

# Integrating Sustainable Objectives in Transmission System Operators' Projects

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A decision-support framework for the prioritisation and integration of sustainable objectives in projects.

Georgios Athanasiou | MSc Construction Management and Engineering



# Integrating Sustainable Objectives in Transmission System Operators' Projects

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integration of sustainable objectives in projects.

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This MSc Thesis report is the last step in a long and challenging journey towards knowledge, personal growth, and academic achievements. A journey that started many years ago in Cyprus where I obtained my BSc degree in Civil and Environmental Engineering and has led me to one of the best universities in Europe and the world, TU Delft.

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## Executive Summary

Integrating sustainability requirements in projects is seen as an important part of stimulating sustainability through projects and procurement. That is especially true for Transmission System Operators (TSOs) like TenneT, who can promote sustainability through their supply chains. The process of selecting which aspects and measures relating to sustainability should be integrated in projects, however, is challenging. This research offers an inside look in the way decision-makers at TenneT perceive sustainability and the associated goals and measures. The research offers a decision-support framework through which decision-makers can identify important sustainability goals, assess their real-life performance, and prioritise their integration in projects. This research aims to explore the connection between the sustainability goals selected by the company and the existing measures applied in the projects. By exploring the perceived importance of the sustainability goals and the real-life performance of their associated measures, recommendations are made to TenneT based on an Importance-Performance analysis, aimed at prioritising the integration of these aspects in projects. This can offer a ranked prioritisation of the various sustainability measures that exist in the company. The research aims to answer the following research question:

**“How can Transmission System Operators (TSOs) prioritise the integration and promote sustainability objectives in their projects and in their supply chain?”**

For this, the following methodology was adopted. At first, a literature review was conducted to define the concepts relevant to sustainability. To properly understand the corporate context of TenneT, experts from the Supply Chain Management (SCM) department were interviewed to discuss and understand the challenges associated with integrating sustainable measures in the company’s projects. The context and challenges pointed to the need for prioritisation of sustainability measures. From the literature review, a decision-support framework for integrating sustainability goals in projects, based on Multi-Criteria Decision-Analysis (MCDA) was identified and modified for this research’s needs. A sustainability workshop and the Best-Worst Method, the MCDA method selected for this research, were then used to offer a systematic approach through which the sustainability aspects, sub-aspects and possible goals and indicators collected in the literature study could be discussed. Decision-makers were asked to select relevant sustainability goals for TenneT, and the ones selected by 3 or more decision-makers were then used for the BWM. This resulted in 3 sustainability aspects and 9 sub-aspects, closely connected to the company’s own goals. Discussing sustainability goals this way allows for the framework to be used in other TSOs as well, that may not have such explicit goals as TenneT. To avoid focusing on already well-performing sustainability goals, the performance of their associated measures was studied, using a Maturity Model from the literature. Finally, an Importance-Performance analysis was performed with the BWM method used for the Importance scale scores and the Maturity Model used for the performance scores of existing measures at the company. The Maturity Model was sent as a questionnaire to decision-makers who shared their thoughts on existing sustainability measures currently used in projects.

The Best-Worst Method showed that the Planet aspect was the most important one for stimulating sustainability. Additionally, the aspect of Reducing Emissions was selected as the most important sub-aspect while in the People aspect, Health and Safety ranked first. The Maturity Model showed that the least integrated goals in projects are Human Rights, Labour Conditions and Decent Work, reducing Energy Consumption, Materials and Natural Resources and Circularity and Waste. Based on the Importance-Performance analysis, the research suggests integrating the sustainable goal of Circularity and Waste in the company’s following projects. This can be achieved by using already existing sustainable measures such as the Raw Material Passport (RMP) in the tender process. Using measures such as the RMP in the pre-qualification phases or selection phase, as entry requirements with specific targets to be met, or as award criteria, aiming to create added value for the project, can stimulate the contractors and suppliers act more sustainably. This will in turn increase TenneT’s sustainable performance and will help the company meet

its own sustainable targets. Combining the results from both the Importance and Performance analyses Figure 1 was created, identifying the sustainability goal “Circularity and Waste” as priority for the next projects.

