

A SUSTAINABILITY ASSESSMENT
FRAMEWORK FOR UNIVERSITIES

By

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To the Faculty of University of Twente:

The members of the Committee appointed to examine the thesis of JAY SANGHVI find it satisfactory and recommend that it be accepted.

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A SUSTAINABILITY ASSESSMENT FRAMEWORK FOR UNIVERSITIES

Abstract

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Universities act as a training ground for our future leaders and these training grounds provide an immense opportunity to deliver innovative solutions to some of our society's toughest problems. Universities with their enormous endowments along with their presence in the social sphere have the unique advantage of shaping our ecosystems, societal structures and human well being. This thesis assignment began as a need to further define sustainability at universities, analyze the different metrics involved in the application of a sustainability assessment framework and a way to compare these metrics with universities around the world. Assessment frameworks in existence are focused on universities in the Global North and the sustainability parameters of the Global South are often missing, there is a need for a framework which crosses spatial and cultural boundaries to allow for comparison and benchmarking of university performances. This framework aims to be applied across different spatial and cultural locales which makes it relevant for universities across the world.

This study was aimed at creating a sustainability assessment methodology for universities using a mixed method research design. The primary data was aggregated from key interviews and online correspondence with experts in the field while the secondary data was aggregated through literature and other online sources. A series of existing assessment frameworks along

with their category/indicator selection criteria, methodologies and benchmarking methods were critically examined and this assessment framework was created building upon these existing frameworks. This framework includes 16 broad categories under which there are 68 indicators which help in an extensive review of a university's sustainability efforts. This framework went through a series of reviews where this framework was examined closely and refined to fit in with the project's research objectives. After the framework was refined, it was applied at one Dutch university (University of Twente) which scored a 4.88 out of 10.

To conclude, future research can be focused on expanding upon this framework by inclusion of new relevant categories and indicators along with expansion of the scoring model ranges to incorporate a higher degree of accuracy to better reflect a university's performance.

Key words : Campus sustainability, assessment frameworks, sustainability indicators, sustainability categories, scoring model sustainability universities

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Chapter One

Introduction

1.0.1 Background

Environmental sustainability started gaining traction in the 1970s when environmental degradation began to be palpable globally and started threatening the social and economic well being of every nation. This was the time when theories such as 'steady-state economics' by Herman Daly and 'the limits of growth' by a group of MIT scientists began to popularize. These theories recognized the absolute limits to economic growth and postulated that the Earth with its burgeoning population and its relentless exploitation of the natural resources will cause severe stresses to our planet's ecosystem which will be unsupportable on our planet by the 22nd century (Meadows 1974). The most important takeaway from these theories is that humankind has the ability to survive if strict limits are imposed on our creation, consumption, and procreation patterns. This is in line with the famous words by Mahatma Gandhi "The world is enough for everyone's need but not enough for everyone's greed" (Balch, 2013).

These theories were often criticized for having a pessimistic outlook of the world but it began a new wave of environmental reforms among private organizations, governments, and the people. The Dutch government's cycle-friendly policies in the 1970s is a fine example of the environmental reforms from this decade. Massive protests were held all over the Netherlands to reduce car usage, provide safe cycle infrastructure and improve the environment.

These protests proved to be effective and the government built a robust cycling infrastructure which has been a tremendous success in terms of saving lives and reducing emissions (Bicycle Dutch, 2011). This environmental wave of the 1970's also brought about the creation of the United Nations Environmental Programme (UNEP) which aimed to coordinate global sustainability efforts and set targets for every nation for its sustainable development. This creation of UNEP was formalised at the United Nations conference on Human Environment in Stockholm in 1972. This conference was also where the inception of sustainability in education was first discussed. Education was formally acknowledged as an important role in the propagation of sustainability principles and in fostering environmental conservation.

Since then, more higher education institutions (HEIs) have become engaged in embedding environmental education and education for sustainable development (ESD) into their system (including education, research, campus operations, community outreach, and assessment and reporting (Cortese, 2003; Lozano, 2006b). Since then, HEI's have also been actively involved in the signing of declaration, charters and initiatives in incorporating sustainability into their workings. More than a 1000 universities from across the world have ratified their commitment to this goal by signing up for these charters and taking suitable actions. Table 1.1 presents the ten most widely recognized initiatives in higher education for sustainable development . These initiatives are widely recognized by experts in the field who believe that they are comprehensive and involve a sizable number of universities.

Year	Event / Declaration	Description
1990	Talloires Declaration, Presidents Conference, France	Started off by Tufts University at their European Centre in Talloires, it involves a ten-point action plan of inculcating sustainability in education, research and operations at universities. To date, over 300 colleges have signed this declaration. (Talloires Declaration, 1990)

1991	Halifax Declaration, Conference on University Action for Sustainable Development, Canada	A seven point action plan for educational, research and public service roles of universities enabling them to become competent, effective contributors to the major attitudinal and policy changes necessary for a sustainable future (Halifax Declaration, 1992)
1993	Kyoto Declaration, International Association of Universities Ninth Round Table, Japan	The Kyoto declaration is an embodiment of both the Halifax and the Talloiries declarations and is signed by 90 universities at the Ninth Round Table meeting in Kyoto, Japan (Marelli, 2011).
1993	COPERNICUS University Charter, Conference of European Rectors	German based organization which aims to inculcate sustainability in education via smart partnerships between the industry and the universities. It also promotes interdisciplinary collaborations. Staff education and audit participation to its 300 universities in 37 European countries (COPERNICUS, 1993).
1999	Dutch Charter for Sustainable Development in Vocational Training	This charter began due to the growing dissatisfaction with the Copernicus charter and it includes checks and a ratings system to judge a university's level of sustainable development. The main goal of this charter was to integrate the Dutch colleges and have a common system of sustainable development and it was signed by 31 colleges (Lozano et. al. 2013)

2000	GHESP	The Global higher education for sustainability partnership began its roots at a joint meeting between University leaders for sustainable future (ULSF), COPERNICUS, UNESCO and International association of universities (IAU). Every partner involved in this meeting concluded that universities must play a more central role in propagation of sustainability (ULSF, 2000).
2001	Lüneburg Declaration on Higher Education for Sustainable Development, Germany	The Lüneburg declaration was a move to re-affirm the participation and commitment of universities in applying the Talloires, Kyoto and the Copernicus declarations. Moreover, further emphasis was made on the importance of education in promoting sustainable development (Lüneburg Declaration, 2001).
2004	The Declaration of Barcelona	The Declaration of Barcelona called for a holistic, critical thinking and a systems based approach to sustainability for engineers. Although heavily focused on engineers, its principles can be valid for any discipline (Declaration of Barcelona, 2004).

Table 1.1 Widely recognized sustainability charters, declarations and initiatives for higher education.

The importance of these charters in the early 2000's is observed by the number of universities interested in signing them. The first sustainability charter - The Talloires Declaration was signed by 356 university presidents who came from 40 different countries. Most of these declarations from the late 1990's to early 2000's were from Europe (7 out of 11). Moreover, the signees of these documents were approximately, 30% from the Global South and 20% from the former Soviet Union countries. (Corcoran, Calder, Clugston, 2002). The difference

in these charters is well highlighted by the research carried out by Lozano et. al. (2013).

Effort	Curricula	Research	Operations	Outreach and collaboration	Universities collaboration	Assessment and Reporting	Trans- disciplin
Talloires Declaration	✓	✓	✓	✓			✓
Halifax Declaration	✓		✓	✓			
Kyoto Declaration	✓	✓	✓	✓	✓		
Swansea Declaration	✓	✓	✓	✓	✓		
COPERNICUS Charter				✓	✓		✓
GHESP	✓	✓	✓	✓	✓	✓	✓
Lüneburg Declaration	✓	✓		✓			
Declaration of Barcelona	✓	✓		✓		1/2 (✓)	✓

Table 1.2 Comparison between charters

It is evident from table 1.2 that almost all of the above mentioned charters have taken into account four out of the six initiatives : Curricula, Research, Operations and Outreach Collaboration. Only The Declaration of Barcelona and GHESP mention the reporting and assessment criteria of charters. Although, signing up for a charter is one step, their actual implementation, monitoring and active assessment is another. The charters help in ratifying a university's commitment to the cause of sustainable development while a sustainability framework helps in understanding the steps that need to be taken to achieve these goals. This is where the role of sustainability frameworks takes shape as it aids the universities in understanding their positives and shortcomings, and provides the areas of the university where sustainability principles need to be applied.

1.0.2 Problem Statement

The definition of sustainability is often malleable and can be different based on the geographical context. Sustainability frameworks developed in the Global North often have categories included in them that are not considered to be crucial in the Global South. For example, issues such as carbon emissions and wage gap are predominantly Northern issues that are often dictated at the global level. Southern issues such as access to continuous water and electricity supply, and severe housing shortages are not sufficiently reflected in these sustainability frameworks (Redclift, 2001). It is important to have frameworks which are fine-tuned to a university's local conditions, national conditions, community, culture, and inculcate suitable global trends in them (Lozano, 2013). The most widely used definition for sustainability is given by the Brundtland Report (1987): "meeting the needs of the present without compromising the ability of future generations to meet their needs". This statement is contentious in the sustainability sector due to it not accounting for geographical context, ecosystem boundaries and the renewal cycles of natural, economic and social ecosystems (Holling, 1992). The definition of sustainability given by (Hollins, 1992): "sustainability is the capacity to create, test, and maintain adaptive capability" is the one that this report follows. In a nutshell, this definition says that as long as the system can adapt, it is sustainable (Voinov, 2007).

The most widely adopted university sustainability frameworks such as STARS and People & Planets have their own scoring systems which rate universities on how sustainable they are. These scoring tools offer a host of benefits like knowledge sharing wherein people of all backgrounds can easily understand the problems at stake, help in a consistent and impartial decision-making, and help in pinpointing the most crucial areas that need to be worked upon. Scoring based frameworks follow the weighted scores method wherein the categories and the indicators are weighted according to their importance. For example in the STARS framework, the category of Air & Climate is accountable for 5.2% of the total points and this

category has two indicators. The indicator 'emission inventory and disclosure' accounts for 27.27% while the 'greenhouse gas emissions' accounts for 72.73%. The method of assigning these numbers as weightages for these categories and indicators are confidential and not publicly available.

While there are other frameworks such as Annual Environmental Report (University of Calgary) and Penn State Indicators report (Penn State University) which do not have scoring in their frameworks and are meant to be more of a self-reflection report. These frameworks are tailored and highly customized for their universities which helps in understanding the university environment, its operations and its stakeholders at a greater depth than the scoring based model. There are advantages and disadvantages to both these types of frameworks and careful analysis must be made about the university's needs before adopting a scoring based framework or a customized framework.

1.1 Research Objective

The principal objective of this thesis is to create an assessment framework which will aid in understanding the different areas of operations in a university and how sustainable they are. It will also help in gauging the level of sustainability at universities. This newly created assessment framework is called university sustainability assessment framework (USAF) and is further demonstrated by using it in a case study: University of Twente (Netherlands).

1.2 Specific Objectives

This research has been motivated by the following specific objectives

1. To assess and include categories and indicators in the framework that are relevant
2. To assess the possibility of inculcating a scoring system within USAF

3. To identify the main factors influencing sustainable development at the University of Twente

1.3 Research Questions

1. To assess and include categories and indicators in the framework
 - (a) What are the categories and indicators that could be used to assess universities in terms of sustainability?
 - (b) What are the kinds of data that universities collect? Would the category/indicator be feasible to assess under these data collection practices?
2. To assess the possibility of inculcating a scoring system within USAF
 - (a) What are the advantages and challenges in implementing a scoring system in a sustainability assessment framework?
 - (b) What will the weights of the different categories & indicators in the scoring system of this framework be?
3. To identify the main factors influencing sustainable development at the University of Twente
 - (a) What are the recommendations that can be provided to the university based on this assessment frameworks application?
 - (b) What are the general conclusions that can be gathered from this assignment?

1.4 Thesis Structure

This thesis report is organized as shown in the table below.

Chapter	Description
Chapter 1	This chapter covers the background, problem statement, research objectives and the research questions.
Chapter 2	This chapter discusses the methodology, processes followed and further explanation of the processes
Chapter 3	This chapter explains the different categories and indicators of the USAF
Chapter 4	This chapter presents the data aggregated after application of this framework on the case study (University of Twente)
Chapter 5	This chapter analyses the case study application and provides recommendations to the University of Twente
Chapter 6	This chapter ends with concluding statements and areas of future research

Table 1.3 Thesis Structure

Chapter Two

Methodology

This chapter of methodology starts with the explanation of the steps undertaken to create this framework. A 5 stage process was developed to achieve the objectives of this thesis as shown in figure 2.1. The explanation of each of these stages has been given below along with the data requirements and the type of data. There is some overlap between some of these stages which is expected.

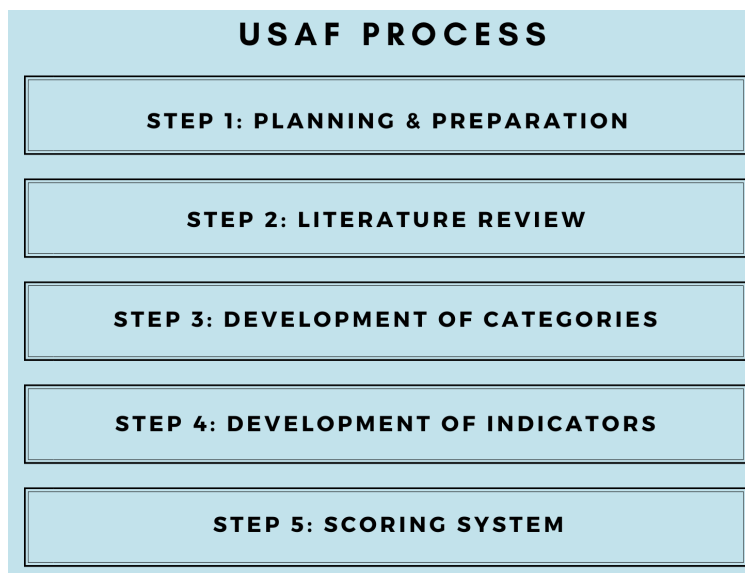


Figure 2.1 USAF Process

2.1 Step 1: Planning & Preparation

From the period of October 2019 to Feb 2020, a thesis proposal was created for this assignment which involved creating a comprehensive literature database, review of key stakeholders in the project, mapping of the case study locations, scheduling of other tasks and a timeline for this project. Moreover, the important steps that had to be undertaken after the thesis proposal was complete, was highlighted and the thesis assignment was then underway.

2.2 Step 2: Literature Review

Sustainability frameworks have steadily been used in universities since the late 1990's and there exists a rich collection of frameworks that have been developed in different parts of the world. These frameworks also help in understanding the socio-cultural and institutional differences that exist in different parts of the world. The search terms that were used are '(Sustainability* or environmental* or social* or educational*) AND (assessment*) AND (frameworks* or reports or system*) AND (universities* or colleges*)'.

There are a multitude of assessment frameworks which have been created for the purpose of assessing a university's sustainability efforts and because of the multiple options available, it is imperative to define what a 'good' sustainability framework is. The following criteria were devised to ascertain if it is a 'good' framework or not –

- The framework has to be of high quality, scientifically valid and easily accessible
- The framework must incorporate a multitude of diverse categories of sustainability with equal weightage given to the various facets of sustainability.
- The frameworks must be dynamic and must be malleable for changing institutional and legal mandates
- The recentness of the framework

The following are the framework assessments that have been studied and incorporated in the making of USAF based on the above mentioned criteria. These frameworks helped in shaping USAF based on their positives or their shortcomings.

a. AISHE

AISHE (Assessment instrument for sustainability in higher education) was developed and validated in Netherlands in 2000-2001 by Duurzaam Hoger Onderwijs (DHO) and Niko Roroda. It is not limited to being an assessment instrument but it is a strategy and a policy instrument. AISHE 2.0 has been developed in the recent past to overcome the shortcomings of the first version and performs assessment via 5 main modules - Identify, Education, Research, Operations and Societal Outreach, all of which have six indicators each. This interactive tool requires a representative from the DHO who runs a short session about the tool and assesses workshop participants to describe future states of performance and the methods of reaching its goals. The main goal of this assessment framework is to assess the quality of sustainability in the education sphere. Although it is firmly grounded in participatory action, it lacks in covering several other areas – finance, governance, community, etc. Moreover, it is narrow in scope as it involves just 15 people to form the final goals and recommendations for the university's goals. While, these 15 people might be of sound scientific background, it is important to include and other stakeholders from the university as well.

b. Penn State Indicators Report

This massive project undertaken by Pennsylvania state university is different from the rest of the literature reviewed in the section as it was done with the sole focus of sustainability at Penn State and it is not meant to be a cross-institutional report. The assessment categories are extensive and cover a plethora of issues and grades the university using a 4 point scale system. The methodology for this 4 point scale system which ranges from a 'thumbs up' to

a 'thumbs down' and two other intermediate positions is not freely available. However, it is an excellent piece of work which is firmly grounded in participatory action and involves a multitude of stakeholders from all backgrounds. This report is a good starting point for policy makers in setting priorities for action and the replication of such work by other universities across the world would be a good starting point towards sustainability. This would help universities understand significantly about the problems faced at their campus. However, the lack of transparency for the performance ratings leave some questions unanswered and a future version of it with performance ratings would be extremely useful for other universities/researchers.

c. Campus Sustainability Assessment Review Project

This project was initiated by Dr. Andrew Nixon and Dr. Harold Glasser at Western Michigan University in 2002. This report reviewed 225 sustainability assessments across the world and defined a set of guidelines for this assessment. This report reviewed the major and the best campus sustainability reports from North America and Europe and used them in the creation of this report. It is a solid report that grades these 225 frameworks that they have reviewed and helps in understanding the differences in approach that different universities take. Moreover, it helps the reader understand the qualities of a good framework that helps it stand out among other frameworks. A weakness of this report would be that it draws out great quantities of assessment guidelines from other reports but it has not addressed the gaps in those reports and subsequently those gaps exist in this report as well.

d. STARS (The sustainability tracking, assessment and rating system)

STARS is the most widely used assessment system across the world. It serves as the baseline for campus assessment frameworks and includes diverse facets of sustainability in their assessment framework. Several other universities around the world have also partaken in it but it is heavily dominated by American and Canadian universities. It is a self reporting as-

assessment framework that measures relative progress towards sustainability. It has five main modules under which indicators are clustered – academics, engagement, operations, planning and administration, and innovation and leadership. These five modules have several sub categories and indicators which are given appropriate weights which helps in the assessment of these categories. The scoring system involves significant data collection about the university campus and its operations, which is why universities take up to a year to collect all the data required. It is done annually by a large number of universities and the progress/decline over the years can be monitored. The scores are awarded using the weighting system and the scores achieved by these universities help in understanding the strengths and weaknesses of the university. The scores tend to be on the stricter side and out of 1200 universities, only 6 have achieved the highest rating of 'platinum'. The major strength of STARS being that it prioritizes performance over strategy and it being straightforward to apply has made it a huge success.

e. Campus Sustainability Assessment Framework (CSAF)

CSAF started off as a undergraduate thesis project by Lindsay Cole along with 15 other researchers at the Royal Roads University, Canada. CSAF measures sustainability of a university using benchmarks – long term and short term. Over the years, CSAF has evolved substantially and has the most comprehensive indicators totaling 170. It measures the movement of the campus towards sustainability and has a simple approach dividing the sustainability assessment into two parts – the human dimension and the ecosystem dimension. The biggest drawbacks of this report are the massive quantities of data required for assessing a university and the absence of a scoring system. Long term and short term targets as proposed by this report can have clear geographical or temporal disadvantages which need to be addressed manually by a participating university.

f. Turkish Campus Assessment System (TCAS)

