



**BARCELONA EAST SCHOOL OF ENGINEERING  
(EEBE)**


**ANALYSIS OF SUSTAINABILITY AND ETHICAL  
IMPLICATIONS OF FINAL THESES AT THE EEBE**

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	<b>Analysis of sustainability and ethical implications of final theses</b>	

## 1 Introduction

Final theses are works in which students demonstrate that they have acquired the skills that they need to practise the specialisation they have studied. These skills must include those that address, analyse and evaluate the three dimensions of sustainability (environmental, economic and social) in their specialisation, with an emphasis on the final thesis and the critical thinking needed to identify the ethical issues that may arise from it.

Article 4.2 of Royal Decree 822/2021 establishes that all university curricula must refer to respect for gender equality and the principle of non-discrimination and consider sustainability and climate change. Knowledge, skills and competencies on any degree include the ability to analyse and assess the social and environmental impact of the technical solutions proposed and to understand the ethical responsibility associated with the specialisation.

Today, sustainability reports are a common requirement—almost an obligation—for companies and their projects. In December 2022, a European directive was approved that progressively obliges companies to provide detailed information on the impact of their activity on the environment, human rights and society (and that will, as of January 2026, be compulsory for all). According to data from the KPMG Survey of Sustainability Reporting, in 2021 96% of the world's 250 largest companies produced sustainability reports.

In this context, the UPC requires that all final theses include a chapter entitled "Analysis of sustainability and ethical implications". This analysis consists of an assessment of the environmental, social and economic impacts and ethical implications of a final thesis. In the event that the final thesis deals with a product / process / research / service / system / building / etc., which we refer to in this document as a **project** and that could eventually be implemented, it must analyse the impact that the proposal would have in its execution during the stages of its life cycle. This document gives guidelines on analysing the sustainability and ethical implications of final theses, but it will be up to the authors to analyse them specifically for their project.

## 2 Sustainability matrix

Table 1 is a sustainability matrix that allows the concepts dealt with in this guide to be identified and organised. Using the matrix in the report is not compulsory, but we advise authors to follow the guidelines given in it.

Table 1. Final thesis sustainability matrix


	Development of the final thesis	Project execution	Risks and limitations in the supply chain
Environmental perspective	Environmental impact	Environmental impact	Environmental risks and limitations
Economic perspective	Project cost	Economic analysis	Economic risks and limitations
Social perspective	Personal impact	Social impact	Social risks and limitations

In this guide, a final thesis is understood to be the academic work itself, which begins with the student accepting the topic and ends when it is presented before an examination committee, and the **project** is understood to be the product / system / process / research / service / building / etc. that the final thesis presents (if this is the case) and that could eventually be implemented. In the latter case, the impact that the proposal would have in its execution during the stages of its life cycle must also be analysed.

For example, the sustainability report on a final thesis that analyses a dataset must address the development of the work (Column 1). The sustainability report on a final thesis that proposes a mobile application, however, can estimate what the impact of the project (the mobile application) would be during its (hypothetical) operation (Column 2).

The sustainability analysis of a final thesis can be divided into three parts as per the columns in the matrix:

- The **development of the final thesis**, which includes all the activities carried out by the student in preparing the academic work, such as research, calculations, meetings, tests, document drafting, etc.

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- The **execution of the project**, i.e. the implications of the execution of the product / system / process / research / service / building / etc. if the final thesis presents a project.
- The **risks and limitations in the supply chain** inherent to the consequences of the academic work and/or its execution at any stage in the supply chain (resource extraction, waste management, transport and distribution, etc.) if the final thesis presents a project.

The **risks** refer to variables that can be identified but not controlled, despite the fact that they may influence the project's success or failure. An example of risk might be the design of new photovoltaic cells that use cobalt imported from the Democratic Republic of the Congo: the fact that this material is not available or is subject to geopolitical tensions puts its supply at risk; in addition, cobalt mining conditions in that country have environmental and social implications. The goal is to identify these associated risks in a world in which these implications are present throughout the supply chain.


As far as **limitations** are concerned, factors that have led both the work and the project to fail in their objectives or expectations regarding execution to be lowered must be taken into account. The main limitations include the following: a lack of resources of all kinds, immature technology, underdeveloped knowledge, restrictions imposed by regulations and the law and the ethical and social considerations associated with the proposal.

As seen in the table, each column must be analysed from three perspectives: **environmental**, **economic** and **social**, that is, the three dimensions of sustainability.

The meaning of each cell in the matrix is the following:

- **Environmental perspective / Development of the final thesis.** This cell represents the environmental impact during the preparation of the work (energy consumption, use of material, reagents, waste generation, etc.). In most works it is sufficient to calculate and briefly analyse the total carbon footprint, which can be measured in CO<sub>2-eq</sub> emissions.<sup>1</sup>
- **Environmental perspective / Project execution.** This cell represents the environmental impact of the project, whether hypothetical or real, during its lifetime. Various indicators or parameters can be used, such as the carbon footprint, energy consumption, waste generation, other specific environmental vectors affected (land, energy, water, etc.).
- **Environmental perspective / Risks and limitations in the supply chain.** This cell represents the risks and limitations and the environmental implications of the project throughout its value chain, for example, use of non-renewable resources, environmental pollution in the extraction stages, high energy consumption in the various stages of the life cycle, generation of waste and pollution


<sup>1</sup> <https://app.electricitymaps.com/zone/ES>

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due to inadequate waste management. It must also include the limitations detected so that calculations of both the work and the project's execution can be estimated.