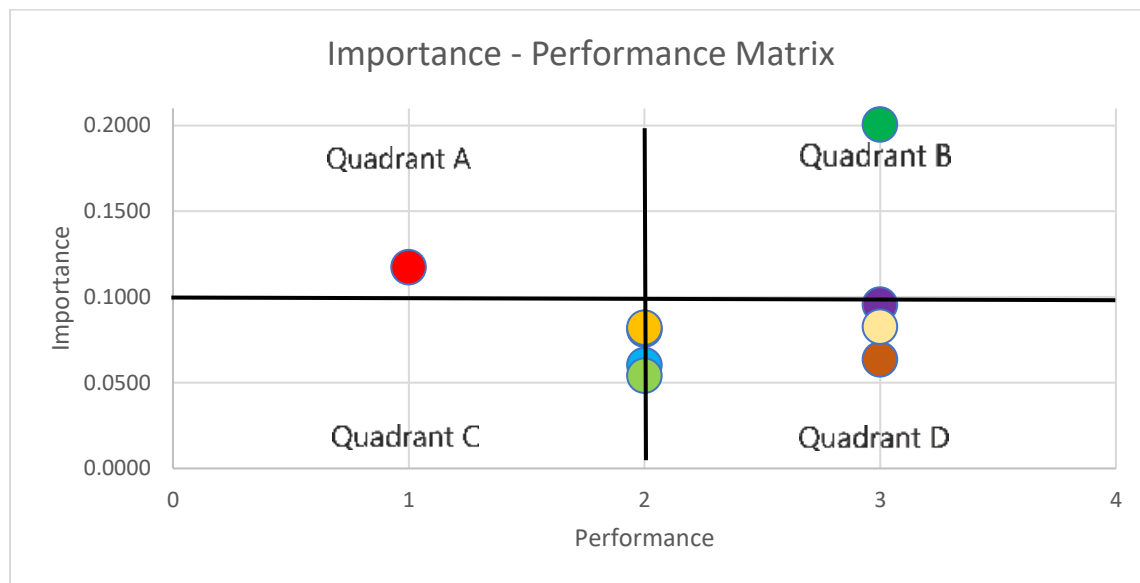


Figure 1: Importance - Performance Chart

### **Recommendations for Research:**

- Although the primary focus of MCDA is the selection of decision criteria and the assignment of weights at each criterion for eventually selecting between alternative actions, the research showed that it can be used to reveal discrepancies in perception and awareness between colleagues and employees of a single organisation. Using methods like the BWM to assess people’s awareness on a variety of issues can yield interesting findings and results.
- Having an experienced person to enable and guide the decision-makers through the BWM comparisons requires extensive knowledge of the model and the company’s context.
- Extending the research to include external stakeholders and understand their thoughts and goals as well as more decision-makers from the company, which allows for a more subjective understanding of the challenges surrounding sustainability within the company.
- Following the same decision-support framework and focusing on more explicit and quantitative decision-criteria which are easier to compare

### **Recommendations for Practice:**

- Translating high-level goals into more explicit targets for the projects could help the people that are directly involved with these projects and create a more cohesive understanding of sustainability.
- Repeat the Importance-Performance analysis in the future to capture any changes in the importance of sustainable goals and their performance in real life. This allows monitoring the maturity level of all the aspects, especially the aspect that is being prioritised. This iteration can help TenneT gradually integrate more sustainable goals, thus improving the sustainable performance of the company incrementally, without disturbing the market and hindering contractor and supplier interest in its projects.

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## List of Abbreviations

**ACM:** Authority of Consumers and Markets

**BWM:** Best-Worst Method

**CO<sub>2</sub>:** Carbon Dioxide

**EU:** European Union

**GHG:** Green House Gas(es)

**IPA:** Importance-Performance Analysis

**KPIs:** Key Performance Indicators

**LPO:** Large Projects Organisation

**LTIF:** Lost Time Injury Frequency

**MCDA:** Multi-Criteria Decision-Analysis

**MCDM(s):** Multi-Criteria Decision-Making

**MEAT:** Most Economically Advantageous Tender

**SCM:** Supply Chain Management

**SD:** Sustainable Development

**SDGs:** Sustainable Development Goals

**SMM:** Sustainable Maturity Models

**UN:** United Nations

# 1. Introduction

This section of the MSc Thesis offers an introduction into the research background and the necessity of investigating the perceived research problem and trying to find solutions. Next, the research objective and the associated research questions and sub-questions are formulated and discussed. Finally, the research approach and research outline selected are presented and explained.