TCAS began as a thesis project by Cansu Tari at the Pennsylvania State University. It has a similar approach to campus sustainability as CSAF and adopts several principles from it such as the egg model of sustainability and some of the indicator categories. It is a comprehensive document enlisting the steps that Turkish universities must take to achieve sustainability in their campuses. The interesting aspect about this report is that the author has taken into consideration the local topographical conditions, the geo-political climate of Turkey and Turkish legislation into the picture and has a tailor-made approach to assess sustainability. This thesis project has six core categories under which there are several indicators – Academic Knowledge, Engagement, Building Environment, Operations, Planning and administration and Innovation. There are a total of 130 indicators making this a broad all-inclusive report.

g. People and Planet

People and Planet is a UK based student-run organization which assesses a university's sustainability based on their environmental and ethical performances. The assessments are carried out annually and have 13 indicators with appropriate weights. The data for these indicators are obtained from the university website or from other independent external verification agencies. The indicators are broad, easy to understand, verify and implement but the indicator questionnaires are changed every year making it challenging to compare to previous year's assessments. Several British universities undertake it every year to assess their university's progress and being a British run organization, the indicators and categories are tilted towards the sustainability problems faced in the UK. Moreover, assessments are verified based on the data available on the university website and this method of assessment can have several pitfalls, the most common one being the lack of publicly available information on a university website about its operations.

h. Sustainability Assessment Questionnaire (SAQ)

SAQ is a qualitative tool devised to assess the extent of sustainability at a university. It measures sustainability in 7 critical areas and is a useful tool for any university to jump-start their sustainability assessment but it lacks in other ways as there is no way to compare or benchmark the findings and could be challenging to find some of the answers in the questionnaire. These questionnaires are sent to relevant stakeholders on campus whose answers are noted and the commonalities found among answers are presented as results. While being a very basic questionnaire of 25 questions, it can be a starting point for universities wishing to involve themselves in a sustainability assessment of their campuses.

i. Hokkaido University Sustainable Campus Assessment System

A comprehensive document created by the Hokkaido university titled ‘How to create sustainable campus assessment system’ is a rich source of data that lists the steps to be followed to create a framework for assessing sustainability at universities. This framework then compares five leading assessment frameworks from all over the world in terms of their categories, indicators, and objectives which helps in understanding the key differences in approach among frameworks in different areas of the world. It is easy to understand this document and grasp the full extent of it if the reader possesses prerequisite knowledge of assessment frameworks and is otherwise a difficult document to follow. Moreover, it is not a framework on its own but more of a guiding document on how to create a framework. It helps the reader understand the various steps to be followed and the gaps in current sustainability assessment frameworks that need to be filled.

j. UI Green Metrics

UI Green Metrics started off as an initiative by Universitas Indonesia in 2010 because the university felt that practices of that time did not reward universities working to increase its

sustainability efforts on their campuses. They believed that the process had to be overhauled and they started off their own framework having 6 categories and 39 indicators. It is basic and does not involve collecting large amounts of data. Moreover, they even developed their own scoring system and decided to rate universities on a scale of A-F instead of a numerical score to ease comparison between universities. While the framework is robust and the scoring system works well, the biggest drawback of this framework has been its lack of attention to the social sphere of sustainability. It is specifically targeted towards universities in the Global South that wish to operate and educate its university in a more sustainable manner

2.3 Step 3: Selection of dimensions and categories in USAF

The selection of different categories for USAF is a challenging prospect due to various considerations such as category placement, category viability, ease of quantification, relevance and importance. Before choosing the categories for this assignment, it was imperative to assess the main dimensions under which categories would be put under. Dimensions in this assignment are the broad umbrella terms under which categories would be assigned. Selecting the dimensions would be the first step and this assignment took inspiration from the egg model of sustainability which was introduced by IUCN in 1994 which illustrates the relationship between people and ecosystem as one which is co-dependent on each other. Just as an egg is good only if both the white and yolk are good, so a society is well and sustainable only if both, people and the eco-system, are well. Social and economic progress will only take place if the environment offers the required resources: natural resources, infrastructure for new manufacturing sites , employment, constitutional attributes (recreation, fitness, etc.). The ecosystem must thus be viewed as a super-coordinated structure with respect to the other aspects of the triangle or prism models: societal, financial and institutional (Stone,

2012). This model believes that social and institutional characteristics of our society will only flourish if the ecosystem flourishes. This model is a simple, easy to understand and apt for the creation of this framework.

In the egg model of sustainability, the dimensions are ‘people’ and ‘ecosystem’. The people dimension explains about the sustainability principles involving the members related to the organization in question while the ecosystem dimension explains about the local ecosystem in place and the rules/regulations affecting it. Several categories can then be assigned to these dimensions.

EGG MODEL OF SUSTAINABILITY

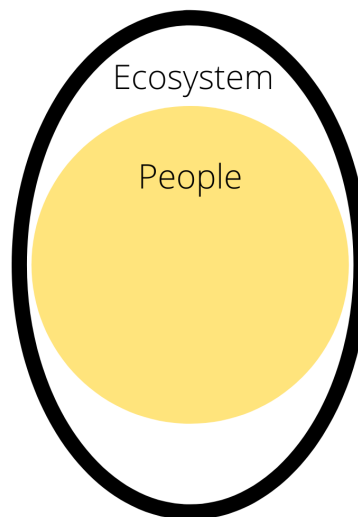


Figure 2.2 Egg model of sustainability IUCN : Guijt & Moiseev (2001)

USAF went a step further and the ‘institution’ dimension was added to it as shown in figure 2.3 The institution dimension addresses the process of decision-making, boards that are in charge of the executive decisions and other auxiliary operations that are taking place in the background at universities . This directly affects the people and the ecosystem dimension as well as each of these three dimensions are closely interconnected and changes in one are reflected in another. The role of the institution dimension at universities is undertaken by the university board, executive members, student governments, staff unions

and other student/staff organizations. They are in charge of the decisions that are made which directly affect university members and the ecosystem of the university.

EGG MODEL OF SUSTAINABILITY

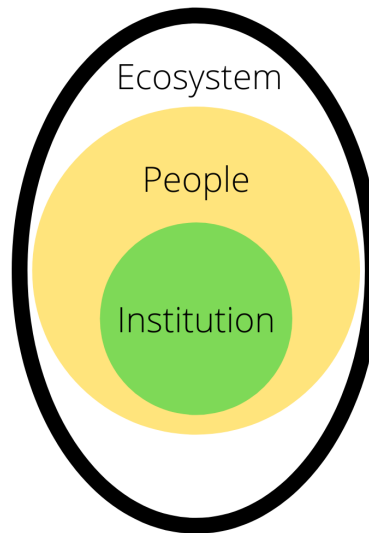


Figure 2.3 Adapted egg model of sustainability in USAF

The approach for creation of categories for this thesis assignment has been done using several main guidelines:

- To consist of maximum number of categories as possible and refine them continuously.
- The categories are comprehensible for every segment of the society
- Intended to be used at any university with a few alterations

Once, the main dimensions have been defined, the next step in the process is the selection of relevant categories under each of these dimensions using the above mentioned guidelines. A thorough literature review was performed to assess the various categories selected by other assessment frameworks and this is illustrated by the following tables. The tables have been divided into the three dimensions as mentioned in the previous section. The tables 2.1, 2.2 & 2.3 show the eight of the most common sustainability assessment frameworks in use today

along with the presence/absence of a category in its assessment framework. The categories have been aggregated from a host of different sources: Literature review, discussions with sustainability experts and current trends. This method of reviewing the presence of a category in other frameworks by means of comparison helps in filling in the gaps that exist in these frameworks. Several notable gaps that were found, were noted and USAF was created with the inclusion of these important categories that were left out in other frameworks. A common trend noticeable from these tables is the complete absence of sustainability assessment of the social sphere of universities.

Ecosystem Dimension				
Categories Frameworks	AIR	WATER	LAND	ENERGY
AISHE	—	—	—	—
PENN STATE REPORT	—	✓	✓	✓
CSARP	✓	✓	✓	✓
STARS	✓	✓	—	✓
CSAF	✓	✓	✓	✓
TCAS	✓	✓	✓	✓
PEOPLE & PLANET	✓	✓	—	✓
UI GREEN METRICS	—	✓	✓	✓

Table 2.1 Frameworks and their categories in the ecosystem dimension

Based on careful consideration of these categories and their relevance, USAF was incor-

People Dimension									
Categories \ Frameworks	CURRICULUM	RESEARCH	COMMUNITY	HEALTH	ENGAGEMENT	FOOD	DIVERSITY	INNOVATION	TRANSPORT
AISHE	✓	✓	✗	✗	✗	✗	✗	✗	✗
PENN STATE REPORT	✗	✓	✓	✗	✗	✓	✗	✗	✓
CSARP	✗	✓	✓	✗	✗	✓	✗	✗	✓
STARS	✓	✓	✓	✗	✓	✓	✓	✓	✓
CSAF	✓	✓	✓	✓	✓	✓	✓	✗	✗
TCAS	✓	✓	✗	✓	✓	✓	✓	✓	✓
PEOPLE & PLANET	✓	✗	✗	✗	✓	✓	✗	✗	✗
UI GREEN METRICS	✓	✓	✗	✗	✗	✗	✗	✗	✓

Table 2.2 Frameworks and their categories in the people dimension

Institution Dimension								
Categories \ Frameworks	WASTE	INVESTMENT	WORK-PLACE	PURCHASING	STUDENT FINANCE	STAFF & STUDENT RIGHTS	GOVERNANCE	INFRA-STRUCTURE
AISHE	✗	✗	✗	✗	✗	✗	✓	✗
PENN STATE REPORT	✓	✗	✗	✓	✗	✗	✓	✓
CSARP	✓	✗	✗	✓	✗	✗	✓	✓
STARS	✓	✓	✓	✓	✗	✗	✓	✓
CSAF	✓	✓	✓	✓	✓	✗	✓	✓
TCAS	✓	✓	✓	✓	✗	✗	✓	✓
PEOPLE & PLANET	✓	✓	✓	✗	✗	✓	✓	✗
UI GREEN METRICS	✓	✗	✗	✗	✗	✗	✗	✓

Table 2.3 Frameworks and their categories in the Institution dimension

porated with the following categories under the following dimensions as shown in figure ??.

The gear model is used in the figure which demonstrates that for efficient functioning, a synchronous balance of the individual elements is needed, in this case the three dimensions: Ecosystem, People and Institution. Out of all the categories reviewed in literature research, the only category that has been left out is the category of innovation. Innovation at universities can be in the form of ground-breaking research, new policies, academic programs and projects. The category of innovation is only present and has been defined substantially in the STARS framework. It would be an extremely challenging task to quantify the merits of innovation in sustainability principles of a university and the complexities of it combined with the lack of time, led to the category of innovation being dropped.

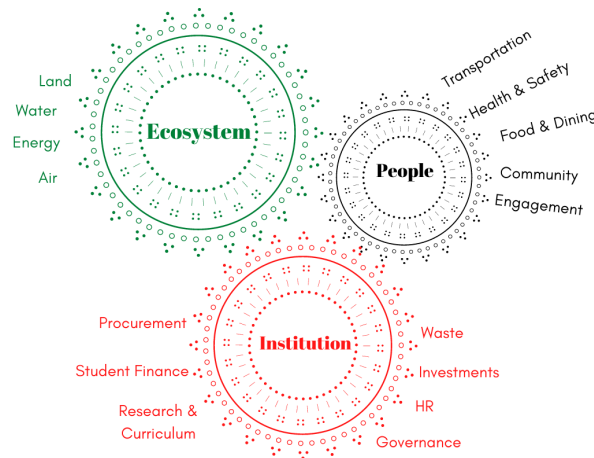


Figure 2.4 The categories and dimensions in USAF

2.4 Step 4: Development of Indicators

This thesis has been formulated using a top-down approach wherein the framework has been broken down into several categories with each category having several indicators. The

indicators are a mix of qualitative and quantitative and a mixed research design method is used for the selection and creation of these indicators. Due to the vast amount of literature that was available, defining a ‘good’ indicator was deemed necessary and a good indicator having certain criteria was needed. The following criteria were determined in choosing a ‘good’ indicator –

- The data for the indicator has to be accessible and of high quality.
- The indicator must have relevance to the multitude of stakeholders involved on universities.
- The indicator must be easily understandable.
- The indicator must be as specific as possible
- The indicator must have geographical connotations and must be relevant in the local context.
- The indicator must be malleable to changing institutional mandates.
- The indicator must be helpful to the people in charge of effecting necessary change.

Based on the above mentioned guidelines for choosing indicators, a thorough literature search was conducted among assessment frameworks to assess indicator types and their relevance. A list of possible indicators for each of the categories was created and this list highlighted the indicators that were deemed necessary to cover along with the appropriate level of detail required. A table was created to list the common indicators under each of this category to which several new indicators were added based on my own best judgment and interactions with experts working in the field. This table underwent several iterations of revisions, rephrasing and additions to it over the course of the thesis assignment and the final list is illustrated in table 2.4 below. The indicators from database were incorporated into USAF based on relevance, importance and personal judgement.

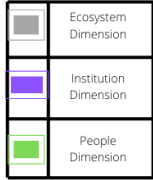
1. AIR 1.1 Air Quality Index 1.2 Indoor Air Pollution 1.3 Total CO₂ Emissions 1.4 Air Quality Complaints 1.5 Key Sources of Air Pollution 1.6 Particulate Matter Production	2. WATER 2.1 Water Consumption 2.2 Water Consumption Trends 2.3 Water Metering 2.4 Water Use Efficiency 2.5 Wastewater Quality & Quantity 2.6 Wastewater Treatment 2.7 Water re-use and recycle 2.8 Rainwater Management	3. LAND 3.1 Land Use Trends 3.2 Pesticides and Fertilizers usage 3.3 Landscape Management 3.4 Campus Biodiversity
4. ENERGY 4.1 Energy Consumption 4.2 Sources of Energy 4.3 Energy Conservation Policies 4.4 Energy Use Patterns 4.5 Energy Efficiency	5. PROCUREMENT 5.1 Sustainable Procurement Policies 5.2 Local Sourcing 5.3 Amount spent on Paper 5.4 Amount spent of Equipment 5.5 Usage of Life-cycle Analysis 5.6 Decision-making Authority	6. GOVERNANCE 6.1 Goals & Mission of the Institution 6.2 Green Campus Office 6.3 'Green' Initiatives undertaken/planned 6.4 Environmental Management Systems 6.5 Environmental Task forces 6.6 Role of Student Governments & Unions 6.7 Data Reporting and Sharing
7. WASTE MANAGEMENT 7.1 Total Waste Generated (All Streams) 7.2 Waste Generation Trends 7.3 Recyclable Waste 7.4 Hazardous Waste Generation 7.5 Waste Violations 7.6 Waste Reduction Programs 7.7 Waste Management Policies 7.8 Waste Disposal Costs (All Streams) 7.9 Waste Diversion Schemes 7.10 Construction & Demolition Waste	8. RESEARCH & CURRICULUM 8.1 Programs Inculcating Sustainability 8.2 Courses Inculcating Sustainability 8.3 Sustainability Literacy Assessments 8.4 Research Involving Sustainability 8.5 Funding for Sustainability Research 8.6 Funding for Sustainability Initiatives 8.7 Research Collaboration 8.8 Open Access to Research	9. STUDENT FINANCE 9.1 Student Loan Debt 9.2 Scholarships Available 9.3 Student Fee Gap 9.4 Availability of Part-time Student Jobs 9.5 Support for Under-represented
10. UNIVERSITY AS EMPLOYER 10.1 Employee Compensation 10.2 Employee Wage Gap 10.3 Employee Satisfaction Levels 10.4 Diversity & Equity 10.5 Support for Disabled Staff 10.6 Staff Retention Rate	11. INVESTMENTS 11.1 Ethical Investments 11.2 Environmentally Safe Investments 11.3 Investments in Local Community 11.4 Investments in Student/Staff initiatives 11.5 Responsible Investment Committee 11.6 Investment Disclosure	12. COMMUNITY 12.1 Behavior and Attitudes towards Sustainability 12.2 Community Partnerships 12.3 Community Service 12.4 Community Engagement
13. HEALTH & SAFETY 13.1 Physical Health 13.2 Mental Health 13.3 Crime 13.4 Accidents on Campus 13.5 Occupational Health & Safety System 13.6 Work-related Injuries or ill-health	14. SERVICES 14.1 Housing 14.2 Recreation 14.3 Jobs 14.4 Local Transit 14.5 Spiritual Services	15. FOOD & DINING 15.1 Sustainable Food Procurement Policy 15.2 Food Diets Offered 15.3 Food Waste 15.4 Local Food Sourcing 15.5 Fair Trade Products 15.6 Ethical Meat Sourcing 15.7 Nutritional Information
16. ENGAGEMENT 16.1 Satisfaction Levels 16.2 Competitions & Programs for Students/Staff 16.3 Volunteerism 16.4 Involvement of Student Unions/Student Clubs 16.5 Inter-campus Collaboration 16.6 Internship/Outreach Opportunities 16.7 New Student Orientation 16.8 New Staff Orientation 16.9 Public Policy Participation	17. TRANSPORTATION 17.1 Transportation Modal Split 17.2 Green Vehicles on Campus 17.3 Support for Sustainable Transportation 17.4 Car Sharing Programs 17.5 Bicycle Facilities & Programs 17.6 Local Transportation Subsidies 17.7 Electric Charging Facilities 17.8 Parking Footprint of Cars	

Table 2.4 USAF database of categories and indicators

Using the figure illustrated above, the skeleton of the framework is complete and the complete framework of USAF is illustrated in detail in Appendix A. Out of the indicators

shown above, some were eliminated due to irrelevance or doubts from experts about their validity. There were several complications regarding the placement of indicators in the correct categories and there were several discrepancies as an indicator could be valid in more than one category such as CO2 emissions which could be placed in either Air or Energy, in case of such discrepancies, personal judgment along with a literature review of other sustainability assessment frameworks was used to place them in appropriate categories. An example of a category and indicators along with it is shown in figure 2.6

PROCUREMENT		
Indicator	Findings	Rating
1.LIFE CYCLE COST ANALYSIS <i>The usage of life cycle cost analysis in the iniversity's procurement policies</i>		
2.EQUIPMENT <i>Total amount spent on equipment that is sustainably and efficiently manufactured</i>		
3.PAPER CONSUMPTION <i>Total pieces of paper purchased by all departments of all types (Recyclable, tree-free, chlorine free etc.)</i>		
4.LOCAL SOURCING <i>Total amount in euros spent on sourcing products locally</i>		

Figure 2.5 Procurement category with its indicators

2.5 Step 5: Scoring

This section describes how USAF weights its categories and indicators. In order to implement a scoring based system, it is important to assign weights to categories that will contribute to the total score. This weighting of categories is a challenging prospect and is often skipped in assessment frameworks due to its challenges, difference of opinion among the experts in this field or due to other socio-cultural factors which are different in every university setting. It is important to weight these as not all categories and indicators are equally important in

a sustainability assessment framework. For example, the category of water which includes water consumption, waste water treatment etc. is arguably more important than the category of Engagement which assesses if students/staff are sufficiently engaged. It is akin to comparing apples and oranges but several other factors play a role in deciding the importance of one over the other. These factors can be spatial, temporal, behavioral, preferential etc. based on the researcher's outlook, preferences, literature review and interaction with other relevant experts in this field. USAF has 3 dimensions: Ecosystem, Institution and People and these three dimensions have 68 indicators under them. Although the number of indicators is different in each of these dimensions, the need to balance the environmental, social and institutional aspects of sustainability which is in line with the concept of triple line of sustainability, makes it crucial to give equal weightage to all these three dimensions i.e. 33.33%. The following sections further explain how the categories and indicators are weighted.

