

SUSTAINABILITY ANALYSIS FOR THE BACHELOR'S THESIS

PLEASE NOTE: THE ASSESSMENT OF THE SUSTAINABILITY ANALYSIS WILL BE BASED ON YOUR CAPACITY TO ANALYSE THE PROJECT'S SUSTAINABILITY, RATHER THAN ON THE PROJECT'S ACTUAL DEGREE OF SUSTAINABILITY.

1. Introduction

A sustainability report is a common requirement—almost an obligation—for IT companies and their projects today. Prestigious organisations such as the Global Reporting Initiative (GRI), the UN Sustainable Development Knowledge Platform and Electronics Watch measure the impact on sustainability of IT companies' products and services. The GRI, for example, defines standards for compiling reports on a project's impact on climate change, human rights, transparency and quality of life, among other aspects.

The GRI's standards represent the global best practices for reporting an organisation's economic, environmental and social impact. You can find various companies' sustainability reports in the GRI's Sustainability Disclosure Database¹. Look for an IT company that is related to your project. You will find that almost all major companies publish their sustainability reports annually.

All the bachelor's theses presented at the Barcelona School of Informatics (FIB) should include in the final report a chapter entitled "Sustainability Analysis". In this document, some guidelines are given to help you to prepare a sustainability analysis. Part of it should also be submitted during the Project Management course.

2. The matrix of sustainability

The sustainability analysis will be based on the application of the matrix of sustainability shown in Figure 1 to the bachelor's thesis. The analysis of a project's sustainability is divided into three parts, identified by the matrix columns:

- The **project put into production (PPP)**, which includes the planning, development and implementation of the project.
- The **exploitation** of the project, which starts once the project has been implemented and ends when it is dismantled.
- The **risks** inherent to the project during its construction, useful life and dismantling.

	PPP	Exploitation	Risks
Environmental	Consumption of the design	Ecological footprint	Environmental
Economic	Invoice	Viability plan	Economic
Social	Personal impact	Social impact	Social

Figure 1. Matrix of sustainability for the bachelor's thesis

Each column must be analysed from three perspectives: **environmental**, **economic** and **social**, the three dimensions of sustainability.

Risks refer to variables that we can identify but not control, even though they could influence the success or failure of a project. In contrast, unexpected events generally cannot be anticipated, as they are outside of the expected life cycle and therefore will not be considered in the sustainability analysis. An example of a risk: a mobile application is designed for online sale, but the competition decides to copy our idea with a similar initiative. An example of an unexpected event: with no advance warning, a state law will ban internet sales from next week. Unexpected events cannot be anticipated. If the media had already been discussing the possible approval of such a law, it would be a risk rather than an unexpected event.

The meaning of each cell in the matrix is:

- Environmental/PPP cell: represents the impact on the environment during the preparation of the bachelor's thesis (energy consumption and waste generation). The ecological footprint can be measured, for example, in kWh and tons of CO₂ emissions caused by carrying out the bachelor's thesis.
- Environmental/Exploitation cell: represents the ecological footprint that the project will have throughout its useful life. It can be measured, for example, using the same parameters as the above cell.
- Environmental/Risks cell: represents all the eventualities that could make the environmental impact of the project more negative than expected in the project report.
- Economic/PPP cell: represents the consumption of resources (material and human) during the entire project and the cost of these resources. It would be the equivalent of the invoice that would be sent to a potential client of the project and requires detailed time planning of the bachelor's thesis.
- Economic/Exploitation cell: represents the project's viability plan. In the case of a bachelor's thesis, this plan will be set out in a highly simplified form.
- Economic/Risks cell: represents all the eventualities that could lead to the project taking longer than planned to become viable or it never becoming profitable.
- Social/PPP cell: represents the impact that carrying out the project has had on the people who have worked on it. Given that it is difficult to quantify this impact, try to reflect on how the project has changed you and your closest environment.
- Social/Exploitation cell: represents the impact that setting up the project will have on the various groups related directly or indirectly with the project. It is difficult to quantify, so you should reflect on the potential effects of your project.
- Social/Risks cell: represents all the eventualities that could lead to the project having a more negative social impact on one of the related groups than forecast in the project report.

In principle, a bachelor's thesis will have a narrower scope than an engineering project, as shown in Figure 2. In any case, the scope of an engineering project and that of a bachelor's thesis only extends as far as its implementation. Nevertheless, the bachelor's thesis should include a series of reflections on the project's useful life and associated risks, as the challenge of trying to predict what could happen helps students to gain a strategic vision.