- **Economic perspective / Development of the final thesis.** This cell represents the cost analysis of the (material and human) resources used throughout the work. It could be said to be equivalent to the invoice that would be sent to a potential customer and requires detailed planning if the final thesis presents a service (engineering analysis, consultancy).
- **Economic perspective / Project execution.** This cell represents the economic analysis of the project's execution. In the case of final theses, the analysis may be presented in simplified form because it is merely a forecast.
- **Economic perspective / Risks and limitations.** This cell represents all of the project's implications and contingencies from a supply chain perspective, during the project's development but especially during its execution, for example, the market cost of the raw materials and energy resources needed, market volatility, etc.
- **Social perspective / Development of the final thesis.** This cell represents the impact that the execution of the work has had on the people who have worked on it (at least the student and the supervisor). For example, it might include an awareness of situations that were previously unknown and a reflection on the social dimension of the project, if it has one.
- **Social perspective / Project execution.** This cell represents the impact that the project's execution would have on all interested parties, that is, any group that is directly or indirectly related to the project. These groups may be owners/managers, workers, suppliers, consumers (direct users), local communities or other parties (indirect or passive users). Social repercussions can be very eclectic, and they are generally difficult to predict and quantify. Nevertheless, they can be identified, for example, employment rate, technological development, promotion of social responsibility, transparency, etc. The enormous range of current social sustainability indicators can be seen in the GRI standards.<sup>2</sup>
- **Social perspective / Risks and limitations.** This cell represents all of the project's implications at the social level throughout the supply chain. The groups that must be considered are the same as in the previous section but here all stages of the life cycle are taken into account, which is especially relevant in developing countries, for example, child labour, safe and healthy living conditions, fair wages, etc.

<sup>2</sup> <https://www.globalreporting.org/standards/download-the-standards/>

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### 3 Guiding questions to prepare the report

To prepare the sustainability analysis, we suggest asking yourself a series of questions. The answers constitute the sustainability analysis in the corresponding chapter of the work. See these questions in Table 2.

Not all the questions are relevant to all types of final theses. You need to think about which questions are specifically relevant to your final thesis and which are not. You should also think about (and discuss in the sustainability analysis) any other questions, other than those included in this document, that may be relevant to your final thesis. Thinking deeply about the sustainability of your final thesis is likely to reveal both positive and negative effects. However, bear in mind that the negative effects on the sustainability of your project will not lead to a negative assessment of your sustainability analysis or of your final thesis.

Table 2. Questions to answer when preparing the sustainability analysis of the final thesis

	Development of the final thesis	Project execution	Risks in the supply chain
<b>Environmental perspective</b>	<p><b>AMB.D.1:</b> Quantify the environmental impact of the work. What measures have you taken to reduce its impact? Have you quantified this reduction? Does your design follow circular economy principles?</p> <p><b>AMB.D.2:</b> What is the origin of the raw materials and/or other materials you have used, if any? Do your suppliers publish environmental reports? What directives do they follow?</p>	<p><b>AMB.X.1:</b> What (material and energy) resources do you estimate will be used to launch the project and during its execution? What will the environmental impact of these resources be?</p> <p><b>AMB.X.2:</b> Will the project reduce the use of other resources? Overall, will the project's execution improve or worsen the environmental footprint?</p> <p><b>AMB.X.3:</b> What waste is generated at the end of the life of the project? How can the environmental impact of the waste generated be reduced?</p> <p><b>AMB.X.4:</b> Could the project be carried out with a more efficient use of resources?</p>	<p><b>AMB.R.1:</b> What impacts can be identified in the supply chain? In the pre-/post-execution stages? What is the biggest impact?</p> <p><b>AMB.R.2:</b> What alternatives exist in terms of suppliers, markets, materials, energy sources, technology?</p> <p><b>AMB.R.3:</b> What constraints and risks can be identified from an environmental perspective throughout the supply chain?</p>

Abbreviations: AMB = Environmental, EC = Economic, SO = Social, D = Development, X = Execution, R = Risks and limitations




	Development of the final thesis	Project execution	Risks in the supply chain
<b>Economic perspective</b>	<p><b>EC.D.1:</b> Quantify the costs (human and material resources) of carrying out the final thesis.</p> <p><b>EC.D.2:</b> Have you taken into account the labour costs of supervision and tutoring?</p>	<p><b>EC.X.1:</b> What is the estimated cost of the project (CAPEX/OPEX)? What are the most substantial costs of the project?</p> <p><b>EC.X.2:</b> Have you considered the environmental costs (carbon tax)?</p> <p><b>EC.X.3:</b> Would waste management entail any additional costs?</p> <p><b>EC.X.4:</b> Could any other project benefit from the results of this project from an economic perspective?</p>	<p><b>EC.R.1:</b> What economic risks can be identified in the supply chain? Are there any (material and energy) resources that put the project at risk due to geopolitical or market concerns?</p> <p><b>EC.R.2:</b> What have been the main limitations of the economic analysis? Which economic parameters show the most uncertainty?</p>