2.5.1 Weighting of Categories

In this assessment framework, the weighting of categories is done with the help of analytic hierarchy process (AHP) which is one of the methods used in multi criteria decision making analysis. AHP helps in converting subjective/objective criteria into quantitative data which can be analysed and compared. The categories are to be weighted according to the researcher's personal judgement, interactions with experts and other literature reviews. This would enable universities to create its own tailor-made assessment framework which would enable it to analyze its shortcomings. In case comparison has to be made between two or more universities, the weightages are obtained via collaboration with the other universities using AHP. This method of using AHP enables universities to create a framework for personal reflection and compare it with other universities if need be. Appendix C illustrates the weightages for the categories of USAF.

2.5.2 Weighting of Indicators

Every category as mentioned in the above chapter has a variable number of indicators within the category. It is important to ascertain which indicator is more important than the others and assign weights to them based on importance. The level of importance helps in ascertaining the weight of the indicator and helps in developing a fair scoring system. Although, it is important to weight the indicators according to their importance, USAF assigns each indicator with equal weightage in a category. This is done due to a lack of reliable data present for all the indicators and the lack of time to conduct a study to ascertain the individual weights of an indicator.

2.5.3 Score Range

The scoring under USAF follows a 3 point scoring system as illustrated in the figure below. In case the data is not available for a particular indicator, the score for that indicator is considered as a 0.

Score	Symbol	Description
0		Performance consistently poor or sustainability principles lacking; Massive Improvement needed
0		Data not available or sufficient data not available to provide a score
1		Performance is adequate or average; Inconsistent; Improvement needed
2		Exemplary performance at a very high level; A possible model for other universities;

Figure 2.6 Scoring range in USAF

Chapter Three

University Sustainability Assessment Framework (USAF)

USAF is an independent research project which aims to fill the gaps in existing campus sustainability assessment frameworks. Several notable gaps that have been found, such as exclusion of social sphere of sustainability, localized indicators that are irrelevant in other universities (national and international), categories and indicators that are outdated and the exclusion of institutional operations. These gaps have been filled to the best of my abilities with thorough a literature review, personal judgement and interaction with experts and peers. Moreover, USAF was created as a framework that is relevant to campus based universities across the world and does not have localized categories and indicators. It helps university administrators understand the areas of the campus that needs to be improved and it helps in propagating sustainability awareness of the campus to its university members.

The results of this thesis are a number of pieces that need to come together in order to be effective. Chapter 2 explained the creation process of this framework, the methodology, the convergence of methods and the relational aspect of this framework to other sustainability assessment frameworks. This chapter illustrates the framework that has been created. The framework has 72 indicators, each of which associated with the category it is under.

The explanations of these indicators along with its need for inclusion in this framework is elucidated. Chapter 4 is the application of this framework to the University of Twente.

This section further explains the categories and indicators as chosen in USAF. Figure 3.2 which illustrates the dimensions and categories is expanded upon in this chapter and clear definitions provided to each indicator. The whole framework is available in appendix A.

DIMENSIONS	ECOSYSTEM	INSTITUTION	PEOPLE
CATEGORIES	AIR	RESEARCH & CURRICULUM	COMMUNITY
	WATER	STUDENT FINANCE	ENGAGEMENT
	LAND	WASTE MANAGEMENT	SERVICES
	ENERGY	GOVERNANCE	TRANSPORTATION
		INVESTMENTS	FOOD & DINING
		PROCUREMENT	HEALTH & SAFETY
		UNIVERSITY AS EMPLOYER	

Table 3.1 Categories in USAF

3.1 Ecosystem Dimension

3.1.1 Air

Several studies over the decades have proven that air quality can have a significant impact on humans and can affect us physiologically and psychologically. Poor air quality combined with indoor air pollution accounts for 7 million premature deaths in the world (WHO, 2020). Good air quality is essential for optimal performance and is essential to every human being. There are various targets set by World Health Organization (WHO) and IPCC (Intergovernmental

DIMENSION	ECOSYSTEM			
CATEGORIES	AIR	WATER	LAND	ENERGY
INDICATORS	PM PER FTE	POTABLE WATER CONSUMED	MANAGED GREENSPACES	ENERGY USE IN BUILDINGS
	CAMPUS AQI	STORM & GREY WATER REUSE	TREES ON CAMPUS	ENERGY USE IN TRANSPORTATION
	SMOKE-FREE SPACES	SMART WATER METERS	IMPERMEABLE SURFACE COVER	RENEWABLE ENERGY CONSUMPTION
	INDOOR CO2 MONITORING	LEAK DETECTION & EFFICIENCY	FERTILIZER & PESTICIDE USE	ENERGY METERING
	AIR QUALITY COMPLAINTS	WASTE WATER TREATMENT	LAND USE TRENDS	ENERGY POLICY

Table 3.2 Ecosystem dimension with its categories and its indicators

Panel on Climate Change) to reduce greenhouse gas emissions and improve the ambient air quality. Air pollution being one of the major issues in our world and one of the key challenges in our fight against global warming makes it imperative to include as a category in this assessment framework. Moreover, ensuring good quality indoor and outdoor air at universities will result in a healthier and a more productive work-force.

Carbon Footprint measures the total carbon footprint (in tonnes) produced per full-time equivalent (FTE) for all its energy and transportation uses. Anthropogenic carbon emissions are the one of the major causes of global warming and several activities in universities can be sources of carbon emissions such as combustion of fuels, processes in laboratories, transportation, agricultural processes, etc. This category recognizes the global effort in reduction of their carbon emissions and helps universities in understanding its own carbon emissions.

Campus AQI is an indicator that assesses the air quality index (AQI) of the location of the university over the course of one year (Average AQI of one year). Essentially AQI is

a number given out to the general public by the weather forecasting agencies that lets the public know about the quality of the air. The AQI measures four pollutants namely ground level ozone, particle pollution, carbon monoxide, and sulfur dioxide (US EPA, Office of Air and Radiation, 2014). Different governments have different air quality standards for these pollutants. The AQI helps in understanding the effects that the air around you can have on your health and to prevent exposure to health problems, it is important for universities to continually monitor the AQI of its campuses to safeguard its students and staff.

Smoke-Free Spaces assesses the number of smoking free zones present at the university. Moreover, it also assesses the distance of the smoking zones from other public areas and its nuisance to non smokers. Cigarette smoke is known to have carcinogenic chemicals (World Health Organization, 2019) and is a detriment to good health not only to the smoker but to non-smokers as well due to the second-hand smoke. Young smokers are found to have a higher likelihood of lung illnesses, more coughs, greater chances of stroke and a higher risk of heart failure (Gough, Fry, Grogan, Conner, 2009). It is important to include this indicator as young smokers are susceptible to various diseases early on in their lives and laying the basis for the development of serious diseases in adulthood.

Indoor CO2 Monitoring assesses the number of indoor areas in the university buildings that have CO2 monitoring systems in place. Indoor air quality (IAQ) depends on the concentration of contaminants indoors and the efficiency of the ventilation system to remove them. Higher than recommended levels of CO2 indoors has an impact on its occupants and renders them lethargic, drowsy, distracted and increases their exposure to other unhealthy gases and particulate (Prill, 2013). To ensure that the concentration levels of students/staff is not hampered by these indoor air pollutants and to prevent exposure to these unhealthy gases it is important to measure indoor air quality levels at all times with the help of sensors or other indoor air quality monitoring systems.

Air Quality Complaints checks the number of indoor or outdoor air quality complaints (verbal, written etc) made at the university and the method of redressal by the university. Although data for this indicator may be hard to find, it is important to understand the university's efforts in addressing poor air quality.

3.1.2 Water

Water scarcity is a global phenomenon which is especially felt in countries of the Global South. The explosive population growth, climate change and pollution are threatening freshwater sources around the world. Active management of water infrastructure helps in increasing water use efficiency and reducing waste. Moreover, water pollution is a major threat to human health and other ecosystems and it is necessary to conserve our depleting water resources. Water is an obvious sustainability issue for campuses due to its intensive use by its residential units, campus grounds and laboratories, and hence, it was essential to include this category in this framework.

Potable Water is an indicator that assesses the volume of potable water consumed annually on campus for all uses per FTE. In case data is available, the trends in change from past years are noted and the reason in increase/decline is further analyzed. Potable water consumed per FTE helps in understanding if the water consumed at universities is different from the national average or other universities. Moreover, it helps in opening up avenues to analyze this in-depth and reduce potable water usage. University campuses are water use is similar to that of medium sized cities which makes it essential to monitor and conserve water on university campuses (Bonnet, Devel, Faucher, Roturier, 2002).

Storm and Grey Water Reuse assesses the volume of storm and grey water that is reused for non potable water purposes annually in the university. Greywater is one of the major contributors of domestic wastewater, representing more than 70% of the total

wastewater volume in Latin-American countries. Its reuse can provide non-potable water which would help in reducing the water usage per person by up to 50%, or even more (Eriksson, Andersen, Madsen, Ledin, 2009). Meanwhile, storm water harvesting might not be enough to meet the water supply demands of rural and urban population but it could be an effective secondary water source. For a university to reduce its water demands, branching out to these effective and proven water management strategies can help significantly in reducing its demand on ground and surface water.

Smart Water Metering is an indicator that checks the number of buildings that have smart water meters installed to measure water use and discharge. Smart water meters are a giant leap from traditional water meters and have resource optimization, water conservation and leakage detection, and advanced data analytics capabilities which are absent from traditional water meters. These smart water meters are estimated to reduce water use by 12% according to Thames water, a UK based water utilities company. (Aquatech, 2019). Moreover, smart water meters are known to offer several other advantages such as deferred network augmentation and access to instant customer service (Thiemann, Haas, Schlenger, 2011) which can help universities significantly reduce their water demands and improve the efficiency of the current water supply systems.

Leak detection & efficiency is an important indicator that assesses the number of water distribution systems that are tested for leaks and for its efficiency at regular intervals. Leaks account for 10-30% of distribution input in the developed world and can reach upto 70% in developing countries (Beuken, Lavooij, Bosch, & Schaap, 2008) which makes it necessary to check for leaks and efficiency of the water distribution systems at regular intervals.

Waste Water Treatment Waste Water Metering assesses the volume of waste water (black grey) produced on the campus and the volume that is being treated on-site annually that meets the local regulatory standards. There are several methods by which universi-

ties treat waste water, the common ones being constructed treatment wetlands or a waste treatment plant. To prevent pollution of other ground or surface level water sources, it is essential for the wastewater to be treated. Moreover, this indicator helps in analysing the waster water trends in terms of its sources in a university which can be used to effectively map out strategies to reduce this volume.

3.1.3 Land

Sustainable land use is the management of our land resources such as the natural environment and the built environment around us with appropriate management practices to ensure it meets current human needs and the needs of the future. The sustainability of a land resource is determined by the interaction between the land, the weather and the human activities affecting land and weather (FAO, 2015). Campus based universities often have large swathes of land devoted to various uses which makes it necessary to adopt sustainable land use practices to ensure the balance between the natural ecosystem and the built environment.

Managed Green Spaces is an indicator that assesses the total green areas of the campus compared to the built up areas. Green spaces are vital for health and well being of an individual and has been proven to reduce stress (Wells & Evans, 2003). The ratio of green spaces to built up area is further analysed by using the numbers from previous years, this helps in understanding the change in land use patterns and the path the university is on in terms of its land management practices.

Trees on Campus is an indicator that assesses the number of trees that exist on the campus. A further division of these trees into native species and non-native species of trees is done. In a university environment where stress is ever-present, trees provide the much needed stress buster in form of its shade, aesthetics or better air quality than indoor spaces. Moreover, trees play a multitude of roles such as acting as a sound barrier or a wind barrier

and helps in maintaining privacy in campus housing (Nowak Crane, 2002). Although, these functions are provided by both native and non-native trees, the former require more upkeep, greater cost and possible negative environmental benefits (Hill, 2014).

Sustainable Campus Planning Guidelines helps in assessing if the university's land acquisition decisions of the past 2 years have included sustainability as a criteria or not. Universities are constantly evolving and are a hive of construction activity and it is important to understand if the principles of sustainability are considered in making of these executive decisions. With the rise in student enrolment, universities are splurging big on new construction and in 2015 US universities spent a record breaking \$ 11.5 billion of taxpayer money on construction of new facilities on campus (Poliakoff, 2018). However with the average of 42% occupancy rate in American Universities (Meadows, 2016), the construction of new buildings is heavily criticized. This indicator helps in understanding the new construction activity on campus, funds allocated for this construction and if other factors such as land use management, occupancy rates etc. are taken into consideration before the finalization of these projects.

Fertilizers & Pesticides is an indicator that assesses the usage and the kind of fertilizers and pesticides in use in the management of the campus grounds. The goal of the universities should be to minimize the usage of these harmful chemical compounds and switch to eco-friendly products. Pesticides and fertilizers often seep into waterways which could impact our drinking water and affect our health which warrants us to take this issue seriously and minimize the usage of these chemicals.

3.1.4 Energy

Our lives are intricately intertwined with our electronic devices which require energy to operate. Be it our personal electronics to indoor heating in our buildings, they all require

energy and it is important to understand the source of this energy and the outcomes that are directly/indirectly caused by using this energy. The need to move away from fossil fuel based sources of energy to renewable sources is a massive challenge that is more important now than ever. Universities having multiple buildings and thousands of students in a small locale consume large amounts of energy and to be truly sustainable, it is important to analyse the sources of energy at the university, the energy use patterns and a concerted effort to switch to renewable sources of energy. These reasons make a compelling argument for energy to be included as a category in this framework.

Electricity Use measures the electricity used on the university campus in the academic buildings, residential buildings, outdoor areas, supermarkets and other spaces. The total electricity used for these areas is taken per FTE and this helps in comparison with other universities or in analysing trends over the years. The results can be skewed because not every student lives on campus and not every university has residential areas on the campus but it gives a good general idea of where the university stands in terms of its electricity use in buildings. In Europe, buildings account for a staggering 40% of the total electricity consumption (Zhao Magoulès, 2012). Universities typically own/manage several buildings and this indicator will help universities in understanding the electricity consumption in these buildings and identify ways to reduce it.

Energy Use in Transportation helps in assessing the total energy used for transportation per FTE. The total energy used for transportation is found by addition of the energy used by the fleet of vehicles owned by the university which helps in its operations and the different forms of transportation used by the university members. It would be extremely difficult to find the exact number for this indicator and an approximate number is calculated from the data available. The transport sector in Europe is rapidly expanding and currently accounts for 30% of final energy consumption in EU (EEA, 2018). Universities being the

destination for a large number of commuters makes this an important criteria to analyze.

Green Energy Consumption is an indicator that assesses the total energy created/bought from renewable energy sources. The energy could be created on campus or be bought from renewable energy providers. The amount of green energy used compared to the total energy used on campus is then found and compared with other universities. Moreover, the national average for universities or the energy source patterns over the past years can be analyzed as well which would give interesting insights about the university's green energy consumption. This indicator is important in the local and national context to achieve targets set by their nations. The Europe 2030 target for renewable sources of energy is 32% (Eurostat, 2017) while the target set by NAFTA(North American Free Trade Association) is 50% by 2030 (Welle, 2016). For these targets to be achieved, individuals, businesses, universities and a host of other organizations must switch to renewable sources of energy.

Energy Metering is an indicator that checks if the university has transitioned to installing smart energy systems on the campus. Smart energy meters help in relaying real time usage data to the consumers which is accurate. Traditional meters do not have these functions and consumers are at a disadvantage when using these as the energy consumed is estimated and not accurate (Zoopla, 2018).

Energy Policy assesses the energy policies that are in place in the university which are aimed at conservation of energy, shift to renewable forms of energy, improving energy efficiency and promoting awareness. It also measures the efficacy of these policies and their impacts on the members of the university. These policies have many important roles and a sound policy can help in achieving national and global energy targets.

DIMENSION	INSTITUTION						
CATEGORIES	RESEARCH & CURRICULUM	STUDENT FINANCE	WASTE	GOVERNANCE	INVESTMENTS	PROCUREMENT	HR
INDICATORS	RESEARCH	STUDENT LOANS	WASTE STREAMS	STUDENT GOVERNANCE	ENVIRONMENTALLY SAFE	LIFE CYCLE COST ANALYSIS	EMPLOYEE SATISFACTION
	ACADEMIC PROGRAMS	SCHOLARSHIP	HAZARDOUS WASTE	WEBSITE	FOSSIL FUEL INVESTMENTS	EQUIPMENTS	WAGE GAP
	COLLABORATION	STUDENT FEES	WASTE QUANTITIES	FUTURE PLANS	TRANSPARENCY	PAPER CONSUMPTION	REPRESENTATION
	SUSTAINABILITY LITERACY	STUDENT JOBS	WASTE VIOLATIONS	SUSTAINABILITY OFFICE	INVESTMENTS IN UNETHICAL BUSINESSES	LOCAL SOURCING	
	INCENTIVES						

Figure 3.1 The categories and dimensions in USAF

3.2 Institution Dimension

3.2.1 Research & Curriculum

The topic of Research & Curriculum is frequently avoided in sustainability frameworks as it is hard to quantify successes and failures in this category, however in this framework it is considered important as research/education in sustainability principles helps in gaining valuable insights of this esoteric field and helps in promoting sustainable education. Research in sustainability helps in unlocking cleaner/greener solutions and also helps in understanding human attitudes towards sustainability which is crucial in implementation of sustainability principles. Education of sustainability principles to students provides them with an invaluable learning experience about the need to live in harmony with the ecosystem. It helps students become more aware of the problems at stake and helps in raising new generations of students versed in sustainability principles.

Research is an indicator that assesses the number of full-time students and staff involved in sustainability focused research. Sustainability has grown from a significant yet limited field of study into being a critical framework for policy formulation (McManners, 2019). This massive importance that sustainability focused research has on society and our way of life

deems it to be an important indicator.

Academic Programs assesses the total number of programs and courses that have substantial sustainability related content. In the past decade, the new academic research programs in sustainability has rapidly emerged (van der Leeuw, et al., 2012), seeking to understand the complex, dynamic interactions between human and environmental systems (Kates, 2001). These programs and courses are crucial in the propagation of sustainability principles and forms the backbone for a new generation of sustainability researchers.

Collaboration is an indicator that assesses the number of courses/initiatives that involve a collaboration between two or more departments in a sustainability oriented topic. Sustainability problems arise from a broad variety of scientific fields, ranging from natural sciences to social sciences and humanity and interdisciplinarity has become the core concept in the area of sustainability research (Yarime et al., 2012). This helps in different esoteric fields collaborating to find solutions to these 'wicked' problems and is why it is an essential concept in solving sustainability issues.

Sustainability Literacy analyzes the number of assessments undertaken annually by the university to assess the knowledge of sustainability principles among its students and staff. The assessments are independent of courses and should be uniform for students and staff. They also help in assessing current levels of knowledge, track changes over time, and evaluate the effectiveness of courses and curricula in meeting sustainability knowledge objectives.

Incentives is a quantitative indicator which analyzes the amounts spent by universities on incentive programs for student/staff led training, research or initiatives. This indicator helps in understanding the different ways universities encourage sustainability principles among its university members apart from classroom based courses.

3.2.2 Procurement

Sustainable procurement helps in ensuring that the products and services we buy are as sustainable as possible. These products and services should have low environmental impact and must be sourced ethically. Organizations must implement sustainable sourcing as a procurement function as this forms the entryway for goods and services. There are several advantages of buying sustainable products: They help in influencing manufactures to shift to more sustainable products and in protecting and conserving natural resources (Rosmarin, 2020). Universities being the beacons of knowledge in society and being big consumers of goods have to include sustainable procurement policies in their purchasing departments. Moreover, there are several legal mandates which have been passed by governments to include this criteria in all governmental purchasing decisions, for example, In 2005 the Koopmans/De Krom motion was adopted by the House of Representatives in Netherlands. This motion proposed that the government include sustainability as an important criterion in 100% of its procurement and investment by 2010 (Radboud University, 2019). These arguments for sustainable procurement makes it important to include in this framework.