## 1.1 Background

Sustainability is seen as one of the most important challenges the world needs to address today (G. Silvius, 2017) and sustainable development is becoming the leading model of development for organisations and nations as a response to the environmental crisis and the adverse social inequalities which are prevalent in the world (Waas et al., 2014). The environmental aspect of sustainability has gained traction and received a lot of focus over the past decades, with the European Union (EU) drafting the 2020 and 2030 Climate and Energy frameworks in 2007, aiming to reduce Greenhouse Gas (GHG) emissions, increase its share in renewable energy production and improve energy efficiency for its member states (Rodrigues, 2013). Similar agreements and frameworks, most notably the 2015 UN Paris Agreement and the Kyoto protocol, have also focused on the decrease in GHG emissions in the fight against climate change and the increase of renewable energy technologies. On a national level, the Dutch government signed and adopted the Dutch Energy Agreement in 2013, which encompasses the ambitions and targets to be met by 2023 (Ministry of Economic Affairs and Climate Policy 2016). In alignment with the European Commission and the 2020 and 2030 climate frameworks, the Netherlands aim to increase their share of renewable energy production to 14% by 2020 and to 16% by 2023, by strengthening the economy and investing in renewable energy sources. The agreement was signed by the government and various market parties, including the national Transmission System Operator (TSO) TenneT, trade unions and environmental organisations. Following the 2015 Paris Agreement, the Netherlands committed to a 20% reduction by 2020, a 40% reduction by 2030 and an 80-95% reduction by 2050, compared to 1990. The country's share of renewable energy must also reach 27% by 2030, while for 2050, climate-neutrality and an almost 100% sustainable energy are the goals. These efforts to decarbonise the economy by increasing the production and transmission of renewable energy and investing in new technologies can be briefly labelled as the "Energy Transition". In a pro-active approach, the Dutch government has designated the wind farm zones, carries site investigations, issues tenders for subsidies and has assigned TenneT, as the sole grid connection company, responsible for connecting the energy produced to the high-voltage grid. The connection of the energy produced by the planned offshore wind farms requires a lot of projects to be managed by TenneT. Cables, substations, and platforms need to be designed, constructed, and operationalized for the Netherlands to meet their sustainable goals. These projects need to adhere to the EU's Public Procurement Legislation and TenneT is responsible for the associated tender processes.

The social aspect of sustainability and the holistic nature in which sustainability needs to be addressed is discussed in the 2015 Sustainable Development Goals (SDGs) of the United Nations (UN) and has been addressed at the organisational level by the Corporate Responsibility or the Corporate Social Responsibility (CSR) departments within companies. According to KPMG, in 2005, 68% of the Global 250 firms have generated separate annual sustainability reports discussing environmental as well as social issues, while in 1999 the overwhelming focus was solely placed on the environmental aspect (Carter & Rogers, 2008). Montalbán-Domingo et al. (2018), identify a research gap in the social aspect of sustainability which has been overshadowed by the environmental aspect, when it comes to construction procurement practices. Most studies, according to the authors, have focused on the implementation of environmental criteria and the literature associated with the social dimension is scarce.

