to the expansion of the notion of sustainable development throughout the community. As a matter of fact, education is transcendental to empower students and get them to participate in sustainable development programs along campus and in real life projects (Lyons, et.al, 2001).

In order to work for the engagement of the community in sustainability issues, a baseline must be created, and this is done through an assessment of sustainability culture. In USFQ an assessment has not been made, but it can incorporate assessments created by other universities. For example, the University of New Hampshire has created an online survey based in the practices recommended by AASHE. They implemented the survey in 2016 and have conducted it annually. The survey was composed of several sustainability-related questions, and was imparted for students, faculty staff and administrative personnel. The questions were about sustainability perception, interest level on sustainability aspects, engagement in sustainability programs, sustainability knowledge, and sustainability criteria, among others. The importance of assessing sustainability culture is that it gives a practical baseline from which can be considered strategies to promote sustainability engagement in the campus (STARS, 2017).

Sustainability practice and engagement is a complex system, and must be achieved through several perspectives, however, the basis of all the sustainability movement in a university, are the local policy (Lyons, et.al, 2001). This area is the one in charge of regulating and promoting the appliance of sustainability along the campus, thus, it is very important the existence of a published strategic plan, or a guiding document that includes sustainability at a high level. USFQ does not have such document or policy, and it is extremely important to develop one and apply it in the university. A plan has to be developed for the specific economic, social and environmental situation of USFQ, still, a plan from another university could be taken as a basis for the development of a proper plan. According to the STARS assessment, the University of New Hampshire got a score of 4 out of 4 points in sustainability planning, therefore, it could be a good role model for developing the university's plan. The strategic plan of that university has developed "commitment to sustainability" as one of the six visions and values inside the plan. Also, the Sustainability Institute is considered one of the four targets for strategic academic initiatives to develop working relationships and academic interdisciplinary programs. The Sustainability area is a great section of importance in the plan of New Hampshire University, and it addresses several areas of sustainability. Within the strategic plan, they mention the sustainability objectives and published plans for important areas such as: curriculum, research, public engagement, air and climate, buildings, energy, grounds, purchasing, transportation, waste, water, investment and finance, among the principal. Therefore, for each category mentioned,

they have developed strategies to improve them and achieve sustainability in the campus site (STARS, 2017). A strategic plan referring to sustainability is extremely important to develop in USFQ. It can be seen an example of sustainability planning for USFQ in the Appendix section.

With sustainable planning, the most important issues from Universidad San Francisco de Quito have been covered, as well as different methods to solve them. As it was mentioned before, sustainability is a complex system that must take into account several factors and variable in order to have a real improvement. The assessments that evaluated USFQ focused in 5 important major areas, that were: Operations, Research, Education, Engagement and Outreach Services. By developing a baseline about the sustainability level in USFQ, it is possible to search for strategies in order to improve the execution of it in the campus. Although there can be several methods to reach sustainability, it is extremely important to take into account that politics have major influence in the university, and the most efficient way to achieve sustainability is by approaching the politics and exercising influence in them (Lyons, et.al, 2001).

Sustainability is not just a way of accomplishing the law or merchandising the university, instead, it is the way in which universities (in this case) can decide to cause either a positive or negative impact in the environment. Taking into account that the impact they exert will not only influence the present generations, but especially the future generations. It is in the hands of every actor of the society to leave a better or worse world for the present and future generations, taking into account the social, economic, and environmental capitals (Cortese, 2003).

5 BIBLIOGRAPHY

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6 APPENDIX

Sustainable Planning for USFQ based on the Sustainable Planning for University of New Hampshire (STARS, 2017)

*It is important to develop a published strategic plan that includes sustainability practices

For example, University of New Hampshire has, within its strategic plan, a headline specific for commitment to sustainability in the "visions and values" section. It has several objectives related to sustainability that must be achieved by 2020. Those objectives are part of several sustainability areas, such as curriculum, research, operations, planning and administration. Therefore, for USFQ, the objectives from the strategic plan can be proposed for 2025 in all the areas previously mentioned.

List of measurable sustainability objectives that address Curriculum

- First, there must be created incentives in order to develop courses related to sustainability,
- Every student from USFQ will gain knowledge of the complexities and interconnectedness of economic, environmental, and social challenges
- The number of courses dealing with sustainability will rise from 91 to 110, and will be dispersed in many faculties different from biology and environmental engineer.
- It will be developed courses related with immersive experience for students from several faculties
- All the previously mentioned objectives must be accomplished for January 2020

List of measurable sustainability objectives that address Research

- There must be developed incentives in order to promote sustainability research
- Increase the funds designed for sustainability research
- Encourage inter-faculty research, facilitating and strengthening faculty from different schools withing USFQ to engage in common research
- Increase the publication of research findings related to sustainability
- Develop initiatives for open-access information related to sustainability
- All the previously mentioned objectives must be accomplished for January 2020

List of measurable sustainability objectives that address Engagement

- Assess sustainability culture
- Develop an employee educators outreach program

- Continue to work with state and regional partners to reach integrated solutions to face the present challenges such as climate change
- Continue to grow the number of meaningful relationships between university faculty, staff and students with the communities
- All the previously mentioned objectives must be accomplished for January 2020

List of measurable sustainability objectives that address Operations

- Develop timelines, targets and action items under a USFQ Climate Action Plan to help move USFQ towards carbon neutrality
- Develop immediate and future actions to reduce energy costs, lower greenhouse gas emissions and improve energy and water conservation through technological improvement, increase in efficiency
- Develop programs for conservation and recycling of water
- Implement sewerage programs at a university level
- Develop and implement an improved tracking system for sustainable purchases (food, electrodomestics)
- Increase local and regional produce procurement
- Strengthen the ecosystem management of the campus
- Maintain and expand the USFQ composting program
- Develop incentives for recycling within USFQ`community
- Keep promoting the program "Auto Compartido"
- All this objectives must be accomplished by January 2022

List of measurable sustainability objectives that address Planning and administration

- Research sources for obtaining seed capital for creating a Green Revolving Loan
- Keep developing and modifying the present sustainable planning, in order to achieve a higher level of sustainability through time