Life Cycle Cost Analysis is an indicator that assesses if the concept of life cycle cost(LCCA) analysis is used in the university's procurement policies. LCCA is very important in procurement as it includes other cash flows over the entire life period of the product/service. The other types of costs involved in LCCA that are taken into account are operating costs, end-of-life costs and longevity. It is not an attractive option for governments and organizations because of its higher upfront costs and a lack of motivation to use LCCA often arises from the fact that financial gains or long-term benefits that will arise in the future can be uncertain (Perera, 2009). The reason for inclusion of this indicator is that economy is as important as social and environmental issues which is in line with the concept of triple bottom line of sustainability.

Equipment is an indicator that accounts for the total amount spent on equipment that is sustainably manufactured. The equipments may be in the form of research equipments, sports equipments, office equipments and other allied goods. This indicator helps universities understand the amounts spent on their equipment and if the supplier providing it follows sustainable manufacturing policies. To check if an electronic item is sustainably manufactured, Electronic Product Environmental Assessment Tool (EPEAT) standards are used to ascertain sustainability in manufacturing.

Paper Consumption is an indicator that assesses the amount spent on paper at the university. Universities typically order several types of papers for its uses and these can be classified under post consumer recycled paper, paper from agricultural residue, FSC Certified paper etc. The reduction in the use of paper has several positive benefits such as reducing costs in terms of purchasing and disposal, reduced printing costs as a direct result of using lesser paper and other environmental benefits. Paper consumption cost universities thousands of dollars every year and the environmental effects of paper are devastating. Paper being a cheap commodity in Global North countries like the USA, Japan, and Europe wherein an average person uses between 250 and 300 kilos of paper every year. If every person on this planet used 200 kilos of paper every year, there would be no trees left (The World Counts, 2020). Because of the massive uses of paper by university members, this indicator is considered important.

Local Sourcing is an indicator that assesses the amount spent by universities in sourcing its products locally. The products can be food, paper or other commodities needed for the operations of the university. The definition of local sourcing varies widely but this framework has set the definition of local as within a 100 km radius from the campus. The reason for having different definitions is that ‘local’ can vary according to the issue being measured and a 100 km radius is considered a reasonable distance for procurement of items that a

university needs (Cole, 2003). Local sourcing has several advantages namely: Better supply-demand strategies, reduced supply chain costs, better for the local community and better for the environment (Thomas, 2019).

3.2.3 Human Resources

In any modern organization, the role of the Human Resources (HR) Department is to recruit, screen and interview potential candidates. They also handle disputes, payroll systems, training and developing the culture of the organization. There are various social aspects of an organization that the HR controls and they find the balance among employees of different genders, sex and ethnicities. The HR and sustainability teams hold different but complementary responsibilities when it comes to building and maintaining a workplace culture. The sustainability team often may be tasked with articulating corporate 'purpose' and 'values', while the HR team holds most of the keys to bringing these values to life, through identifying and recruiting diverse talent, ensuring employee well-being, engaging and retaining employees, and establishing incentive programs (Enright Lovi, 2018). Universities which employ a large number of people require a solid HR department to ensure smooth functioning of the university. HR is deemed as an important category in this framework as this framework believes that the working together of the the sustainability team and HR will help tackle evolving issues relating to fair work, fairness and ethics and satisfy the expectations of its workforce community.

Employee Satisfaction is an indicator that assesses the satisfaction of the employees with the university. Employee satisfaction is extremely important in any organization as it directly affects the productivity levels (Harter, Schmidt, Hayes, 2002). It is important for every university to take into account the satisfaction level of their employees and redress their concerns effectively. This indicator is included in this framework as the satisfaction of staff directly affects the education levels, research levels and the service levels that is

imparted on the other university members.

Wage Gap is an indicator that analyses if there exists a wage gap between staff of different genders or ethnicities. It is important to address this indicator due to the disadvantages faced by women and people of colour. In USA, women earn 81.4% the amount their male counterparts make, and its worse for women with colour (Brundage, Vernon - BLS, 2016). Paying women less than men is not only unfair, but also has far-reaching implications for society. By tackling unequal wages, performance can be improved, it can help in raising workforce morale, raising engagement levels and in reducing absenteeism (EHRC, 2010).

Representation is an indicator that assesses the percent of staff belonging to different genders, ethnicities, minorities or having disabilities. Representation and diversity is important in the context of a university as it gives you access to a greater range of talent, helps in understanding other cultures, helps in forming different perspectives within the world we live in and it helps in dispelling negative stereotypes, and personal biases about different groups. In general, cultural heterogeneity allows one to identify and appreciate "ways of being" which are not their own. When people from a variety of cultures come together, they contribute to language skills, new ways of thinking, new knowledge, and different experiences which adds to the social character of a university promoting inclusiveness (Shemla, 2018).

3.2.4 Investments

Typically, Universities have large endowment funds. Endowments reflect capital or other financial assets that are donated to universities or colleges that are meant to be invested in order to maximize the principal and generate potential income for future investments and expenses.(Phung, 2019). These endowment funds are invested for short term or long term in real estate, bonds, cash in hand, commodities and hedge funds (Moore, 2017). Due to the enormous size of their endowments, universities diversify their investments and

often invest in fossil fuel companies and in companies having unethical practices and these practices have resulted in massive student protests in countries like UK and USA. The students have demanded that universities stop investing in fossil fuel and other environment destructing companies (Times Higher Education, 2019). As these investments directly affect our ecosystems, it is extremely important to consider this category in this framework.

Environmentally Safe is an indicator assesses the university's investments in environmentally safe firms, funds or practices. Universities are wary of investing in environmentally conscious companies as they believe it could lead to lower returns on their investments but research by (Trinks et al., 2018) shows that found fossil fuel stocks don't outperform other stocks and don't provide many benefits from a diversification standpoint. It is crucial that universities invest towards environmentally conscious companies and this indicator helps in assessing how the university chooses to invest.

Fossil Fuel Investments is an indicator that assesses if there exist any investments made by the university in fossil fuel companies. Fossil fuel companies have accelerated global warming and divesting from them is a necessary step that has to be undertaken.

Transparency is an indicator that assesses the transparency of university investments. It also assesses if the university's investments portfolio is publicly available.

Investments in Unethical Businesses is an indicator that assesses if the university invests in businesses that have unethical practices and in stocks that have questionable operational or recruitment activities. Stocks/Investments in tobacco companies, alcohol companies, arms companies, companies recruiting child labourers, companies which have a history of discriminating against people of different genders/sex/ethnicity and a company's callous attitude in its operations, are some examples of unethical investments (Scott, 2016). The major problems of the world are not vices like gambling or smoking. Instead, divest-

ment from these companies that benefit privately from aggressively promoting behavior that creates collective ecological damage and social inequality is necessary.

3.2.5 Waste Management

Typically, universities have a large number of office buildings, academic buildings, supermarkets, restaurants and other facilities that generate significant amounts of materials and waste. Waste provides an otherwise unnoticed potential to increase the sustainability of the organization, mitigate greenhouse gas emissions and minimize costs. David Korten, an economist and a Harvard University professor famously said this about the waste generated in our societies: "To achieve true sustainability, we must reduce our 'garbage index' — that which we permanently throw away into the environment that will not be naturally recycled for reuse — to near zero. Productive activities must be organized as closed systems" (Masdorf, 2010). This category is crucial for the well being of our society as disposing of waste has huge environmental impacts and can cause serious health problems, generates methane gas, which is explosive and contributes to the greenhouse effect, produces gases when burnt and simply throwing things away leads to a waste of resources (Issi, 2011). It is important for universities to have sustainable waste management policies to reduce its wastes and gradually switch to a zero waste policy.

Waste Streams is an indicator that assesses the number of waste streams that the university has. Waste sources are the flow of different waste from its origins to recovery, recycling, or disposal. Waste streams can be classified into two distinct types: streams made of materials (such as metals or plastics) or streams made of other items (such as electrical waste or end-of-life vehicles) that need special handling and eventually feed into streams of other materials (EU Think Tank, 2015). It is essential to have as many waste streams as possible to segregate appropriate waste so that it can either be reused or recycled. Moreover, different waste streams have different processing methods and the mixing of wastes often

leads to extra efforts to segregate it or further disposal.

Hazardous Waste Management is an indicator that assesses the total weight of hazardous waste generated at the university. Hazardous wastes are wastes with properties that make them dangerous or potentially harmful to human health or the environment. There can be several sources of hazardous waste in universities: from research labs to cleaning supply rooms, waste must be managed and disposed of properly, as inadequate waste management poses health and safety risks to students, staff, and the environment. Although an expensive and a complicated process, universities must ensure that hazardous waste is properly managed.(Larson Waste Inc, 2018). Moreover, this indicator also assesses the university's hazardous waste management policies and practices which help in understanding its operations. In case, the waste management of the university is contracted to an external third party waste management firm, an analysis about the firm's hazardous waste management practices needs to be made which helps in the assessment of this indicator.

Waste Quantities is an indicator that assesses the total weight of the waste produced by the different waste streams on campus over a time period of the last three years. This number can be analyzed further by dividing it by the number of university members and can be compared to other universities. It is a significant metric which helps universities in understanding its largest waste streams and ways to reduce its flows.

Waste Violations is an indicator that assesses the total number of waste violations reported in the last two years. The number and the type of waste violations help in understanding the university's waste management stream and its commitment to keep the university members safe. This indicator relies on waste violations reported transparently by the university and in case of discrepancies, a report by an external third party waste management company which assesses the university's waste management policies and operations can be valid for this indicator.

3.2.6 Student Finance

Universities provide several other functions apart from education and in terms of student finance, they help in easing a student's financial burden in the form of scholarships, providing part time jobs and subsidized goods and services. There are several commonly faced issues by students in terms of their personal finance such as mounting debt, lack of part-time job opportunities and uncertainties in future. These problems of student loan debt combined with a lack of other financial incentives leads to a host of problems in a student's life such as greater financial strain due to stress, depression, anxiety, and ill-health (White, 2015). These stresses combine with the already stressful environment of a university leads to further deterioration of a students mental health. These issues fall in the sphere of social sustainability and make it an important category to include in this framework.

Student Loans is an indicator that assesses the total number of FTE graduates who are funding their studies with a loan from the government, banks or an external agency. Higher education is an expensive affair which comes with a massive price where student loans have become a common occurrence and 70% of all college students in USA graduate with a significant amount of loans (Hess, 2019) and As of 2018, a total of 44.2 Million borrowers now owe a total of over \$1.5 Trillion in student debt (Friedman, 2018). These staggering figures make it a crucial indicator to analyze in this framework.

Scholarships is an indicator that assesses the total number of scholarships provided by the university. Scholarships help immensely in reducing financial strain on a student and helps students from disadvantaged backgrounds access higher education.

Student Fees is an indicator that assesses the hike in fees for all students from the last 3 years. It also assesses the fee-gap between international and domestic students. Due to the rising costs of education since the 1980's in USA, fees for domestic students increased by

25.3% at private colleges and about 29.8% at public colleges while on average an international student's fees are three times more than the domestic students fees (Schulmann, 2019). These hikes combined with massive gaps between international and domestic students leads to an unfair system and the reasons for these is important to analyze.

Student Jobs is an indicator that assesses the total number of student jobs available for all students on campus. Universities have several academic and non academic tasks that can be performed by students and this indicator assesses if universities assist students with these jobs. The largest obstacles to gaining employment as a student seems to be the infuriating dichotomy of "lack of experience", legal boundaries for international students and the inabilities of speaking the local language (Horton-Insch, 2014).

3.2.7 Governance

The word 'governance' applies to how the institution's academic affairs are dealt with. Academic governance will typically cover subjects such as enrollment , academic guidelines and quality of education (Advance HE, 2019). However, good university governance is necessary to maintain and operate any university. This is based on five principles, namely: transparency, accountability, responsibility, independence, and fairness (Samandar, Tawe, Musa, 2017). Universities are adjudged based on several other factors namely: Presence and roles of student governments in decision making, futuristic outlook and the ability to provide transparent information. The executive decisions made by the governing boards of a university directly impact student life, ecosystem of the campus, the university's vision and outlook, and the culture of the locale. This category is considered important in all three dimensions of the framework- social, environmental and economic and hence it is decided to include this category in this framework.

Student Governance is an indicator that assesses the number of student run sustainability organizations that have a role in the decision making process in the university. Moreover, organizations that work towards improving sustainability on/off campus are also analyzed. Student organizations that are involved in the decision making processes in a university help students in soft skills development, team work, practical real-life experiences and help in overall character development (Bentley University, 2018). Moreover, students working in sustainability organizations gain significant knowledge of sustainability principles and practical work experiences that go a long way in propagating sustainability.

Plans for the Future is an indicator that assesses the total number of sustainability related plans and initiatives drafted for the future. A university's operations are broad and typically sustainability plans for the future fall in the areas of emissions and energy, campus operations, nature and ecosystems, health and well-being, and culture and learning. This indicator helps in understanding the sustainability plans for the future, its monitoring and the working groups involved in the drafting of these plans. It also helps in propagating awareness of sustainability principles and due to the prominent position held by universities and academicians, these plans act as models of sustainable practices which can be replicated elsewhere.

Sustainability Office is an indicator that assesses the presence of a sustainability office operating in the university. A sustainability office on a university is alternatively termed as 'green office'. The Green Office is a physical channel for sustainability within a university, designed for students and staff alike. The members of this office carry out sustainability projects and facilitate the implementation of sustainability ideas by the community or the university. They are the first point of contact for sustainability initiatives, training, research and other allied activities of sustainability on campus. They play a crucial role in developing sustainability of campus ecosystems, inculcating sustainability principles in education and

propagation of sustainability to other university members. Moreover, this indicator also assesses the transparency of information provided by the sustainability office, its working groups, its ongoing initiatives and other metrics which help in understanding the operations conducted here.

Website is an indicator that assesses the presence of a clear website created by the university to highlight its sustainability initiatives, policies and the workings of the sustainability office. It is important to have a clear website for making a good first impression for prospective students and staff. Moreover, a clear website for sustainability related content helps in gauging the transparency of the university's policies, initiatives and workings.

3.3 People Dimension

DIMENSION	PEOPLE					
CATEGORIES	FOOD & DINING	ENGAGEMENT	COMMUNITY	HEALTH & SAFETY	SERVICES	TRANSPORT
INDICATORS	LOCAL FOOD	SATISFACTION LEVELS	COMMUNITY PARTNERSHIPS	PHYSICAL HEALTH	HOUSING	TRANSPORT MODAL SPLIT
	CATERERS POLICY	EVENTS & COMPETITIONS	COMMUNITY SERVICE	MENTAL HEALTH	RECREATIONAL SERVICES	GREEN VEHICLES
	FOOD WASTE	VOLUNTEERISM	COMMUNITY STAKEHOLDER ENGAGEMENT	INCIDENTS OF ASSAULT	SPIRITUAL SERVICES	ELECTRIC CHARGING INFRASTRUCTURE
	DIET TYPES	NEW STUDENT & STAFF ORIENTATION		WORK-PLACE ACCIDENTS		LOCAL TRANSPORT
				MOTOR - VEHICLE ACCIDENTS		BICYCLE PROGRAMS

Figure 3.2 People Dimension with its categories and indicators

3.3.1 Food and Dining

The UN considers food, water and energy as the nexus of sustainable development due to their massive demands and their strong interlinking with one another. Food and dining

was chosen to be considered as a category in this framework due to its extremely important place in human society and the devastating effects mass agriculture has on ecosystems. Food accounts for over 26% of global greenhouse gas emissions (Poore Nemecek, 2018); Half of all arable and habitable land on this planet is used for agriculture(Ritchie Roser, 2020); 70% of global freshwater withdrawals are used for agriculture (FAO, 2011); 78% of global ocean and freshwater eutrophication (pollution of surface water with nutrient rich pollutants) is caused by agriculture (Poore Nemecek, 2018); Considering these facts, it is important for every consumer to buy sustainably grown food products. In Universities, typically there are several dining areas which attract a large numbers of students which it makes it imperative to assess the food sources and food wastage policies of the university.

Local Food is an indicator that assesses the percentage of all food sourced locally by the university or its caterers. Universities procure large amounts of food directly from the farmers, food processing units or through suppliers. Locally grown food is a term used when food is produced within a set geographical boundary that can be considered local to you. Locally grown food benefits the local society in terms of job creation and sales, it helps the consumer get 'fresher' produce at a store close to them and it helps in reducing the distance the food has to be transported. Since universities procure large quantities of food, alternatively available local foods can reduce their food miles and by extension their carbon footprints by a significant number. This indicator is important as it concerns the environmental aspects of food and the social aspects of the local community as well.

Sustainable Food Policy is an indicator that assesses the total number of caterers operating on campus and if they have a sustainable food policy that is being implemented. Universities often hire caterers on a contract to operate restaurants on the campus, it is essential for universities to assess the caterers based on their sustainable food policies and use it in evaluation among the other caterers. These sustainable food policies help in procuring

clean and green food from local sources which have positive benefits to human health and environment.

Food Waste is an indicator that assesses the amount of food waste that occurs at university dining halls. "Food waste refers to the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers" (FAO, 2015a). Food waste is a global problem and is one of the key targets in sustainable development goals of the UN. It is estimated that around 1/3 of the world's food is lost or wasted every year (FAO, 2015a) while around 9 million people die from hunger and hunger related diseases and another 840 million people suffer from under nutrition (FAO, 2009). These distressing figures point out the massive problems with food waste and why every consumer must avoid food waste as much as possible.

Diet Types is an indicator that assesses the total number of different diets that the university caters to. University members might not adhere to a certain diet due to ethical, religious, health or other personal reasons. Hence, it is important for university dining areas to try to cater to as many diet preferences as possible. These diet preferences have a direct impact on our ecosystems and several universities that have shifted to a vegetarian diet have slashed their carbon emissions by a third (BBC, 2019). Apart from having environmental impacts, a university atmosphere must be inclusive by providing health and nutrition to members conforming a different diet type.

3.3.2 Engagement

Student engagement is multi-faceted construct involving the three dimensions that are dynamically interrelated : Behavioral engagement, emotional engagement and cognitive engagement (Martin Torres, 2016). Engaging students has several benefits such as increase in student satisfaction, increases student enthusiasm, decreases sense of isolation, and improves

overall success. Moreover, Student engagement is increasingly viewed as one of the keys to addressing problems such as low achievement, boredom and alienation, and high dropout rates (F. Martin Bolliger, 2018). Engagement in universities can happen in a multitude of ways: Classroom engagement, competitions and programmes, cultural events, new student/staff orientations, involvement of students/staff in local community or recreational activities etc. Engaging students/staff in these events help in developing their character and imbibing a community spirit which serves several purposes in the social aspect of sustainability.

Satisfaction Levels is an indicator that assesses the level of satisfaction among the university members. As Elliott Shin, 2002 put it, ‘Student satisfaction is being shaped continually by repeated experiences in campus life. It is also claimed that the consistency of the course and facets of the program, as well as the campus setting, are both drivers of satisfaction (Browne, et. al, 1998). Satisfied students have shown to have greater retention rates and better academic performance which enhances the reputation of the universities (Schertzer Schertzer, 2004). These factors are important in having better a better workforce and healthier students at a university and is why this indicator was included in this framework.

Events & Competitions is an indicator that assesses the total number and the kinds of competitions and events held on the university campus annually. Competitions and events are important in a student’s life as these interactions help students build relationships, recognize different perspectives, and interact with other cultures. These events are an opportunity to expand one’s social circle and provides a much needed break from academics which improves long term productivity (Southern Cross University, 2018).

Volunteerism is an indicator that assesses the total number of organizations and students within the university volunteering in a sustainability focused operation. Volunteerism has several benefits that include giving back to the community, helping people, helping the

environment, creating new experiences, enhancing or developing skills and spend time with peers who are into similar activities as you (Mcfadden Smeaton, 2017). Volunteering has several crucial social, environmental and economic benefits and universities must support and expand their volunteering programs.