The UN believe that securing a satisfactory quality of life must be accompanied with strategies that improve health and education, reduce inequality, and create economic growth whilst placing climate change at a central stage and working to preserve the environment (United Nations, 2020). The 17 SDGs are an example of the emerging importance and the shift in how development is perceived to safeguard every aspect of sustainability in society (Kornov, 2020). These goals range from eradicating poverty, to producing clean energy and achieving gender equality and are interconnected and interrelated. For example, while energy is mentioned explicitly in SDG 7 “Affordable and Clean Energy”, it has interconnections and can affect other aspects of the 16 remaining SDGs (Santika, 2019). Thus, TSOs like TenneT, being responsible for the transmission of electricity in the high-voltage grid, have an important role in the holistic implementation and promotion of Sustainable Development. TSOs and the companies in their supply chain are considered focal points in the sustainability discussion as various frameworks and objectives set on international, European, and national level in the Netherlands place the production and transmission of energy as an agent of change and sustainable development. The scope of this MSc Thesis focuses on the Dutch TSO, TenneT and aims to help the company improve its sustainable performance and promote sustainability in its supply chain, by integrating incrementally sustainable objectives into its projects. This can help TenneT lead the Energy Transition and establish itself as an industry leader in sustainability which can improve its reputation and cooperation with stakeholders and other market parties and safeguard its competitive edge.

TSOs operate under several unique conditions and characteristics which make the incorporation of sustainable objectives in their projects and the associated decision-making processes challenging. TSOs operate in a complex global market and are involved with projects which can have adverse effects and consequences on the environment and society. Scarce materials and resources are used to produce the necessary assets for the transmission of electricity, which stresses the limits of the planet. Due to the highly specialised and segregated nature of a TSO’s supply chain, the adverse effects on nature and society span between the different activities, sub-suppliers, sub-contractors, and the different phases of a project. Activities such as the extraction of raw materials, the transportation of products and the execution of works can have serious effects on people and the planet and extensive planning is needed for the minimisation and avoidance of such effects. Monitoring these effects on nature (e.g., GHG emissions etc.) and society (e.g., labour conditions etc.) across the various points in time and geographic locations is challenging and is a limiting factor in the integration of sustainability measures in the TSO projects. Additionally, the increasing electricity demand and the long-term nature of TSO projects contribute to the inability of decision-makers to fully integrate sustainability in the decision-process, as it is often the case that short-term technical and economic goals are prioritised over long-term sustainability goals, when the two are conflicting (Hajonides Van Der Meulen, 2017). Contractors, market parties and TenneT can also suffer from *organisational inertia*, the inability to adapt when facing changes in the external environment. The sustainable development goals of the EU and the UN are ambitious and multi-faceted, which means that TSO projects need to follow sustainable processes alongside their end-goal of increasing the transmission of renewable energy. Thus, TSOs, need to work closely together with their suppliers and interested contractors to develop sustainable goals and measures, as the implementation of these measures and achieving these goals is directly connected with these parties (Meehan & Bryde, 2011).

European TSOs and TenneT follow the European Procurement Law, when the cost of contracts surpasses the predetermined thresholds of the EU, and need to base their tender processes on equal, transparent, and appropriate requirements for all market parties. This limits the range of criteria that can be used by decision-makers to promote sustainability, as any discriminatory exclusion of a possible contractor, (i.e., due to geographical reasons) is not allowed. Additionally, the decision-making process used for selecting the sustainable goals a project should achieve, inherently faces certain challenges. The different values, norms and past experience guide the thought process of decision-makers and personal biases shift their preference

towards specific sustainable goals (Waas et al., 2014). Time-related constraints and fear of contractors losing interest in the tender process of a projects also prevent the integration of all the sustainable development goals TenneT has simultaneously and indicates the need for prioritisation and gradual integration of these goals and aspects in the projects. All these challenges can hinder the decision-making process and the ability of decision-makers at TenneT to integrate the company's sustainable goals in projects. They raise the need for a systematic approach which can be used by decision-makers to ease the process of integrating sustainable goals in the company's projects. Such an approach requires the comparison of sustainable goals and existing sustainable measures, associated with them, and the selection of some of these goals and measures to be integrated in an incremental manner. The importance of sustainable goals, in their ability to promote sustainability in projects can capture the urgency of certain goals and their preference by the decision-makers. Additionally, the performance of existing measures can provide an additional understanding of the current situation of these measures and reveal whether the company is on the right track to achieve its goals.