Abbreviations: AMB = Environmental, EC = Economic, SO = Social, D = Development, X = Execution, R = Risks and limitations

	Development of the final thesis	Project execution	Risks in the supply chain
<b>Social perspective</b>	<p><b>SO.D.1:</b> Does this work include significant reflections on personal, professional or ethical standards? Has inclusive and non-sexist language been used?</p> <p><b>SO.D.2:</b> What is the current situation of the socioeconomic sector related to the work?</p> <p><b>SO.D.3:</b> If you have used raw materials, have you checked whether distributors, manufacturers, suppliers and retailers publish codes of ethics or conduct?</p>	<p><b>SO.X.1:</b> Who benefits from the project's execution? Could any group be negatively affected? If so, to what extent?</p> <p><b>SO.X.2:</b> To what extent does the project solve the problem initially identified? Which groups (workers, consumers) may benefit?</p> <p><b>SO.X.3:</b> Are there other ways of executing the project that have different social impacts?</p> <p><b>SO.X.4:</b> Does the project avoid gender biases, stereotypes and roles?</p> <p><b>SO.X.5:</b> Have you considered the usability of your product for people with diverse needs (age, gender, sex, functional diversity, cultural diversity, etc.)? Are there barriers to using it?</p>	<p><b>SO.R.1:</b> Have the most relevant groups in the project's supply chain been identified? Could any group be negatively or positively affected?</p> <p><b>SO.R.2:</b> Which pre-/post-execution stages present the most risk in terms of the social aspects? What alternatives may be considered?</p> <p><b>SO.R.3:</b> What is the main limitation when the social dimension of your project is considered? Are there any ethical implications as far as the groups affected by your project are concerned?</p>

Abbreviations: AMB=Environmental, EC= Economic, SO= Social, D = Development, X= Execution, R = Risks and limitations

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## 4 Ethical implications

As shown in the previous tables, your professional activity will have environmental, social and economic impacts that can generate ethical problems that must be identified, analysed and answered.

To carry out this report, we propose the following questions about the ethical dimension of your final thesis:

- What specific needs or interests is your work responding to? Who defined these needs? (This may range from increasing knowledge of basic science to responding to a specific SDG.)
- Who can benefit from your work? Is there any group or community that may be harmed by this benefit?
- Is there any benefit for society as a whole in your work?
- Can you anticipate consequences of your final thesis beyond those sought with the proposal?
- If the profession has a code of ethics, is your work respecting all of its points?

Your work must respect the guiding principles of the [UPC Code of Ethics](#) and, if it is a research paper, also of the [UPC Code of Research Integrity](#). Remember to include in the final thesis the commitment to comply with these codes and the data protection law (GDPR) that you signed when you enrolled.

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## 5 Relation to the Sustainable Development Goals

To complete the report, all that remains is to indicate whether the final thesis contributes to any of the Sustainable Development Goals (SDGs).<sup>3</sup> The SDGs, approved by the United Nations in 2015 and also known as the 2030 Agenda, have 169 milestones that you can review in the table you will find [in this link](#).

Briefly explain whether your work and/or project contributes to any of the specific goals or to the general spirit of any of the SDGs in some way and why.

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<sup>3</sup> <https://sdgs.un.org/goals>

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## 6 Proposal for the structure of the sustainability chapter of final theses

We propose that you structure the chapter in your final thesis that includes the sustainability report in the following way, although you can do it differently as long as it contains all the necessary content.

### Chapter X. Sustainability report

#### X.1. Sustainability matrix


X.1.1. Environmental impact (“development”, “execution” and “risks and limitations in the supply chain”)

X.1.2. Economic impact (“development”, “execution” and “risks and limitations in the supply chain”)

X.1.3. Social impact (“development”, “execution” and “risks and limitations in the supply chain”): this must also include a gender equality analysis.

#### X.2. Ethical implications


#### X.3. Relation to the Sustainable Development Goals

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## 7 Conclusions

A good professional must be aware of the environmental, social and economic impacts of their specialisation and know how to decide on the ethical problems that may arise from it.

This document presents a method for carrying out a sustainability analysis of a final thesis. However, given the diversity of final theses at the EEBE, if students want to organise their sustainability analysis in a way that is different to what we describe here because they consider it to be more suited to their final thesis, they may do so as long as a full and justified analysis is carried out.

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## 8 Appendix: additional reference material

### 8.1. Examples of sustainability analyses

Pending preparation at the EEBE

### 8.2. Explanatory videos

[https://www.youtube.com/playlist?list=PLkgord6\\_YlwRMC8lt6gNJTO96cknfx1P1](https://www.youtube.com/playlist?list=PLkgord6_YlwRMC8lt6gNJTO96cknfx1P1)