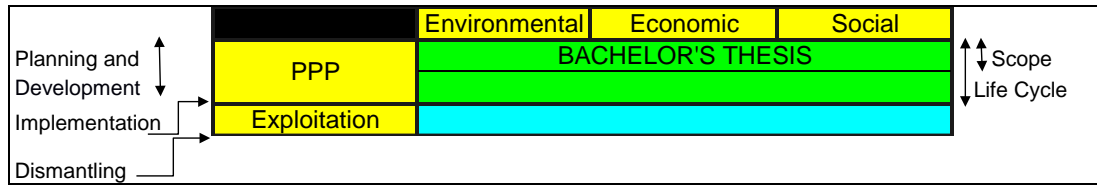


Figure 2. Scope of the bachelor's thesis in the sustainability matrix

3. Questions students should ask themselves

To prepare the sustainability analysis, we suggest you ask yourself a series of questions that you should answer in the corresponding chapter of the report. Figure 3 shows these questions. Row "I" of each dimension of sustainability corresponds to the questions you should ask yourself in the Project Management course (the initial stage of the bachelor's thesis), while row "F" contains the questions you should ask while you are carrying out the project, whose answer you should include in the sustainability analysis within the project report (final stage of the bachelor's thesis).

Not all the questions are relevant to all types of bachelor's thesis. You should consider which of the questions apply to your bachelor's thesis and which are not applicable. You should also consider (and discuss in the sustainability analysis) which questions other than those included in this document would be relevant to your bachelor's thesis project.

In-depth reflection on the sustainability of your bachelor's thesis will probably reveal both positive and negative consequences. However, **in no case** will negative consequences on the sustainability of your project lead to a negative assessment of either your sustainability analysis or your bachelor's thesis.

		PPP	Exploitation	Risks
Environmental	I	Have you estimated the environmental impact of undertaking the project? Have you considered how to minimise the impact, for example by reusing resources?	How is the problem that you wish to address resolved currently (state of the art)? In what ways will your solution environmentally improve existing solutions?	
	F	Have you quantified the environmental impact of undertaking the project? What measures have you taken to reduce the impact? Have you quantified this reduction?	What resources do you estimate will be used during the useful life of the project? What will be the environmental impact of these resources?	Could situations occur that could increase the project's ecological footprint?
		If you carried out the project again, could you use fewer resources?	Will the project enable a reduction in the use of other resources? Overall, does the use of the project improve or worsen the ecological footprint?	
Economic	I	Have you estimated the cost of undertaking the project (human and material resources)?	How is the problem that you wish to address resolved currently (state of the art)? In what ways will your solution economically improve existing solutions?	
	F	Have you quantified the cost (human and material resources) of undertaking the project? What decisions have you taken to reduce the cost? Have you quantified these savings?	What cost do you estimate the project will have during its useful life? Could this cost be reduced to increase viability?	Could situations occur that are detrimental to the project's viability?
		Is the expected cost similar to the final cost? Have you justified any differences (lessons learnt)?	Have you considered the cost of adaptations/updates/repairs during the useful life of the project?	
Social	I	What do you think undertaking the project has contributed to you personally?	How is the problem that you wish to address resolved currently (state of the art)? In what ways will your solution socially improve (quality of life) existing Is there a real need for the project?	
	F	Has undertaking this project led to meaningful reflections at the personal, professional or ethical level among the people involved?	Who will benefit from the use of the project? Could any group be adversely affected by the project? To what extent?	Could situations occur in which the project adversely affects a specific population segment?
			To what extent does the project solve the problem that was established initially?	Could the project create any kind of dependency that puts users in a weak position?

Figure 3. Questions in the sustainability matrix of the bachelor's thesis (I: initial milestone, F: final milestone)

3.1. Environmental impact study

In this section, you should estimate the environmental resources that your project will use. One relatively straightforward way to achieve this is to calculate the consumption of your bachelor's thesis in kWh.

All humans permanently consume around 19.5 TW, which is around 2,700 W per inhabitant of the planet (this is an average figure, given that Spaniards consume around 4,500 W, Germans 6,000 W, and Americans 12,000 W, while Indians consume around 700 W, and Bangladeshis 200 W)².

In the initial stage (Project Management course), you must estimate the environmental resources that will be consumed in **the design** of your project, while in the final stage (sustainability analysis) you should establish the environmental resources (ecological footprint) that your project will consume during its useful life.

To put the numerical result into context, and to have an order of magnitude that reflects the significance of the project's consumption, the following table provides some examples of consumption in everyday activities.