By analysing these two characteristics, the several sustainability goals of TenneT can be described and assessed in terms of their importance and their real-life performance. This can reveal possible ways and strategies to be followed according to each sustainable goal's score, following the Importance-Performance Analysis (IPA) developed by Martilla and James (1977). IPA aims at supporting managers identifying the aspects that a company should focus on more, and the areas where the company may be consuming too many resources on. The IPA was initially developed for marketing strategies, however, it has since been used for sustainable development, for example in the creation of a systematic approach to identify and prioritise sustainable opportunities for start-ups (Selimi 2021), and in discovering transition pathways towards sustainability, for construction enterprises (Chang et al., 2017). An improvement strategy can be identified based on the findings of the IPA which can allow TenneT to gradually integrate sustainability goals in its projects, focusing on improving their real-life performance and the stimulation of sustainability in projects incrementally. By performing the IPA iteratively, TenneT can successfully capture the dynamic nature of sustainability and monitor possible changes in the importance and real-life performance of its sustainable goals. Thus, the company can successfully identify future sustainable goals to be integrated in its projects, increase its sustainability performance, and promote sustainable development through its supply chain and lead the Energy Transition.












## 1.2 Problem Definition

One of the main challenges TSOs face, in their attempt to successfully integrate sustainable objectives in projects, is the translation of high-level sustainability goals to quantifiable and measurable sustainability aspects and indicators which can be used at project-level to promote sustainability in the supply chain, thus improving the sustainable performance of the company. TenneT as the sole TSO in the Netherlands and one of four TSOs that operate in Germany has already established its objectives regarding sustainability for the near future and through its CSR 2025 Ambition Document links these objectives to several targets in accordance with Elkington's Triple Bottom Line of People, Planet and Profit. The ambition areas expressed in the 2025 ambition document aim to enhance the energy transition in a sustainable way, allowing TenneT to lead the way in maximising social contribution while at the same time minimising its impact as a TSO. Table 1 provides an overview of the CSR department's ambitions, its focus areas and the connection its goals have with the UNs SDGs. In more detail, TenneT's ambitions regarding People focus on Society, Diversity and Safety, while for the Planet the focus is on increasing Circularity, reducing the impact on Climate, and reducing the impact TenneT's operations have on nature. The focus regarding Profit is to maintain a competitive advantage by securing a higher return on capital than the regulatory determined return, to provide capital providers the necessary assurance of success and growth. However, the People

and Planet aspects of sustainability seem to receive much more interest and focus by the CSR department, in terms of ambitions, objectives and Key Performance Indicators (KPIs) to be achieved by 2025.

Table 1: TenneT's CSR Ambitions for 2025

Source: TenneT TSO B.V., 2019

Sustainability Aspect	Ambition Area	Short Description	Targets	UN SDGs
<b>People</b> 	<b>Society</b>	Adress stakeholders' concerns	To Be Determined	
	<b>Diversity</b>	Between male and female (for now)	In 2023 <ul style="list-style-type: none"> <li>• 22% female management</li> <li>• 22% female population</li> <li>• Executive and Supervisory Board members 30% female</li> </ul>	
	<b>Safety</b>	Number one priority for all operations	In 2020, Total Recordable Incident Rate <3.74	
<b>Planet</b> 	<b>Circular</b>	Minimising the use of scarce material, reusing them, and reducing waste in TenneT's operations	In 2025, <ul style="list-style-type: none"> <li>• 25% less virgin copper use</li> <li>• 25% less non-recyclable waste use</li> </ul>	
	<b>Climate</b>	Reduce the impact on climate caused by TenneT's operations	In 2020, climate neutral for substations, offices, and mobility In 2020, Reduce SF6 leakages (<0.28%) In 2025 fully climate neutral	
	<b>Nature</b>	Minimise the impact on nature, protect and improve the local nature	In 2020, zero net impact on nature	 
<b>Profit</b> 	<b>Profitability</b>	Remain attractive to capital providers by proving TenneT's ability to turn capital into profit	Return on Invested Capital > Return on Equity	