New Student/Staff Orientation is an indicator that assesses the number of events that are conducted for incoming students and staff to introduce them to the academic and the campus life. These events help the students in receiving academic advice, meeting other incoming students, understanding and familiarizing with the campus facilities and understanding other information on the local community. These events help in involving the student/staff in the community and helps them settle down faster.

3.3.3 Community

Universities are influential hubs that boost employment and expenditure in the local area. Their social, cultural and academic influences places them at the heart of the local community. Local communities and universities have a symbiotic relationship in a locale where both benefit from each other. The biggest benefit of this relationship is when the a local community's epistemic knowledge is combined with academic knowledge of universities to address societal and environmental issues. Moreover, an area where a reputed university is present has a clear comparative advantage in terms of increasing the attractiveness for investors and businesses alike. (Florida, 2004). Universities are major employers in a region directly and indirectly through the spending activities generated by its university members (Universities UK, 2015). It is clear that universities have a significant impact on a local community and this relationship can be beneficial in expanding knowledge of environmental and social issues.

Community Partnerships is an indicator that assesses the total number of partnerships with local businesses for fostering sustainability. These partnerships can help students in having a better understanding of the local economy, local ecosystem problems and developing a community spirit

Community Service is an indicator that assesses the total number of students involved in community service in the local area. Community service helps in increasing social responsibility, building a relationship with the local community and helps students in applying academic knowledge in practical situations.

Community Stakeholder Engagement is an indicator that assesses the total number of local community stakeholders who have had direct engagement with students at the university with the aim of fostering knowledge of the local ecosystem. These community stakeholders can be local environmentalists, farmers, community experts etc.

3.3.4 Health and Safety

The educational sector in most parts of the world is massive, growing, involves employees with a wide variety of organisational cultures, and involves high risk exposures (Venables, 2006). Of all the transformations to have occurred in universities in recent years, the one that is the most unnoticed is the inculcation of health in university campuses. Health centers offer significantly more functions today and the demands of these services is on the rise where (Altschuler, 2013). University students are at a critical juncture in their lives as they have to manage their own health, finances, academics etc with little to no parental oversight which inculcates habits in them that can affect them over a lifetime. A university member's physical, mental and emotional health should be at optimal levels to ensure high productivity and it is the university's onus to provide facilities for recuperation in case any of these deteriorate. The importance of human health in sustainability is massively understated

(Venables Allender, 2006) and this category is included to ensure that it gets the attention it merits.

Physical Health is an indicator that assesses the total number of physical health care professionals working at the university. The number of physical health care professionals per FTE on campus or the number of students that are registered with these physical health care professionals help in understanding the needs of the university.

Mental Health is an indicator that assesses the total number of mental health care professionals working at the university. Universities being stressful places can be behave as pressure cookers for some students and in a survey conducted by National Union of Students, Eight out of 10 students (78%) have experienced mental health issues (Gil, 2017). Mental health issues are equally important as physical health issues and this indicator helps in understanding the mental health needs and services provided in a university.

3.4 Transportation

Universities hold a unique role in shaping the local transportation culture. They also play a big role in shaping their campuses, communities, land use infrastructure and pedestrian/bike paths (Ellis, 2003). Universities have to manage their own fleets of vehicles and that combined with the private transport owned by its university members and public transport connectivity poses a big challenge. Universities also have a big challenge in inculcating sustainability principles in the transportation needs of the university members, it requires shaping of the attitudinal and physical barriers of its members towards sustainable transportation (Kaplan, 2015). Sustainability in transport systems requires the promotion of links between environmental protection , economic efficiency and social progress (Rodrigue, 2020). Moreover, since transportation is the leading cause of global warming (NASA Earth Sciences, 2010), it makes it an important category to address due to the imposing obstacles

involved in it.

Transportation Modal Split is an indicator that assesses the percentages of FTE using different modes of transportation modes available. (Bicycle, Car, Train etc.) Analyzing the modal split of the university members helps in setting targets and framing policies to ensure a balanced and a sustainable transportation network.

Green Vehicles is an indicator that assesses the percentage of vehicles owned by the university that run on alternate fuel or electricity. Universities typically own large fleets of vehicles for their operational needs and this indicator helps in analyzing if the percentage of university's electric vehicle fleet is above or below the national average for electric vehicles ownership.

Electric Charging Facilities is an indicator that assesses the number of electric charging points available on campus. This infrastructural addition of charging points provides several benefits to a university: an extra incentive for university members to adopt electric vehicles, propagate education about electric vehicles and reduce the carbon emissions of the university.

Local Transportation is an indicator that assesses if there exist other local public transportation options to the university (buses, trams, trains etc.) and if university students are subsidised for it. This indicator helps in assessing the connectivity of the university to public transportation. Moreover, subsidizing student transit is a popular concept in North America and the UK, wherein it provides an incentive for university students to use public transport and provides guaranteed riders and revenue for the local transit authority.

Bicycle Programs is an indicator that assesses the number of programs carried out by university to promote bicycle usage/bicycle sharing and the infrastructural facilities available

on campus for safe and secure bike storage. This indicator helps in assessing the bicycle infrastructure of a university campus and the university's commitments to reduce motorized vehicle usage on campus. Moreover, bicycles provide a healthier commuting option and do not emit carbon emissions which makes it a good eco-friendly option for the university members.

3.5 Notable Categories and Indicators Excluded

USAF has 16 categories and 68 indicators which are broad and malleable. However, some categories and indicators have been excluded from this framework that are present in other frameworks. The list below explains the categories and the indicators under it that have been excluded.

1. **Buildings :** Out of the assessment frameworks that have been reviewed, the category of buildings which includes its water consumption, energy consumption, the method of construction and its green certification levels is sparsely addressed. Some assessment frameworks that have included buildings as a category assess the buildings mainly based on LEED (Leadership in Energy and Environmental Design) scores. LEED scores are given by the US Green Building council which is a private non-profit organization. Several studies have found that buildings that are LEED certified are only slightly better than other buildings and often times worse (Sepp, 2014). Moreover, LEED ratings given to buildings measure the performance of the building at the time of its opening which is not a promise of continual performance as have been evidenced in several LEED rated buildings in the USA (Navarro, 2009). Due to these inconsistencies and the lack of LEED being used as a building rating standard across the world, this category was avoided. However, other building indicators such as water consumption, energy consumption, land use planning and indoor air quality control have been included in other categories.

2. Innovation : Innovation as a category has been included in some assessment frameworks which addresses innovative solutions that have been devised by universities to environmental or social problems. Assessment frameworks such as STARS have included innovation in their framework and based on the innovation at the participating university, they are awarded innovation points. Several indicators that are present in this category have been added to this assessment framework, albeit in a different category. For example, indicators related to wage gap, diversity, community partnerships, bicycle programs, community gardens etc. have been added to other appropriate categories in this framework. Moreover the difficulty in quantifying innovation, combined with the lack of data availability and the North-Americanized aspects of this category did not deem it to be included as a category in this framework.

Chapter Four

Case Study Application

This chapter discusses how the framework was applied to the chosen case study: University of Twente along with the results obtained. The chapter begins with a general background of University of Twente followed by application of the framework which is divided into the three dimensions.

4.1 Background

The University of Twente (UT) was founded in 1961 in the city of Enschede which is located in the Eastern part of Netherlands. While it began as a Technische Hogeschool in 1961, it was renamed to Universiteit Twente in 1986 due to the amendments in the Dutch Academic Education Act. Enschede has a rich history and was a major centre of textiles production until the 1970's when it declined rapidly. The region is largely reliant on agriculture followed by a service industry. The university is located on the 135 acre country estate of drienerlo which includes meadows, woodlands and waterways. Moreover, it is the only campus university in the Netherlands (ESN Twente, 2014). Today, University of Twente is one of the finest universities in the Netherlands and a part of the 4TU which is a collaboration between the four technical universities in Netherlands. Additionally, UT is consistently ranked among the top universities and is ranked 186 in the QS world rankings index. The

University of Twente is organized into five faculties namely- Behavioral Management Social Sciences(BMS), Engineering Technology(ET), Electrical Engineering, Mathematics Computer Sciences(EEMCS/EWI), Science Technology(TNW) and Geo-information Science & Earth Observation(ITC).



Figure 4.1 The famed letters outside the campus



Figure 4.2 Aerial view of the campus

4.1.1 University Members

Before the implementation of USAF in University of Twente, it would be prudent to map out the university members (Students/Staff) and tabulate their numbers, diversity and gender. This is illustrated in the tables below.

	2016	2017	2018
Bachelors	5320	5487	6023
Masters	4168	4101	4230
Premaster	399	398	392
Postmaster	139	63	58
Postinitieel	506	461	433
Total	10026	10435	11136

Table 4.1 Student enrolment in UT from 2016-2018

	2016	2017	2018
Academic Staff (fte)	1521.7	1585.7	1635.8
Support & Management Staff (fte)	1087.9	1120.8	1127.5
Total	2609.7	2706.5	2763.3
% Women	40.7%	41.6%	42.3%
% From outside Netherlands	23.2%	24.8%	24.9%

Table 4.2 Faculty & staff members from 2016-2018

4.2 Ecosystem Dimension

4.2.1 Air

Carbon Footprint : University of Twente has been recording its annual carbon footprint in terms of scope 1,2 & 3 emissions since 2014.

Scope 1 emissions : Scope 1 emissions include combustion of fuels in buildings, vehicles & refrigerant cooling. These are responsible for 1957 tonnes of carbon.

Scope 2 emissions : Scope 2 emissions include electricity consumption and the heating network. These are responsible for 16,291 tonnes of carbon

Scope 3 emissions : Scope 3 emissions include procurement of goods/services, new building construction, transportation & distribution, employee travel on official purposes, commuting employees & commuting students. These account for 10,438 tonnes of carbon

The total carbon footprint for the year 2018 was 28,596 tonnes of carbon. Source: (CO2 footprint rapportage 2018)

Campus AQI : The city of Enschede has one open source AQI measuring station at Winkelhorst. The annual average (2019) AQI as measured at Winkelhorst which is about 4.5 kms away from University of Twente is 33. An AQI between the ranges of 0-50 is considered good (AQICN 2020).

Smoke Free Spaces : In 2018, University of Twente supported the National Prevention Agreement which bans smoking on educational institutions from Jan 2020 and enforceable by August 2020. The university has taken significant steps to help smokers quit their habit in the form of several group and individual guidance programs. The university had also removed ash trays and smoke shelters across the campus by March 2020.

Before this enforcement, the building tenant was in charge of providing one or more areas outside the building for the purpose of smoking. The building tenant would be in charge of

the location of the smoking zone, the ashtrays/smoke shelters and the enforcing of smoking rules around the building. (UT, 2019a) There is a designated smoking zone outside every building on the campus, often very close to the building itself and adjacent to pedestrian/bike paths.

Indoor CO2 Monitoring : Indoor carbon dioxide monitoring sensors are installed in indoor spaces having highly varying crowd numbers such as classrooms or other common areas of an academic building. The number of sensors installed is not available but there are approximately 20 such sensors in every building while every sports building has 45 sensors (R. Klumpert, personal communication, May 1, 2020).

Air Quality Complaints : The number of complaints is unavailable but there are a few complaints from the occupants of the older buildings on campus with respect to the indoor temperatures due to the malfunctioning of the indoor heating system (B. Marechal, personal communication, April 29, 2020).

4.2.2 Water

Potable Water : The quantity of potable water consumed at University of Twente in 2017 was 81,800 m³ and this was a significant increase from 2016 (68,658 m³) and 2015 (71,866 m³). The main reasons for this could be the increase in the number of students and usage of potable water to cool research equipment. (UT, 2018) The table below illustrates the water use per FTE on the campus.

Year	Water Consumption (m3)	Number of students/staff	Water Use/FTE
2015	71,866	12,562	5.72
2016	68,658	12,247	5.60
2017	81800	12,021	6.80

Table 4.3 Water Consumption per FTE

Storm and Grey Water Reuse : The University of Twente has a substantial plan for reusing storm water and has a solid infrastructure in place for the collection, storage and treatment of this water. The table below illustrates the various points on campus where water is stored and their uses.

Location	Use
Water storage under faculty club car park	Soil infiltration
Gravel layer under car park 2	Soil Infiltration
Ponds	Watering lawns
Hogenkamp	Watering sports fields%
Technohal	Flushing toilets
Brooks	unknown
Horst	Cooling Research equipment

Table 4.4 Water Sources and uses

While there is significant storage and treatment of storm water on campus, the quantities of these are unavailable. Moreover, the quantities of grey water reused is not available as well.

Smart Water Metering : All buildings on the campus are equipped with smart water meters except Pakkerij, ITC hotel, ITC building, Therm and the wooden cabins (Opslagruimten en Blokhutten), and Technohal has smart water meters but it has issues which need fixing (B. Marechal, personal communication, April 29, 2020). Hence, Out of the 72 academic buildings on campus, 5 do not have smart water metering installed in them.

Leak Detection & Efficiency : Leaks and efficiency checks are performed when the water meters display error messages or if there are any interruptions in the water supply. The presence of these smart water meters help in minimizing the number of scheduled checks.

Waste Water Treatment : The waste water from UT is sent to the pumping station located on the campus and this is sent to Vechtstromen Water Board which is a government water board in charge of flood defense, water quantity management and water quality management. The treated water is then sent to Kristalbad which is a storage area for water and a recreational spot. The volume of wastewater from the last 2 years are tabulated below. These values are the combination of some quantities of storm water run-offs and wastewater from the buildings on campus. The volume of waste water treated on-site with constructed wetlands or any other method is unknown. The above mentioned volumes of waste water have been provided upon request from (Marechal, Personal Communication, 2020)

Year	Volume (m3)
2018	222,465
2019	239,259

Table 4.5 Volume of Waste Water Generated

4.2.3 Land:

Managed Green Spaces : University of Twente is abound with woodlands, lawns and other recreational spots. The total area of managed green spaces is tabulated below.

Type of green space	Area
Grass	15 ha.
Lawn	31 ha.
Shrub	1.9 ha.
Trees	43.7 ha.
Total	91.6 ha.

Table 4.6 Managed green spaces at UT

The total building area of UT is 25.18 ha (R. Klumpert, personal communication, May

19, 2020). The ratio of green spaces to the built up area is 3.6:1

Trees on Campus : The University of Twente does not collect the data for the number of trees on campus. Although, UT does collect data for trees that are close to pedestrian or bike paths (3m away) but the rest of the trees are not included in this data set. Moreover, the tree species data is collected only for a select few trees and is largely absent for most of the other trees on campus (N. Schwarz, personal communication, April 6, 2020).

Sustainable Campus Planning Guidelines: In its 60 year history, UT has not acquired any land. In the past 4 years, UT has worked on two major real estate initiatives : Health cluster in Technohal building required a major renovation and shifting the ITC faculty from the city centre of Enschede to the Citadel building on campus (University of Twente, 2017). These real estate plans did not require following a sustainable campus guideline as it was mainly renovations and shifting from one existing building to another on campus. Moreover, in case UT needs to construct a new building on campus, the beeldkwaliteitsplan (Campus plan) is consulted with the head architect who guides UT on the zoned areas of the campus (B. Marechal, personal communication, April 30, 2020).

Fertilizers & Pesticides : The management of the campus grounds has been contracted to Krinkels which is a landscape management company based in Hengelo. Krinkels uses no pesticides or fertilizers in the management of the green areas of the campus. In the management of the algal growth on the artificial turf fields, bacteria is used to kill the algae instead of harmful pesticides (B. Marechal, personal communication, April 30, 2020). There is a species of caterpillar (Oak processionary caterpillar) which is abundantly found in spring/summer on oak trees in the Netherlands. These caterpillars are poisonous and can cause severe itching and a host of other problems upon contact. There are several oak trees on the UT campus and to prevent people from going near these trees, the trees are covered with red stickers and warning signs. The caterpillar infestation is treated with the use of

nematodes(roundworms) which help in eliminating these caterpillars (B. Marechal, personal communication, April 30, 2020).

4.2.4 Energy

Electricity Use : UT has an extensive energy consumption and use policy which is updated every 4 years. The table below illustrates the energy consumption and energy consumption/FTE at UT.

Year	Electricity Consumption	No. of FTE	Electricity Consumption/FTE
2018	20,473	13900	1.47
2019	20,067	14,286	1.40

Table 4.7 Electricity Consumption at UT

Energy Use in Transportation : Data Not found

Green Energy Consumption : In terms of green energy consumption, UT has installed solar collectors and solar water heaters on the roofs of buildings adjacent to the outdoor swimming pool. These solar collectors and heaters help in heating the pool. The annual output of these being 52 GJ (UT, 2015). Moreover, there are 585 solar panels on the roof of the Technohal building which contributes to 160865 Wp. No further data on the solar panel efficiencies is available which makes it impossible to quantify this data to meaningful numbers. Moreover, the number of solar panels installed and their total output is unavailable as well.

Energy Metering : UT has smart energy meters installed on 29 buildings on campus which are connected to the grid and help in day to day monitoring of energy use (UT, 2020a). The data for these buildings are available on the energy data website for UT which is freely

accessible.

Energy Policy : UT has developed an extensive energy policy over the last two decades which is updated every 4 years. Moreover, UT signed the long term covenant agreement on energy efficiency with the Dutch government which aimed at improving energy efficiency and reducing energy use. The aim was to reduce energy use by 30% in a 15 year period (2005-2020). In 2005, UT consumed 62000 MWh of energy while in 2018, UT consumed 42000 MWh of energy, a reduction of 36.5% which is well and beyond the target set of 30% (UT, 2019a). In terms of energy consumption, UT has taken significant measures over the years with the help of efficient building measures and the amount of energy consumed has been on the fall since 2005. The next step that UT is working on is increasing awareness of energy use among its members and this is expected to further reduce energy consumption at UT (UT, 2019a).

4.3 Institution Dimension

4.3.1 Research & Curriculum

Research Data not found.

Academic Programs : UT has several programs focusing on sustainability and numerous courses having substantial sustainability content which are tabulated below. Table 4.8 below illustrates the programmes with substantial sustainability content and table 4.9 illustrates the courses in the departments of UT that have substantial sustainability content.

Name of Program	Type of Study
Advanced Technology	Bachelors
ATLAS	Bachelors

Integrated Civil Engineering Systems	Masters
Environmental & Energy Management	Masters
Natural Resources Management	Masters
Water Resources & Environmental Management	Masters
Sustainable Energy Technology	Masters
Water Technology	Masters

Table 4.8 Sustainability focused programs at UT

1. BMS	2. ET	3. ITC
1.1 <i>Economic Methods of Sustainability Assessment</i> 1.2 <i>Energy, Sustainability & Society</i> 1.3 <i>Environmental Policy</i> 1.4 <i>Policy & Sustainability</i> 1.5 <i>Sustainability & Law</i> 1.6 <i>Sustainability Politics & Policies</i> 1.7 <i>Sustainability Research Forum</i> 1.8 <i>Environment & Technology</i> 1.9 <i>Environmental Management</i> 1.10 <i>Circular Sustainable Business Development</i> 1.11 <i>Crossing Borders</i> 1.12 <i>Ecology</i> 1.13 <i>Societal Challenges</i> 1.14 <i>Sustainable Bio-resources Supply Chain Management</i> 1.15 <i>Sustainable Cities</i>	2.1 <i>Energy & Sustainability</i> 2.2 <i>Sustainability & Circularity in Civil Engineering</i> 2.3 <i>Sustainable Civil Engineering</i> 2.4 <i>Sustainable Transport</i> 2.5 <i>Water & Energy</i> 2.6 <i>Water Footprint Assessment</i> 2.7 <i>Urban Resilience in a Changing Climate</i> 2.8 <i>Water & Climate</i>	3.1 <i>Environmental Modelling</i> 3.2 <i>Environmental Niche Modelling</i> 3.3 <i>Climate Resilient Cities</i> 3.4 <i>Role of Forests in Climate Change Mitigation</i> 3.5 <i>Sustainable Land Management Policy</i>

Table 4.9 Courses on sustainability at UT

Out of the five departments at UT, three provide courses with substantial sustainability content in them as shown in table 4.7. This data was formulated based on course titles and course descriptions provided on Osiris, which is a centralized platform that displays all the courses available at UT.