Activity	Consumption per hour
Person in normal routine	~ 0.1 kWh
Person running	~ 1 kWh
Fridge A+	~0.5 kWh
Electric bathroom heater	~ 1 kWh
PS4 game console	~ 0.125 kWh
Air conditioning A+	~ 1 kWh
LED 32" television	~0.03 kWh

You must also answer the following question: How is the problem that you wish to address resolved currently (state of the art)? In other words, explain the solutions that are currently available and, from an environmental perspective, the problem/need that you aim to tackle. You should also estimate how your solution environmentally improves on existing ones.

In the final stage, you should estimate the environmental risks. In other words, you should answer questions such as the following: Could situations occur that could increase the project's ecological footprint? Explain likely, but insignificant, potential situations that you cannot address due to a lack of time, resources or ability that could lead to an increase in the ecological footprint.

3.2. Economic impact study

In this section, we introduce the questions you should ask on the economic viability of your project. You are not required to undertake an exhaustive analysis of viability, returns on investment, funding or other topics that, however, should be considered in a master's thesis.

In the initial stage, you should estimate the cost of the project/invoice (and include detailed planning). Specifically, during this stage you should answer questions corresponding to the two rows of the matrix labelled "Invoice" and "Viability plan". In the final stage (sustainability analysis), you must submit an analysis of deviations from the initial proposal, if applicable, in addition to the economic calculation of the invoice for the project design. Specifically, you

should answer questions corresponding to the cells of the matrix labelled “Invoice” and “Viability plan”.

In the final stage, you should also reflect on economic risks. In other words, consider whether situations could occur that would be detrimental to the viability of the project. Explain potential situations (that you have not considered due to a lack of time, resources or ability) that could have a negative impact on the economic viability of your project.

3.3. Social impact study

In this section, we present questions that you could ask on the social impact of your project. You should consider the social implications for the project's target group and for other groups. For example, the creation of a recycling system is a social improvement, but it also initially complicates the daily lives of users as they must change their habits.

Specifically, you should answer the questions in the sustainability matrix labelled as “Personal impact”, “Social impact”, and “Social risks”.

Questions referring to **personal impact** should address how undertaking the project has affected you and your closest environment: How has it changed your life, if it has, or how has it changed your vision of life? Has it made you aware of situations you did not know about before? In the initial stage you will probably have to make forecasts, while in the final stage you must reflect on the questions in Figure 3.

Questions referring to the **social impact** should be focused on considering the implications that undertaking your project could have for society. To answer questions in the initial stage and the final stage proposed in the matrix, you should identify the group affected by the problem/need that you will address. Groups related to the project could be owners/managers, employees, suppliers, consumers (direct users) or others (indirect or passive users).

For example, in current car sharing apps, the owner/manager maintains the app, the direct users are the driver and the passengers, and others could be taxi drivers as a group that is adversely affected by the reduction in their turnover.

The social implications of a bachelor's thesis are very diverse, depending on the type of project, and generally they are difficult to forecast and quantify. You can observe the enormous diversity in the real indicators of social sustainability in the GRI standards³.

By way of guidance, below are some considerations that are generally relevant to the type of bachelor's theses carried out at the FIB. These could help you to answer the questions proposed in the sustainability matrix.

- Who did the work that your project will now do? Are jobs at stake? Was it a decent job? Was it routine work? Will quality of working life be gained?
- Have you considered the usability of your product for people with special needs (elderly people, people with visual impairment, disabilities, etc.)? Are there barriers to use?
- Have you assessed the implications of your project in terms of privacy of user data, image rights, etc.? Could your thesis project put anybody in a vulnerable situation?
- To what extent do you consider that your project will increase or decrease social inequality?

- Can the project be used directly by the public administration? Could it provide any service for citizens? Have you considered the implications of using free or proprietary software? Is the final result conceived as a product with copyright or a product for shared use?

When you consider social risks, explain likely, but insignificant, potential situations (that you cannot tackle due to a lack of time, resources or ability) that could be detrimental to the people associated with your project (users, investors, employees, suppliers, etc.).

4. Conclusions

According to data from the KPMG Survey of Corporate Responsibility Reporting, in 2017, 93% of the main companies in the world compiled sustainability reports corresponding to the ecological, economic and social areas.

This document presents a method for carrying out a sustainability analysis for a bachelor's thesis. However, given the diverse nature of bachelor's theses at the FIB, if a student wishes to organise their sustainability analysis in a way other than described here, because they consider that it is more appropriate to their bachelor's thesis, they may do so as long as it results in a good analysis.

The examination committee will assess your project using a rubric⁴. As the student, you must ensure that the organisation of the "Sustainability Analysis" chapter of your report meets the criteria specified in the rubric. These criteria will be used to assess your project's sustainability analysis.