Beyond the Triple Bottom Line, TenneT is committed to the reliable and affordable transmission of electricity to its 42 million end users in the Netherlands and Germany. Thus, grid availability and the reliable transmission of electricity over long distances is important to the company. This means that technical issues such as energy are vital for TenneT's emissions and environmental impact, but also for its core mission of transmitting electricity in a reliable and affordable way. Additionally, staying on schedule is crucial in delivering the necessary infrastructure assets needed for the transmission of, an increasing amount of, renewable energy to the Netherlands and Germany. This means that the on-time delivery of projects is equally important to the company. From the 2019 and 2020 Integrated Annual reports, TenneT's core strategy can be summarised in four strategic goals. Driving the energy transition as a "green" grid operator, energising people with an inclusive working environment, securing today's and tomorrow's electricity supply, and safeguarding the company's financial health. The decision-making process of selecting which aspects of sustainability are to be incorporated in the procurement processes is a complex one, which is affected by personal biases and perceptions of the decision-makers. The different values among the decision-makers in a TSO can also further complicate this process, as different actors are motivated by different goals and have different ways of working. Thus, a process through which the relevant sustainability aspects are identified, discussed, and selected can be adapted to the context of a TSO and combined with tools which can help decision-makers assess the importance of each aspect to TenneT, using weights to indicate importance. The problem lies in the decision-making process, regarding the decision-criteria and sustainability measures which are integrated in the company's projects. Sustainability objectives are characterised by a high degree of complexity for the decision-makers and the organisation's overall strategy. Decision-makers are at the forefront of pressures and calls for action by a multitude of interested parties, for example environmental groups and labour organisations. Decision-makers need to weigh these pressures along with the possible economic returns and the long-term viability of the organisation. It is thus important to incorporate all aspects of sustainability into a framework of alternative actions and goals and use decision-making methods to select between these alternatives. Such a framework can be utilised by TSOs aiming at improving and promoting sustainability in an iterative way and in incremental steps. Waas et al. (2014) suggest that for sustainable development to overcome this gap regarding its practical implementation, it needs to be considered as a decision-making strategy at the very centre of each decision and course of action. This allows sustainability to transform from an intangible guide for certain actions to truly fostering and generating these actions.

The sustainability goals of a TSO begin from a corporate level and are also dictated by powers outside the organisation (e.g., EU, Dutch Government etc.). These goals need to be translated into measurable criteria and specifications to guide decision-makers in the procurement process. The complexity of the process is additionally enhanced by the subjective views and values of decision-makers and the perspective each department has about sustainability, thus indicating the need for objectivity. Furthermore, other criteria or constraints are placed on the decision-makers of a TSO, for example relating to the EU Procurement Processes. This limits the number of sustainable objectives and requirements that TenneT and decision-makers can focus on at once, which requires the use of iterative procedures for the eventual incorporation of all the sustainable goals TenneT. Thus, the integration of sustainable objectives in projects by a TSO can be described as a problem choosing between multiple criteria to identify the most important ones while also assessing their performance to identify possible prioritise actions for their improvement and the overall increase of the TSOs sustainability. By assessing the importance of the company's goals and their real-life performance using the IPA, decision-makers can map the several sustainable goals of the company in an IPA matrix which can guide them in prioritising their focus and efforts on improving certain aspects, repeating the process and gradually but incrementally focus on more and more sustainable goals. This

allows for tackling all the company's sustainable goals in a way that circumvents the challenges and limitations associated with TenneT and its characteristics as a TSO.

### 1.3 Research Objective

The research scope of the MSc Thesis is to propose a methodology which can be used by TSOs for deciding which sustainability goals need to be prioritised and improved, by integrating them in the company's projects, to promote sustainability in the supply chain. This methodology can be used to offer structure and to connect high-level sustainability objectives of a TSO to more concrete solutions for projects. The research aims to help decision-makers discuss what aspects of sustainability are relevant to the TSO and assess their importance through a transparent and objective procedure which can translate the sustainable goals of the organisation into decision criteria for individual projects and showcase the importance of these decision criteria with the use of weights.

While TenneT has its own internal sustainable goals, the research is also aimed at helping TSOs in general. As such, an initial discussion regarding the relevance of several sustainable goals identified in the literature can serve as a conversation starter and a mean for decision-makers to express their thoughts on sustainability.