Collaboration : Data unavailable

Sustainable Literacy : UT does not conduct a sustainable literacy assessments of its students and staff.

Incentives : Data unavailable

4.3.2 Procurement

Life Cycle Cost Analysis : In the procurement of goods/services, UT follows a points based system to evaluate prospective bidders on a tender. This points based system has several categories in it such as quality, cost, convenience, distance from UT, specifications, reputation etc. The category of sustainability is absent from this points based system as of now and there are plans to inculcate it in this system in the near future. The category of sustainability will include LCCA analysis and other categories pertaining to sustainable procurement (R. Belt, personal communication, March 12, 2020).

Equipment : The average annual expenditure on inventory and equipment at UT is €13.94 million (R. Belt, personal communication, May 11, 2020). The list of equipments is not available and it is unknown if EPEAT standards were applied in the procurement of electronics.

Paper Consumption : On average, UT spends € 34,206 annually for its paper needs. The data for the different kinds of paper and the number of paper sheets is unknown (R. Belt, personal communication, May 11, 2020).

Local Sourcing : Data unavailable

4.3.3 Human Resources

Employee Satisfaction : UT conducted a well-being study among its employees which assessed their satisfaction levels, strain levels and other job related well-being indicators. It

was found that the overall satisfaction level among employees at UT is a 7.2 (on a scale of 1-10) which is "neither undesirable nor good" in comparison to other organizations (De Leede, Meijerink, Torka, 2019). Moreover, the report also found that employees at UT were engaged in their work while reporting high levels of strain. The leading cause of this strain being a bad relationship with their manager/supervisor. This strain forces UT employees to work longer hours and spend sick days/vacation days for finishing work. 1 in 7 employees also reported facing aggressive behaviour especially intimidation from other employees/supervisors in the last two years (De Leede, Meijerink, Torka, 2019).

Wage Gap : UT uses salary scales which were developed in the Collective labour agreement of Dutch Universities (CAO-NU). There are 18 scales and the scale for a person is decided on the level of work experience, highest degree obtained and the position that is being applied to (HR-University of Twente, 2019). Interviews with the HR personnel of UT indicated that there existed no wage gaps among people of different genders/race/ethnicity (N. Kollen T. Terpelle, personal communication, April 20, 2020)

Representation : The data for people of different ethnicities or people with disabilities is unavailable. Out of a total of 3150 staff present at UT, there are 1817 males and 1333 females. The gender ratio of males to females is 58:42 (UT,2018). Moreover, To meet the goal of employing more female professors, UT launched the Hypatia campaign to encourage qualified women to apply and work at UT. (UT- Annual Report, 2018)

4.3.4 Waste Management

Waste Streams : UT has a stringent policy of preventing waste and separating its waste into a wide variety of waste streams to facilitate better re-use, recycle or disposal of its wastes. The following are the different waste streams that are present at UT (Waste-UT, 2019).

1. Paper
2. PMB (Plastic, Metal & Beverage containers)
3. Fruit & vegetable Waste
4. Residual Waste
5. Construction & demolition waste
6. Hazardous Waste
7. Glass
8. Bulk residual Waste
9. Wood
10. Expired products
11. Swill
12. Confidential paper
13. White/Brown goods

Hazardous Waste : UT being a technical research university having several laboratories that use hazardous materials and chemicals for its research has a hazardous waste stream. The following are the amounts (in kg) of hazardous waste produced by UT in the time period between 2014-2017.

Year	Quantity (Kg)
2014	35,528
2015	32,188
2016	31,157

2017	23,957
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Table 4.10 Hazardous waste quantities at UT

Waste Quantities : The quantities of waste produced for the streams mentioned in the indicator 'waste streams' are as shown in the tables below.

Waste Stream	2016	2017	2018
Paper	123,939	134,682	181,000
PMB	8,173	9,305	11,000
Fruit & Vegetable	0	0	No data
Residual Waste	386,732	407,904	No data
C & D	1960	2000	No data
Hazardous Waste	31,157	23,957	No data
Glass	19,080	10,770	12,000
Bulk & Residual Waste	24,040	30,880	535,000
Wood	1,750	9,756	38,000
Expired Products	8,890	9,634	No data
Swill	40,810	26,954	51,000
Confidential Paper	32,242	28,426	No data
White Brown Goods	0	3080	No data

Table 4.11 Waste streams & quantities at UT)

Waste Violations : In the past two years, UT has reported no waste violations on its campus. Waste management has been performed according to the local and national laws (C. Hilgeholt, personal communication, April 4, 2020).

4.3.5 Student Finance

Student Loans : Data not available

Scholarships : UT works closely with the Dutch Government in awarding several scholarships to students from different backgrounds. There are several scholarships offered by the UT, Collaboration between UT and private organizations and other non profits. The entire list is available in the Appendix C.

Student Fees : Dutch Universities charge fees based on a student's country of origin. There are two different fee structures in place: Statutory fees and Institutional fees. Statutory fees are set by the Dutch Government and these are applicable to students from the EU/EEA countries. Institutional fees are set by the university and these are applicable for students from non EU/EEA countries. Dutch Universities like most other European universities receive funding from the government for students belonging to the EU/EEA ,and is why their fees are lower than the students from outside Eu/EEA countries. This is explained using table 4.12 (UT, 2020)

Level of Study	EU/EEA Students	Non-EU/EEA students
Bachelors	€ 2143	€ 9125 - 12768
Masters	€ 2143	€ 12500 - 16000

Table 4.12 Fee Structure at UT (UT, 2020)

The fees for Non EU/EEA students for bachelor and master studies are dependant on the type of program they are enrolled in. The only exception to this fee structure are Surinamese students and other refugee students who are required to pay the same fees as EU/EEA students.

Student Jobs : UT has a digital platform called UT-Flex where academic/non-academic jobs are regularly posted. The jobs posted are leaning towards academic jobs and in the period between 2017-2019, 427 jobs posted on this website (UT- Flex, n.d.). In case, a student wants other non academic jobs such as in dining areas, library, supermarket or other administrative duties, they have to approach the organization directly. Moreover, 491 internships and 541 graduation assignments were completed by students at organizations across the Netherlands. UT assisted students in finding these internships, provided remuneration in case of international internships and helped students with the legalities.

4.3.6 Governance

Student Governance : UT has two student-run sustainability organizations which work to promote sustainability on campus. They are Sustain and Green Hub Twente. The mission of Sustain is to promote sustainability awareness on campus and in encouraging students to take part in sustainability initiatives (Student Union UT, n.d.). The mission of Green Hub Twente is to be the focal point of communication between researchers, students and the sustainability office (Green Hub Twente CFM, n.d.). Moreover, they play a major role in shaping sustainability policies and in propagation of sustainability principles among the students and staff of the university. These organizations act in accordance with the campus sustainability office in organization of new initiatives, training and other policy events.

Plans for the Future : UT has several sustainability related plans for the future in all of its working areas but the most comprehensive plan for the future that is in place which encompasses all its working areas is the Shaping 2030 plan. The Shaping 2030 plan has plans and targets set in areas of education, ecosystem, research, curriculum and its operations. This plan has priority targets and long-term targets set along with timelines of these targets which makes it easy for other stakeholders to analyze the goals and targets of this plan. The information for other working areas are as shown below in table . This is

the data gathered from publicly available information and plans in the making or plans not online are not accounted for in this table.

Plan	Description	Pursued by UT? (Yes/No)
Energy Management	Efficiency measures, greenhouse gas reduction and renewables	Yes
Water Management	Efficiency measures and reuse	Yes
Air	Indoor/Outdoor air pollution monitoring and measures	Yes
Wellness	Fitness, safe work environment, spirituality, nutrition, alternative work arrangements	Yes
Procurement	Ethical and environmentally sound procurement policies	No
Waste Management	Reduction, reuse and recycling measures	Yes
Transportation	Transportation policies for commuting to university and the logistics	No
Student Engagement	Community engagement in student government decision-making	No
Investments	ethical and environmentally sound investments	No
Equity	gender, people with disabilities, and ethnicities	No

Conflict and Dispute Resolution processes	Smooth conflict resolution mecha- nisms	No
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Table 4.13 Plans for the future

Sustainability Office : UT has a sustainability office on the university campus which acts as a focal point for all sustainability related matters on campus. Although there exists a website which shows the people involved in the working group improving the sustainability of UT, further information about the initiatives and other operational metrics is absent.

Website : UT has several web pages for sustainability related initiatives and policies. However, there is no central web page linking the sustainability efforts of all the working areas of UT. Several web pages showing data have not been updated to the most recent status and the navigational aspect of the web pages of UT is poor.

4.4 People Dimension

4.4.1 Investments

Environmentally Safe : Data not available

Fossil Fuel Investments : Data not available

Transparency : UT has invested in and helped develop over a thousand spin offs and start ups till data (UT- Annual Report, 2018). However, the list of these companies is not publicly available.

Investments in Unethical Businesses :

4.4.2 Food & Dining

Local Food : Data not available

Sustainable Food Policy : The catering on-site and in dining areas of UT is controlled by a company called Appèl. The dining areas are available in five academic buildings (Horst, Spiegel, Technohal, Ravelijn and Waaier). UT chose Appèl based on a points based tendering system which had sustainable food policy as one of the options and out of all the companies that had applied for the tender, Appèl scored the highest points. Moreover, there are several discussions that are ongoing between UT and Appèl on ways to make the dining areas more sustainable (Hilgeholt, Personal Communication, 2020).

Food Waste : The quantity of food waste that is diverted to the waste stream is not available. However, Appèl (Catering service provider for UT) has been working on reducing its food waste and it is minimal. In cases where there is excessive food left in the dining areas, the food is sent to food banks in the local areas (C. Hilgeholt, personal communication, April 4, 2020).

Diet Types : The canteens in UT cater to four main diet types : Vegan, Vegetarian, Omnivorous and Halal. On request, gluten free and low sodium diet are available as well.

4.4.3 Engagement

Satisfaction Levels : Every student studying in the Netherlands can participate in the National Student Survey which reviews the satisfaction level among students with their programmes, universities, professors and other aspects of student life. It is an annual event and in 2019 UT scored a 4.16 out of 5 which put them in the 3rd place nationally. This was an improvement from last year where UT scored 4.1 and had placed 4th

Events & Competitions : The various departments and student associations at UT organize events throughout the year. Over a 100 major and 1500 smaller events take place on the campus of UT every year (UT- Annual Report, 2018). The events are of various types which are enumerated below.

1. Studium Generale
2. Symposiums/Conferences
3. Festivals & Concerts
4. Ceremonial Events
5. Workshops
6. Career Fairs
7. Entertainment (Music, Art, Dance, Theatre, Comedy, Quizzes)
8. Seminars
9. Competitions
10. Sports events
11. Internal Departmental Events
12. Lunch Lectures
13. Kick in (Orientation programs)

Volunteerism : No data available

New Student/Staff Orientation : For students, there are two intake sessions, the September intake and the February intake which have an orientation programme for incoming students where students are taught about Dutch culture, expectations from the students, concerts, games etc. New staff orientation at UT is different from the students and there is usually an event every month within departments wherein new members of staff are introduced and oriented according to the department.

4.4.4 Community

Community Partnerships : UT has a strong presence in the Twente region and has several strong partnerships with local business and governmental organizations. These businesses and organizations work on a varied mix of environmental and social problems.

1. The Twente Board
2. The Agenda Voor Twente (Agenda for Twente)
3. Novel -T (Business incubator)
4. Smart Enschede en City Deal Kennismaking (Smart Enschede and city deal introduction)
5. Kennispark Business area
6. Omgevingsvisie Oost-Nederland (Environmental Vision - East Netherlands)
7. Keeping Talent in Twente
8. Provincie Overijssel
9. VNO-NCW

The above mentioned data was accessed in the annual report published by UT. Source :(UT-Annual Report, 2018)

Community Service : Data not available

Community Stakeholder Engagement : Data not available

4.4.5 Health & Safety :

Physical Health : UT provides a wide range of physical health services to its university members.

1. General Practitioner
2. Travel Doctor
3. Physiotherapist
4. Dietitian
5. Company Doctor and occupational safety specialist

Mental Health : UT has a professional psychotherapist on campus who tends to the needs of university members who require assistance. Moreover, there are six psychologists and several student counsellors in every departments tending to the needs of the university members.

Incidents of Assault : Data not found

Accidents : In 2018, UT reported 14 accidents that were filed on their online accident and dangerous situations web form. Out of the 14, 11 were work-related accidents (UT-Annual Report, 2018).

4.4.6 Transportation

Transportation Modal Split : The exact figures for this indicator are extremely hard to find. Moreover, Netherlands being a bike-friendly country has a major percentage of the

population using bikes for their everyday commuting. A vast majority of students at UT commute on their bikes. The exact number of other staff and students using either trains or cars is not known but the total annual distance commuted by these modes has been calculated in the Carbon footprint (2018) report published by UT.

University Member	Car (in kms)	Train (in kms)
Students	11,511,468	29,418,000
Staff	9,013,062	8,018,229

Table 4.14 Distance travelled by car or train by university members

Green Vehicles :

Electric Charging Facilities : UT has car and electric bike charging points on several parking locations on campus. The number of these charging points that are available is unknown.

Local Transportation : UT does not offer public transit concession to commuting students. A vast majority of students live in the local areas and commute via bikes. Other forms of public transport that are available are buses and trains. Students belonging to EU/EEA countries get travel allowances wherein they can use public transit for free either on weekends or weekdays, moreover they are given an allowance of €98 every month for travel related purposes (Dienst Uitvoering Onderwijs (DUO), n.d.).

Bicycle Programs : Netherlands is a bicycle friendly country and having a wide network of bicycle lanes makes it easier to universities to provide safe bicycle infrastructure due to institutional support and policies. New incoming students are provided with several trusted locations where they can buy their bicycles from. Moreover, the physical bike infrastructure is solid and bicycle storage facilities are available everywhere on campus.

Chapter Five

Discussion

There is constant talk of a sustainable future and the pathways that need to be adopted to achieve sustainability, but the overarching question of what is sustainability at its most basic tenet or if we are there yet? begs an answer that is conclusive and definitive. This concluding chapter analyzes the data found in Chapter 5 upon application of USAF to the University of Twente and the scorecard of University of Twente in Appendix D. Moreover, other elements of sustainability in universities, the different approaches undertaken worldwide and other points of discussion are further elaborated upon.

5.1 University of Twente Scorecard

The total scores that have been achieved by UT in this framework is illustrated with the table 5.1 below. This analysis helps in understanding the areas of operation that need to be improved at UT and also addresses the total scores of every category in the scorecard. Moreover, this section also provides some key conclusions about UT's areas of operations, areas where improvement is possible and the shortcomings of this framework.

Table 5.1 is generated using data from Appendix C which includes data on the weights of the categories. The scores are calculated from the data in Appendix D which has the full scorecard for the University of Twente. Based on these metrics, the weighted scores

Category				Total	Weight of Category (%)	Weighted Scores
Air	0	1	4	9	5.5	0.495
Water	0	2	3	8	9.5	0.76
Land	1	0	3	6	3.5	0.21
Energy	1	1	3	7	15	1.05
Research & Curriculum	4	0	1	2	10	0.2
Procurement	4	0	0	0	2.5	0
Human Resources	0	2	1	4	3.5	0.14
Waste Management	1	1	2	5	2.8	0.14
Student Finance	1	1	2	5	3.3	0.165
Governance	0	2	2	6	5.9	0.354
Investments	4	0	0	0	5.3	0
Food & Dining	1	1	2	5	2.7	0.135
Engagement	1	0	3	6	9.3	0.558
Community	2	1	0	1	4.5	0.045
Health & Safety	2	1	1	3	4.3	0.129
Transport	2	2	1	4	12.4	0.496
Total	24	15	28	71	100	4.877

Table 5.1 Scorecard for University of Twente

are calculated by the multiplication of the weight of the category and the total score of the category.

- As noted in table 5.1, the score for University of Twente is 71 out of 136 which is equal to 5.22 while the score when the categories are weighted is 4.96. This discrepancy in scores are due to the higher weights in categories that UT has scored lower points in and lower weights in categories that UT has scored higher points in.
- Based on table 5.1, an action priority matrix was created which is illustrated with the help of figure 5.1. This matrix illustrates the areas of UT that can be worked upon to improve its scores. The action priority matrix is divided into 4 distinct areas as shown in figure 5.1. For quick and easy score improvement, areas of high impact-low effort are analyzed. Small improvements such as transparency of collected data and small tweaks in data quality in the categories can significantly improve the score. The improvements

to be carried out are not elaborated upon due to difficulties in conducting interviews with key experts at UT due to the COVID-19 pandemic.

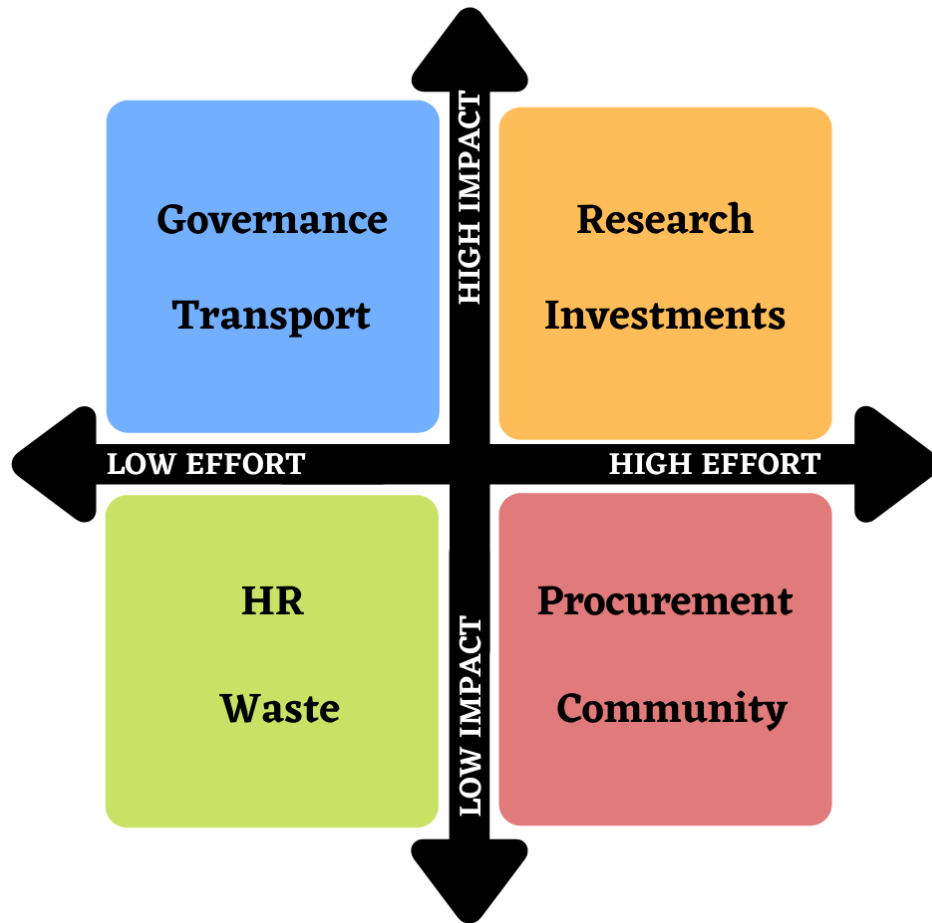


Figure 5.1 Action priority matrix for UT

5.2 Campus based universities and city universities

Universities across the world can be roughly separated based on their location and size. The idea of a sustainable campus can widely vary between campus based universities and city based universities. Campus based universities have most or all of their buildings within a well defined campus grounds and where student/staff housing, recreational facilities and other needs of the campus users are all provided for on the campus. A fine example of a

campus based university is Stanford University in USA. City universities have their buildings, accommodations for students/staff and other university facilities spread across the city. Examples of city based universities include University of Amsterdam and London School of Economics.

Sustainability parameters for different types of universities vary and this is seldom discussed in academic literature. Sustainability assessment frameworks in existence today have no distinction between types of universities and a university is ranked based on assessment criteria which can be biased. For example, in the STARS framework, the category of grounds which assigns points based on the university's landscape management and biodiversity is tilted towards the favour of campus based universities as city based universities usually do not have landscape management practices or a biodiversity hub on their campuses and they do not receive any points for this category. Other indicators such as water use and electricity use can be significantly higher in campus based universities due to more upkeep/use needed for the larger area. It is a difficult task to gauge the sustainability of a university without making these distinctions about the university. Sustainability assessment frameworks do not account for these factors and to gauge a university judiciously, it is important for frameworks to adopt indicators which account for their locations and judge them accordingly. Out of the thousands of universities that have applied the STARS assessment framework in their universities, only nine universities have achieved the platinum rating which is the highest ranking awarded. Out of these nine universities, only one is a city based university – Arizona State University. Although this requires a thorough in-depth research, these insights helps in understanding the biases that exist in sustainability assessment frameworks that work in the favour of campus based universities.

5.3 Universities in the Global North and Global South

A sustainability framework to assess a university on sustainability parameters is a fairly recent development and a closer glance at these frameworks indicates that these frameworks are more relevant for universities in the Global North. Several unique problems that affect universities in the Global South are not addressed in these frameworks. Important issues such as access to education, acceptance rates, the unaffordability of higher education and the gender gap in enrolment are some of the issues that are seldom addressed in sustainability frameworks. Moreover, other non educational issues such as frequent power and water outages, lack of other co-curricular facilities and generally lower level of engagement which are crucial in universities in Global North are seldom present in universities in the Global South.

In terms of research output, Studies have shown that scholars in the global South are under represented in top international peer-reviewed journals (Havergal, 2016). Prominent Global North-based scholars have a broader geographic presence and are typically considered to be at the forefront of information creation and distribution. In the meantime, Global South-based academics are still not an equal part of the major debates and discussions in their fields of expertise. This points to a significant disparity in the research output and information creation mainly due to insufficient funding of projects and a lack of governmental support (Havergal, 2016). Sustainability assessment frameworks take their inspiration from the UN'S Sustainable Development Goals which are a blueprint for a sustainable future. The UN Sustainable developmental goals are a common point of discussion in the sustainability world which is used to underline our vision of an ideal world but should the UN sustainable development commission take into regard more achievable goals for poorer countries? Should the sustainable developmental goals be different for countries in the global north(GN) and different for countries in the global south(GS)? (Sanghvi, 2019). These questions can further be asked about assessment frameworks as well. Is there a need for different sustainability

assessment frameworks for universities in the Global South which adjudges the university fairly and provides targets which are achievable? These questions help in providing an insight about the blurry lines that exist between countries of the GN and the GS. Further research and analyses are required to ascertain these hypotheses and help in understanding the role of sustainability in different geographical contexts.

5.4 Future Research

The need for a relevant sustainability framework applicable to every university in the world has been ever present. This framework has been developed to address this need and cover more categories than other frameworks in existence. However, the number of indicators in this framework is limited mainly due to limited time constraints for this study. An expansion of the number of categories and the number of indicators can provide a better holistic view of the sustainability movement in universities. Thus, further research into this expansion can be of great significance.

Another area of improvement that needs to be done is the language used in this report. Definitions of terms need to be 'exact' and precise without doubts about the scope and the nature of the definitions. There are several terms used in this report which can be defined better such as 'sustainability', 'university members', 'local' etc. Defining these terms and the indicators is crucial for the longevity of this framework to avoid ambiguities in its interpretation.

The scoring model created in this framework is rudimentary in its principles. The scoring ranges can be expanded upon to inculcate a greater range of scores and improve the accuracy of a university's scorecard. Moreover, due to the COVID-19, the application of this framework was not completely successful in University of Twente and this is evident in Appendix B, which has several indicators marked as '0' due to the non availability of data. Future researchers can improve upon this framework and find/analyze the missing data to

get the overall picture of sustainability at the University of Twente.

This version of USAF being a lengthy report comes with several drawbacks. In this age of internet, an online website wherein calculations can be inputted from the user and where data representation can be done in a visually exciting manner, this report seems clunky. Future researchers can create a visually stimulating website which can greatly help in propagation of this framework to other universities.

Lastly, the application of a sustainability assessment framework is one step, but implementing change and following it up with future assessments is a step that needs to be taken after application. A thorough monitoring of the university over a set period of time needs to be done for effectively contributing to sustainability

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APPENDIX

.1 University Sustainability Assessment Framework

AIR

Indicator	Findings	Rating
1. CARBON FOOTPRINT <i>Total amount of carbon di oxide in tonnes produced per FTE. (Scope 1, 2 & 3)</i>		
2. CAMPUS AQI <i>Average Air quality index of the campus over a period of one year</i>		
3.SMOKE FREE SPACES <i>Number of outdoor areas designated to be smoking free and the distances of the smoking areas from public areas</i>		
4. INDOOR CARBON DI OXIDE MONITORING <i>Number of indoor areas having CO2 monitoring systems in place</i>		
5. AIR QUALITY COMPLAINTS <i>Number of air quality complaints received and its effective redressal</i>		

Discussion

WATER

Indicator	Findings	Rating
1. POTABLE WATER <i>Total annual volume of potable water consumed on campus for all uses</i>		
2. STORM & GREY WATER RE-USE <i>Volume of storm and grey water re-used for non potable water purposes</i>		
3. SMART WATER METERING <i>Number of buildings that have smart water meters installed to measure water use and discharge</i>		
4. LEAK DETECTION & EFFICIENCY <i>Number of water distribution systems tested for leaks and efficiency of the fixtures</i>		
5. WASTE WATER TREATMENT <i>Total volume of grey and black water being treated on campus that meets regulatory standards</i>		

Discussion

LAND

Indicator	Findings	Rating
1. MANAGED GREENSPACES <i>Total hectares of managed green spaces on campus compared to the built up areas of campus and other natural areas</i>		
2. TREES ON CAMPUS <i>Total number of native trees and non native trees on campus</i>		
3. SUSTAINABLE CAMPUS PLANNING GUIDELINES <i>The percentage of new land acquisitions in the past 2 years that have been undertaken using sustainable campus planning guidelines.</i>		
4. FERTILIZERS & PESTICIDES <i>Total volume of pesticides and fertilizers used on campus</i>		

Discussion

ENERGY

Indicator	Findings	Rating
1.ELECTRICITY USE ON CAMPUS <i>Total electricity use per FTE in the campus in terms of buildings, outdoor lighting, residences, super-markets and other spaces.</i>		
2. ENERGY POLICY <i>The policies that the university has related to energy reduction and renewable energy.</i>		
3.GREEN ENERGY CONSUMPTION <i>Total energy procured from green energy providers or green energy created on campus</i>		
4.ENERGY METERING <i>Total number of smart energy meters available for monitoring energy use</i>		
5.ENERGY USE IN TRANSPORT <i>Total energy used in transportation needs of the university members/FTE.</i>		

Discussion

RESEARCH & CURRICULUM

Indicator	Findings	Rating
1. RESEARCH <i>Number of staff and students involved in full-time sustainability focused reseach</i>		
2. ACADEMIC PROGRAMS <i>Total number of programs and courses that have substantial sustainability related content.</i>		
3. COLLABORATION <i>Number of courses/initiatives that involve collaboration between two or more departments in a sustainability oriented topic</i>		
4. SUSTAINABILITY LITERACY <i>Number of assessments undertaken by the university to assess knowledge of sustainability among its students & staff</i>		
5. INCENTIVES <i>Total amount in euros spent on incentive programs for student and staff led research, training or initiatives in the field of sustainability</i>		

Discussion

PROCUREMENT

Indicator	Findings	Rating
1.LIFE CYCLE COST ANALYSIS <i>The usage of life cycle cost analysis in the university's procurement policies</i>		
2.EQUIPMENT <i>Total amount spent on equipment that is sustainably manufactured</i>		
3.PAPER CONSUMPTION <i>Total pieces of paper purchased by all departments of all types (Recyclable, tree-free, chlorine free etc.)</i>		
4.LOCAL SOURCING <i>Total amount in euros spent on sourcing products locally</i>		

Discussion

HUMAN RESOURCES

Indicator	Findings	Rating
1.EMPLOYEE SATISFACTION <i>Satisfaction level of employees</i>		
2.WAGE GAP <i>Wage gap between employees of different gender and ethnicities</i>		
3.REPRESENTATION <i>Percent of staff belonging to different genders, ethnic minorities or having disabilities</i>		

Discussion

WASTE MANAGEMENT

Indicator	Findings	Rating
1. WASTE STREAMS <i>The number of waste streams that the University classifies its waste into.</i>		
2.HAZARDOUS WASTE MANAGEMENT <i>Total generation of hazardous waste annually on campus and the management practices involved in its safe storage and disposal</i>		
3.WASTE QUANTITIES <i>Total weight of the different waste streams over the last 3 years.</i>		
4.WASTE VIOLATIONS <i>Total number of waste violations reported in the last 2 years</i>		

Discussion

STUDENT FINANCE

Indicator	Findings	Rating
1. STUDENT LOANS <i>Total number of FTE graduates who are funding their studies with a loan from the government, bank or an external agency</i>		
2. SCHOLARSHIPS <i>Total number of scholarships provided by the university</i>		
3. STUDENT FEES <i>Student fee-gap between international students and local students and fee hikes in the past 3 years.</i>		
4. STUDENT JOBS <i>Total number of student jobs that are available for all students on campus</i>		

Discussion

GOVERNANCE

Indicator	Findings	Rating
1.STUDENT GOVERNANCE <i>Total number of student run organizations that work towards improving sustainability on campus or outside the campus</i>		
2.PLANS FOR THE FUTURE <i>Total number of sustainability related plans and initiatives drafted for future</i>		
3. SUSTAINABILITY OFFICE <i>The presence of a sustainability office in the university campus</i>		
4. WEBSITE <i>The presence of a clear website for sustainability initiatives in the campus and the initiatives followed by the sustainability office</i>		

Discussion

INVESTMENTS

Indicator	Findings	Rating
1. ENVIRONMENTALLY SAFE <i>Investments by the university in environmental friendly firms, funds or practices.</i>		
2. FOSSIL FUEL INVESTMENTS <i>Investments made by the university in firms operating in the fossil fuel industry</i>		
3. TRANSPARENCY <i>The presence of a publicly available investment portfolio of the university.</i>		
4. INVESTMENTS IN UNETHICAL BUSINESSES <i>Investments by the university in businesses having unethical practices</i>		

Discussion

FOOD & DINING

Indicator	Findings	Rating
1.LOCAL FOOD <i>Percentage of food sourced locally</i>		
2.CATERERS POLICY <i>Total number of caterers operating on campus that have a sustainable food policy</i>		
3.FOOD WASTE <i>Amount of food waste diverted from dining halls to solid waste stream</i>		
4.DIET TYPES <i>Total number of diet types catered to in any given week</i>		

Discussion

ENGAGEMENT

Indicator	Findings	Rating
1. SATISFACTION LEVELS <i>Level of satisfaction with the university among the students</i>		
2. EVENTS & COMPETITIONS <i>Total number and kinds of competitions and events held at the university</i>		
3. VOLUNTEERISM <i>Total number of organizations and students within the university volunteering in a sustainability focused operation</i>		
5. NEW STUDENT/STAFF ORIENTATION <i>Total number of student or staff orientation events held to acquaint new arrivals with the local community and surroundings.</i>		

Discussion

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COMMUNITY

Indicator	Findings	Rating
1. COMMUNITY PARTNERSHIPS <i>Total number of partnerships with local businesses for fostering sustainability</i>		
2. COMMUNITY SERVICE <i>Total number of students or student led organizations performing community service in the local area</i>		
3. COMMUNITY STAKEHOLDER ENGAGEMENT <i>Total number of local community stakeholders who have had direct engagement with students at the university with the aim of fostering knowledge of the local ecosystem</i>		

Discussion

HEALTH & SAFETY

Indicator	Findings	Rating
1. PHYSICAL HEALTH <i>Total number of physical health care professionals working on campus</i>		
2. MENTAL HEALTH <i>total number of mental health care professionals working on campus</i>		
3. INCIDENTS OF ASSAULT <i>Total annual number of reported incidents of rape, sexual assault, harassment, racism or other similar events</i>		
4. ACCIDENTS <i>Total annual number of accidents on campus. (Workplace, motor vehicles, etc.)</i>		

Discussion

TRANSPORTATION

Indicator	Findings	Rating
1. TRANSPORTATION MODAL SPLIT <i>Percent of FTE using different modes of transport available. (Bicycle, Car, Train)</i>		
2. GREEN VEHICLES <i>Percent of vehicles owned by the university that run on alternate fuel or electronic technologies.</i>		
3. ELECTRIC CHARGING FACILITIES <i>Total number of electric charging points available on campus</i>		
4. LOCAL TRANSPORTATION <i>Alternative local transportation options and if university students are subsidised for it.</i>		
5. BICYCLE PROGRAMS <i>Programs funded by university to promote bicycle usage/bicycle sharing and facilities for bike storage</i>		

Discussion

.2 University of Twente Scorecard

University of Twente

Scorecard

This scorecard rates the University of Twente based on its performance in the University Sustainability Assessment Framework.

CATEGORY	INDICATOR	RATING	JUSTIFICATION	TARGET / BEST PRACTICE
Air 	CARBON FOOTPRINT		UT has conducted a scope 1, 2, and 3 carbon emission analysis since 2014 and this information is publicly available along with the methodology and analysis from previous years	Best practice involves a full public disclosure of all greenhouse gas emissions that is verified by an external third party. A reduction per capita over the last 3 years and achieving national targets must be a priority.
	CAMPUS AQI		The AQI measured over the period of one year in the vicinity of the UT campus falls in the 'good' category and poses no health concerns for any age groups or at-risk sensitive populations.	The target for any university is to work under 'good' air quality conditions based on the local/national air quality levels in the air quality index.
	SMOKE FREE SPACES		UT's commitments to enforce a non-smoking policy on campus in line with national targets is a beneficial step for the health of its university members.	The target for universities is to have a healthy, non smoking population. In universities, this target can be achieved by legislation, banning sale of tobacco on campus and tobacco control programs
	INDOOR CARBON DIOXIDE MONITORING		UT has installed, monitored and maintained indoor carbon dioxide monitoring systems in every building on campus based on occupancy levels.	The presence of carbon dioxide monitors is a necessity in every indoor place that has high fluctuations. The number of monitoring systems in place and the safe carbon monoxide levels in an indoor space vary between national standards.
	AIR QUALITY COMPLAINTS		There are a few complaints about the air quality in the older buildings on campus which UT needs to work on.	The target for this indicator is to not have any complaints regarding air quality in the campus in a set time period. Moreover, the redressal of any complaint must be prompt.
Water 	POTABLE WATER		Although the volume of water use has risen over the years, UT consumes way below the European average for water consumption per capita in universities (140 LPD). (*1)	The main target of this indicator is to reduce potable water use by setting of targets and adhering to it. Moreover, increasing water efficiency and active monitoring of water usage and analysis from baseline is to be implemented to reduce water consumption (2*)
	STORM & GREY WATER REUSE		Although UT has a substantial plan for stormwater and grey water reuse, the volumes of water reused is unavailable which makes it difficult to analyze the efficacy of these measures.	Best practices in utilizing storm and grey water reuse can be observed in Arizona State University which has comprehensive storm water management policies, guidelines and plans (3) .
	SMART WATER METERING		Although UT has smart water metering in 67 out of its 72 buildings, the lack of smart water meters in the ITC campus and the ITC hotel which houses a significant number of students is the reason for this indicator to not score full points.	The target for this indicator is to have smart water metering for every building on campus to enable active monitoring of water consumption in the campus and analyze data from baseline scenarios
	LEAK DETECTION & EFFICIENCY		Due to UT having smart water meters in most of its buildings, leak detection and efficiency measures are only checked when the smart water meters display that there is a leak which saves significant time and manpower.	The target for this indicator is to have redress the leak immediately when smart waters show an error. In case, smart water meters are not installed, regular checks at time intervals according to the university's facility managers advise need to be conducted.
	WASTE WATER TREATMENT		UT complies with all legal aspects in terms of treatment of its water that is sent to the local water treatment plant.	The target for this indicator is for a university to comply with the local/national regulations for wastewater and to monitor the wastewater volumes/quality from the baseline scenarios.
Land 	MANAGED GREENSPACES		UT has abundant green spaces on its campus with a green space to building area ratio of 3.6:1	The target for this indicator is assess future expansion plans from this baseline to ensure this ratio remains consistent. Data for other universities' green spaces to built area ratio is unavailable and it is a hard metric to compare.
	TREES ON CAMPUS		Although UT has a vast number of trees on campus, this indicator is ranked as 0 due to the non availability of the number of trees and its species which would help in analyzing this indicator	Best practices for this indicator comes from Calvin University in USA which has mapped every tree on its campus along with other important data such as species of the trees, tree diameter, tree location on campus, estimated height and health of the trees (4) .
	SUSTAINABLE CAMPUS PLANNING GUIDELINES		The Netherlands where UT is situated has several laws(Environment and Planning Act (Omgevingswet)) which inculcate sustainability and the environment in planning and zoning of a locale.	Best practices for this indicator comes from Netherlands which has comprehensive environmental and planning legislation which ensures that sustainability is inculcated as a criteria in planning guidelines.
	FERTILIZERS & PESTICIDES		UT does not use pesticides or fertilizers which have harmful effects on the ecosystem. Eco-friendly solutions are used to get rid of pests and in maintenance of the greenspaces.	The target of this indicator is to minimize the usage of fertilizers and pesticides and adopt eco-friendly methods of pest extermination which does not harm the ecosystem.
Energy 	ELECTRICITY USE		The consumption of electricity is going down irrespective of the rise in the number of students and staff. The efficiency measures that have been carried out over the past years has reduced electricity consumption at UT	The target of this indicator is to minimize the usage of electricity by active monitoring, introducing efficiency measures, awareness programs and policies.
	ENERGY POLICY		The updation of the energy policy every 4 years which has ambitious targets set to reduce energy use and switch to renewable forms of energy makes this indicator score full points in this framework.	Best practices for this indicator comes from Thompson Rivers University in Canada which has set high targets for reducing energy use, installation of several renewable energy sources, several awareness programs and easily accessible information (5) .
	GREEN ENERGY CONSUMPTION		Although UT has installed several renewable energy sources, the lack of data availability for a thorough analysis is absent which leads to this indicator being scored as a 1.	Best practices for this indicator comes from Thompson Rivers University in Canada which runs completely on renewable energy either sourced on site, off-site or through renewable energy certificates.
	ENERGY METERING		UT has installed smart energy meters on 29 buildings on campus and the ease of data accessibility is a massive plus for monitoring energy usage at each of these buildings.	The target for this indicator would be to expand the energy metering across the campus perform checks on the efficiency of the energy meters at regular intervals.
	ENERGY USE IN TRANSPORTATION		Data not found	Best practices for this indicator comes from Universiti Sains Malaysia where a survey was conducted to record users transportation modes, average commuter distance, average speed and other variables and the energy used for transportation was calculated (6) .
Research & Curriculum 	RESEARCH		Data not found	The target for this indicator is to have a large number of experts and students from varied backgrounds conducting research in sustainability. Best practices include the University of Connecticut which has 56.3% of its faculty involved in sustainability focused research *7 .
	ACADEMIC PROGRAMS		UT has several academic programs and courses at different entry levels for its university members.	Best practices for this indicator comes from Thompson Rivers University which offers 2800 courses in total, out of which 20% of the courses have substantial sustainability content. *8
	COLLABORATION		Data not found	Best practices for this indicator comes from Stanford University which has dedicated programs, ventures promoting interdisciplinarity among its departments. *9
	SUSTAINABILITY LITERACY		UT does not conduct a sustainability literacy assessment of its university members.	Best practices for this indicator comes from the University of New Hampshire where a sustainability literacy assessment is conducted once a year and a high level of participation is recorded by the university *10 .
	INCENTIVES		Data not found	Best practices for this indicator comes from Carnegie Mellon University that has developed an incentives program for students and staff to conduct research/education in programs inculcating sustainability. *11
Procurement 	LIFE CYCLE COST ANALYSIS		UT does not have LCCA as a criteria in its procurement policies but there are plans to inculcate it in the future.	Best practices for this indicator comes from Cornell University that has developed an extensive policy document for sustainable procurement and includes LCC analysis. *12
	EQUIPMENT		Due to the non-availability of information of the electronics procured and non application of EPEAT standards, this indicator is scored as a 0.	Best practices for this indicator comes from Cornell University that has implemented EPEAT standards in the procurement of its electronic goods. *13
	PAPER CONSUMPTION		Due to the non-availability of information of the types of paper procured, this indicator is scored as a 0.	Best practices for this indicator comes from College of the New Atlantic that has a sustainable paper procurement policy and comprehensive data of all its paper needs and their sources publicly available *14 .
	LOCAL SOURCING		Data not found	The target for this indicator is to source most of their products from the local area. The distance is subject to geographical location of the universities and it is up to the universities to decide on this distance.

CATEGORY	INDICATOR	RATING	JUSTIFICATION	TARGET / BEST PRACTICE
Human Resources 	EMPLOYEE SATISFACTION		UT scores a 1 point on this indicator due to its average score in the satisfaction survey filled out by its employees.	Best practice of this indicator comes from the University of Maryland in the USA where employees are annually surveyed and sessions are held to improve the work life of the impacted staff. *15
	WAGE GAP		There exists no wage gap at UT due to strong labour and union laws in the Netherlands.	The target of this indicator is to not have any wage gap between employees of different genders, ethnicities or disabilities working in the same role.
	REPRESENTATION		UT scores 1 point in this indicator as there exists publicly available information about the sex ratio of students and staff on campus but there exists limited information about diversity of staff	Best practice of this indicator comes from Stanford University which has publicly available information on its student and staff diversity along with a policy plan of improving diversity and equity on campus. *16
Waste Management 	HAZARDOUS WASTE MANAGEMENT		Although the quantities of hazardous waste is publicly available, the different kinds of hazardous waste materials included in this quantity along with its management practice is not publicly available information	The target of this indicator is to monitor hazardous waste quantities, types of hazardous waste and have policies which are continuously updated for effective management of these wastes.
	WASTE STREAMS		Due to the large number of waste streams on campus which makes it easy to store, segregate and properly dispose waste, UT is given 2 points for this indicator.	The target of this indicator is to have the maximum number of waste streams to effectively separate waste to allow for efficient segregation, reuse, recycling or disposal
	WASTE QUANTITIES		The amounts of waste in most of the waste streams has gone up significantly in the years that the data is available for. Moreover, due to the lack of data availability it is impossible to conduct a thorough analysis for this indicator.	The target of this indicator is to monitor the different kinds of wastes generated on the campus and assess the quantities of waste that has been reused or recycled.
	WASTE VIOLATIONS		UT has reported 0 waste violations in the last two years.	The target of this indicator is to have 0 waste violations at a university in any given year.
Student Finance 	STUDENT LOANS		No data available	Best practices for this indicator comes from Columbia University where 75% of graduates do not have student loan debt and need-based aid is given to 100% of the students who apply for it. *17
	SCHOLARSHIPS		UT offers a wide variety of scholarships to its students from varied backgrounds.	The target for this indicator is to give a fair chance to students from different backgrounds in pursuing higher education with the help of providing a wide range of scholarships and need-based tuition aid unconditionally for all.
	STUDENT FEES		This indicator is scored a 1 because of the wide disparity in the fee differences between international and EU/EEA students. Internationals pay upto 6-8 times more than a European student. In USA, Internationals pay 2 times more, In Canada 3 times and in the UK 2 times.*18	The target of this indicator is to assess the affordability of fee structures at a university for people of different backgrounds. Although a lot more in-depth analysis is to be done on the source of funding, living standards etc, this gives a general idea of the disparity that exists.
	STUDENT JOBS		UT provides a lot of resources for students looking for a job. The wide variety of options available for students and the number of students placed in these jobs help in scoring this indicator with 2 points.	The target for this indicator is for universities to assist every student with finding varied kinds of jobs, assistance with work permits, providing a fair salary and ensuring a good work-life balance.
Governance 	STUDENT GOVERNANCE		UT has student bodies which play a role in the decision making process, although the information about the roles played and the decisions implemented with the help of student bodies is absent and is why this indicator is given 1 point.	Best practices for this indicator comes from University of California, Irvine which student councils working at the highest position at the university along with a detailed document highlighting their roles and the decisions made by this council *19.
	PLANS FOR THE FUTURE		UT has sustainability plans for the future in almost every area that it operates in. These targets set in these plans are ambitious and the roadmaps set out to these plans is a good start.	The target is to have sustainability plans for every area that the university operates in and expand to other areas that it can make an impact in. These plans are the first step towards sustainability and are extremely crucial in inculcation of sustainability in universities.
	SUSTAINABILITY OFFICE		UT has a sustainability office on campus which works in tandem with other student organizations and the university board.	The target for this indicator is for every university to have its own sustainability office working along with multiple student and staff led sustainability associations.
	WEBSITE		Although UT has several websites highlighting their initiatives and the progress of the plans carried out so far, the absence of the web page for the sustainability office along with non update of several web pages is the reason it is scored as 1 point.	The target for this indicator is to have a dedicated website for sustainability efforts which highlights the university's plans, initiatives and other stakeholders it is working with.
Investments 	ENVIRONMENTALLY SAFE		Data not found	Best practices for these indicators comes from Arizona State University (ASU) which invests heavily in businesses which have exemplary sustainability practices as defined in their sustainable investment portfolio. Along with these investments, ASU has a publicly available investment policy which outlines their efforts, commitments and partnerships. Moreover, the size of investments in various industries is also public promotes transparency. ASU has publicly divested from fossil fuel industries and industries in unethical industries or having unethical practices. *20
	FOSSIL FUEL INVESTMENTS		Data not found	
	TRANSPARENCY		Data insufficient to make a thorough analysis.	
	INVESTMENTS IN UNETHICAL BUSINESSES		Data not found	
Food & Dining 	LOCAL FOOD		Data not found	The target for this indicator is to source most of the university's food needs from the local area. The distance is subject to geographical location of the universities and it is up to the universities to decide on this distance
	SUSTAINABLE FOOD POLICY		UT has a sustainable food policy which is used in the selection of caterers operating on campus.	The target for this indicator is for universities to have a sustainable food policy which is used to educate, promote awareness and have a lower impact on the ecosystems.
	FOOD WASTE		UT does not actively monitor its food wastes but excessive food is donated to food banks.	The target for this indicator is to actively monitor the food waste that occurs on campus and prepare effective strategies to mitigate this waste in the future. The target for this indicator should be to not have any food related waste occur at the university.
	DIET TYPES		UT offers its members a wide variety of food types catering to their needs.	The target for this indicator is for universities to try and include as many diet types it is possible for its university members having a religious, moral or a health related obligation to seek out a particular diet.
Engagement 	SATISFACTION LEVELS		Students at UT are highly satisfied according to a national level survey held. UT ranks 3rd nationally in terms of student satisfaction levels.	The target for this indicator is for universities to undertake a student satisfaction survey annually and assess the positive feedback and the shortcomings. This is vital in improving the university and listening to student's needs of the university.
	EVENTS & COMPETITIONS		There are a large number of events held at UT every year catering to students and staff having varied hobbies and interests.	The target for this indicator is for universities to host a large number of diverse events to broaden the minds of students and staff and provide them with the cultural, sports, academic and other activities/events that they need.
	VOLUNTEERISM		No data found	The target for this indicator is for universities to encourage volunteering with the help of its partners and help students access volunteering opportunities.
	NEW STUDENT/STAFF ORIENTATION		Incoming students & staff are oriented properly with the campus, its surroundings, the legalities and other aspects of life in Netherlands.	The target for this indicator is for universities to host events for incoming students and staff and help them settle down with the help of fun activities, providing important information and assistance.

CATEGORY	INDICATOR	RATING	JUSTIFICATION	TARGET / BEST PRACTICE
Community 	COMMUNITY PARTNERSHIPS		UT has a strong presence in the local community and this is evident with the number of partnerships that UT has fostered with organizations in the local community.	The target for this indicator is for universities to have the role of a leader in the local community and fostering awareness, community spirit, innovation by forming networks with the local community.
	COMMUNITY SERVICE		Data not found	The target of this indicator is to encourage students to volunteer/work in organizations performing community service of any kind in the local area. This helps in students understand the local community and fosters community spirit.
	COMMUNITY STAKEHOLDER ENGAGEMENT		Data not found	The target for this indicator is for universities to act as bridges between local community and its students. Local stakeholders possess unique knowledge that can be beneficial to a student in a number of ways.
Health & Safety 	PHYSICAL HEALTH		UT provides excellent physical health service to its university members and achieves full points for this indicator.	The aim of this indicator is to the presence of physical health services offered at the university along with the different kinds of physical health services.
	MENTAL HEALTH		UT provides mental health services to its university members .	The target of this indicator is to assess the presence of mental health services at the university.
	INCIDENTS OF ASSAULT		Data not available	The target of this indicator is to have 0 incidents of assault at the university and make it a safe and an inclusive place.
	ACCIDENTS		There were a small number of accidents at the UT, mostly work related. Due to the non availability of the exact nature of these attacks, it is impossible to assess this indicator thoroughly.	The target of this indicator is to have 0 accidents at a university in any given year.
Transport 	TRANSPORTATION MODAL SPLIT		Data not available	Best practices for this indicator comes from Columbia University where 71% of students use a form of transport that is sustainable. *19
	GREEN VEHICLES		Data not available	Best practices for this indicator comes from Columbia University where all the vehicles owned by the university are either electric or hybrid. *20
	ELECTRIC CHARGING FACILITIES		UT has electric charging facilities available on several places on campus but the exact number of these is unknown and is why this indicator is given 1 point.	The target for this indicator is to map out electric charging facilities throughout the campus that are available for students and staff. The number of these depends on the geographical context and other infrastructural needs.
	LOCAL TRANSPORTATION		Although UT does not provide local transportation concession to its students, students from the EU/EEA area get travel allowances and hence this indicator is scored a 1.	Best practices for this indicator comes from Columbia University which has a free shuttle program for all which connects different parts of its campus which operates throughout the day. Moreover students and staff get a 25% discount on public transit in the city.
	BICYCLE PROGRAMS		UT has several bicycle programs and a solid bicycle infrastructure which merits it full points for this indicator.	The target for this indicator is to have a solid bicycle infrastructure in the university and promote bicycle programs which help in its adoption.

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.3 Appendix C

Weighting Categories

The categories in this framework have been weighted using AHP. The online AHP calculator provided by Business Performance Management Singapore has been used to create this. This calculator can be found at [BPMG AHP Calculator](#).

The following sections will illustrate the further weightages of categories in the three dimensions

.3.1 Ecosystem Dimension

The 4 categories under Ecosystem dimension are :

1. Air
2. Water
3. Land
4. Energy

1. Step 1: The pair wise comparison for these categories is illustrated in the table below.

A - wrt AHP priorities - or B?	Equal	How much more?
1 ☐ Air ☒ Water	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
2 ☒ Air ☐ Land	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
3 ☐ Air ☒ Energy	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
4 ☒ Water ☐ Land	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
5 ☐ Water ☒ Energy	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
6 ☐ Land ☒ Energy	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
CR = 2.6% OK		

Figure 2 Pair wise comparison of categories in ecosystem dimension

There are 17 sustainable development goals (SDG) that are designed as a blueprint to achieve sustainability for all (United Nations, 2018). These SDG's when initially introduced by the UN were not prioritized and UN declared them all to be equally important. However, in 2019 a study conducted by (New America & OECD, 2019) interviewed experts from think tanks, governmental organizations, civil societies and universities and prioritized the 17 SDG's in order of importance. The results that were found in this study are used in the AHP calculations made in this framework. The study can be found here [SDG'S in order](#). For example, SDG # 7 (Affordable and clean energy) is prioritized over SDG # 15 (Life on Land) and these metrics help in prioritizing one category over another. Additionally, the categories are weighted against each other to the best of the researcher's personal experiences, interaction with relevant experts and other literature.

Step 2: Once this is complete, the weights are auto generated based on the metrics in the pairwise comparison. The following table illustrates the weightages obtained for categories in the ecosystem dimension

Cat		Priority	Rank	(+)	(-)
1	Air	16.4%	3	3.1%	3.1%
2	Water	28.3%	2	4.6%	4.6%
3	Land	10.6%	4	2.9%	2.9%
4	Energy	44.8%	1	10.2%	10.2%

Figure 3 Weights of categories in ecosystem dimension

Similarly, the pairwise comparison and the weightages for the other categories in the Institution and the People dimensions are shown below.

.3.2 Institution Dimension

The categories in the institution dimension are :

1. Research & Curriculum 25
2. Procurement 3
3. Human Resources 4
4. Waste Management 5
5. Student Finance 5
6. Governance 16
7. Investments 5

Similarly, using the steps as described in the previous section and using data from literature analysis and personal judgement, the following priority matrix and the weightages are generated as shown below.

A - wrt AHP priorities - or B?		Equal	How much more?
1	☒ Research & Curriculum ☐ Procurement	☐ 1	☐ 2 ☐ 3 ☒ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
2	☒ Research & Curriculum ☐ Human Resources	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
3	☒ Research & Curriculum ☐ Waste	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
4	☒ Research & Curriculum ☐ Student Finance	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
5	☒ Research & Curriculum ☐ Governance	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
6	☒ Research & Curriculum ☐ Investments	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
7	☐ Procurement ☒ Human Resources	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
8	☒ Procurement ☐ Waste	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
9	☐ Procurement ☒ Student Finance	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
10	☐ Procurement ☒ Governance	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
11	☐ Procurement ☒ Investments	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
12	☒ Human Resources ☐ Waste	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
13	☒ Human Resources ☐ Student Finance	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
14	☐ Human Resources ☒ Governance	☐ 1	☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
15	☒ Human Resources ☐ Investments	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
16	☒ Waste ☐ Student Finance	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
17	☐ Waste ☒ Governance	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
18	☒ Waste ☐ Investments	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
19	☐ Student Finance ☒ Governance	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
20	☒ Student Finance ☐ Investments	☒ 1	☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
21	☐ Governance ☒ Investments	☐ 1	☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9
CR = 7.7% OK			

Figure 4 Pair wise comparison of categories in Institution dimension

.3.3 People Dimension

The categories present under people dimension are :

1. Food & Dining
2. Engagement

Cat		Priority	Rank	(+)	(-)
1	Research & Curriculum	30.1%	1	6.9%	6.9%
2	Procurement	7.3%	7	3.8%	3.8%
3	Human Resources	10.3%	4	2.7%	2.7%
4	Waste	8.5%	6	3.6%	3.6%
5	Student Finance	9.9%	5	3.2%	3.2%
6	Governance	17.8%	2	7.2%	7.2%
7	Investments	16.1%	3	14.8%	14.8%

Figure 5 Weights of categories in Institution dimension

3. Community

4. Health Safety

5. Transportation

Similarly, using the steps as described in the previous sections and using data from literature analysis and personal judgement, the following priority matrix and the weightages are generated as shown below.

A - wrt AHP priorities - or B?			Equal	How much more?								
1	☐ Food & Dining	☒ Engagement	☐ 1	☐ 2	☒ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
2	☐ Food & Dining	☒ Community	☐ 1	☒ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
3	☐ Food & Dining	☒ Health & Safety	☐ 1	☒ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
4	☐ Food & Dining	☒ Transportation	☐ 1	☐ 2	☐ 3	☒ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
5	☒ Engagement	☐ Community	☐ 1	☒ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
6	☒ Engagement	☐ Health & Safety	☐ 1	☒ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
7	☒ Engagement	☐ Transportation	☒ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
8	☒ Community	☐ Health & Safety	☒ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
9	☐ Community	☒ Transportation	☐ 1	☐ 2	☒ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
10	☐ Health & Safety	☒ Transportation	☐ 1	☐ 2	☐ 3	☒ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	
CR = 1.5% OK												

Figure 6 Pair wise comparison of categories in People

Cat		Priority	Rank	(+)	(-)
1	Food & Dining	7.9%	5	1.3%	1.3%
2	Engagement	28.1%	2	5.2%	5.2%
3	Community	13.6%	3	1.2%	1.2%
4	Health & Safety	13.0%	4	2.3%	2.3%
5	Transportation	37.5%	1	9.1%	9.1%

Figure 7 Weights of categories in People dimension

The above mentioned tables show the weightages of the categories within their respective dimensions but it is important to know their true weights within the whole USAF framework as well. These have been illustrated in the table below. There are minor tweaks to these weightage numbers below to reflect the true picture of the category based on the researcher's discretion.

Category	Weightage (in %)
Air	5.50
Water	9.50
Land	3.50
Energy	15.00
Research	10.00
Procurement	2.50
HR	3.50
Waste	2.80
Student Finance	3.30
Governance	5.90
Investments	5.30
Food	2.70
Engagement	9.30
Community	4.50

Health	4.30
Transport	12.40
Total	100

Table 2 Weights of categories in USAF

.4 Appendix D

Scholarship	Level of study	Target Audience	Amount (euros)
UTS	All Masters Programmes	EU & Non EU countries	3000 - 22000 for one year
UTS by ICD	Masters in Electrical Engineering	EU & Non EU countries	6000 for one year
Holland Scholarship	All Bachelors & Masters Programmes	Selected Non EU countries	5000 for first year
ITC scholarship for Spatial Engineering	Masters in Spatial Engineering	Selected Non EU countries	Scholarship :30629 Waiver: 11466
ITC Excellence	Masters in Geo-information Science & Earth Observation	Selected Non EU countries	Scholarship : 28501 Waiver : 11994
Orange Knowledge Programme	Masters in Business Administration, Communication Science, Educational Science & Technology and Public Administration	Selected 50 Countries	Partial scholarship (Amount depending on the need & duration of course)
ESED Scholarship	Masters in Environmental & Energy Management, Geo-information Science & Earth Observation and Sustainable Energy Technology	Selected Non EU countries	19500

Kipaji Scholarship	All Masters Programmes	Students from upcoming economies from South America, Africa & Asia	upto 12000 euros
ASML Technology Scholarship	Selected Masters Programmes	Selected Non EU countries	5000 euros for every year of the course duration
Professor De Winter Scholarship	Masters Programme	Women from Non-EU countries	7500
ISDB	Selected Bachelors, Masters, PhD and short courses	Women from selected upcoming economies of Asia & Africa	Interest free loan with the condition that beneficiaries are required to pay back 50% of the amount to a local fund in their country which gets recycled s future loans to students from that country
UAF	Selected Bachelors, Masters & PhD Programmes	Refugees and asylum seekers who intend to study in the Netherlands	Advisory and counselling services. Financial support (loan) provided in some cases.

Canon Foundation Research Scholarship	PhD	European & Japanese citizens	22500-27500 euros annually for a research project of 3-12 months.
ITTO Fellowship Programme	Short courses in Geo information science & Earth Observation and small grants for post-graduate studies	EU & non EU countries	9250
Education for Nature Programme	Short term & Non-degree courses	Upcoming economies from South America, Asia & Africa	upto 6000 euros
WWF Prince Bernhard Scholarship for Nature Conservation	mid career professional training & short courses	Upcoming economies from Africa, Asia/Pacific, Latin America/Caribbean, Eastern Europe & Middle East	upto 9500 euros

Table 3 Scholarships at UT