By choosing a formal, step-by-step decision-support framework, following an MCDA approach, weights can be assigned to sustainability goals. This allows for a transparent and objective way to showcase the importance hierarchy, which is helpful in deciding where to focus next and which aspects of sustainability are to be integrated in future projects. The next step involves assessing the real-life performance of TenneT's existing sustainable measures, using a Maturity Level method. The final step involves performing the IPA and plotting the sustainable goals in the IPA matrix shown in Figure 2. From that, decision-makers can gain valuable insight as to where their efforts and resources could be focused, which sustainability goals might be over-emphasised at this point and which sustainability goals are on the right path. Thus, decision-makers can use the IPA to select certain sustainability goals and focus more intensely on improving their performance in projects, by integrating them at the various stages of a project, to promote sustainability.

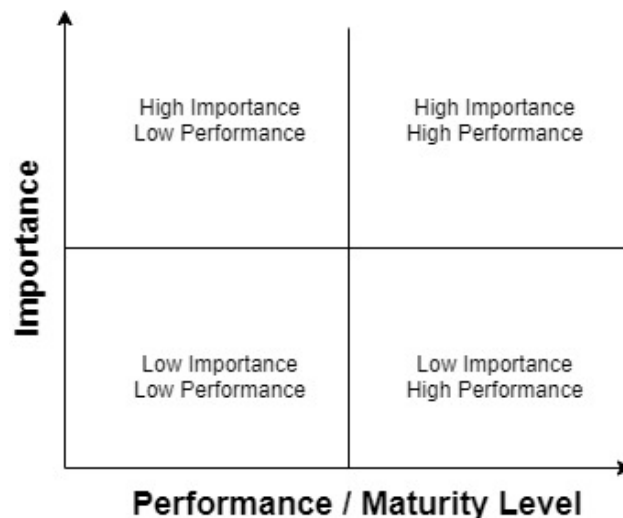


Figure 2: Importance - Performance Matrix

Source: Adapted from Martilla and James, 1977 and from Selimi, 2021

## 1.4 Research Questions

The main research question was formulated based on the problem statement and the research objective:

**“How can Transmission System Operators (TSOs) prioritise the integration and promote sustainability objectives in their projects and the supply chain?”**

To properly reach an answer to the main research question, a set of sub-questions was formulated:

***1. What is the current state of sustainability and sustainable projects in the literature and how is decision-making associated with it?***

The aim of this sub-question is to define sustainability, sustainable development and categorise sustainability objectives in different levels. The result is a sustainability table, entailing the relevant sustainability concerns that companies and projects need to address, and which can be used in the decision-making process to assess alternative solutions.

***2. What do decision-makers at TenneT believe are the most important sustainability objectives in terms of promoting sustainability in their supply chain, that need to be integrated in its projects?***

The aim of this sub-question is to identify what aspects of sustainability are of high importance to the company’s decision-makers. The preference of one sustainable objective over another, for the purpose of this research question, focuses on the ability of a specific objective to better promote sustainability in the project and in the supply chain of the TSO. A workshop with TenneT’s decision-makers from different departments is planned for discussing the company’s sustainability goals and agreeing on what should be considered for the pairwise comparison, using the BWM method. Next, the decision-makers are asked to assess their level of preference over the decision criteria according to the importance each criterion has in promoting sustainability in the projects and down the company’s supply chain. The weighing of the objectives occurs either in the workshop or in a separate meeting with each decision-maker, where they will be facilitated in pairwise comparing the sustainable objectives using the Best-Worst Method.

***3. What do decision-makers at TenneT think of the level of maturity, in terms of project integration, for the sustainability objectives and associated measures and requirements?***

The aim of this sub-question is to assess the degree to which the important aspects of sustainability (for the decision-makers) have been implemented in past projects and to what level of maturity. Maturity for the scope of this MSc Thesis is perceived as the degree to which a measure or requirement stimulates contractors and suppliers to act more sustainably in projects. The assessment of the maturity level of each aspect is performed, after the assessment of the importance of the sustainability goals, by using a maturity model and collecting the thoughts of decision-makers regarding each measure’s ability in past projects to promote sustainability, using a questionnaire. Identifying which measures lack behind in terms of maturity allows for plotting them in the Importance-Performance Matrix and identifying what needs to be prioritised.

***4. What are the sustainability objectives and measures that need to be prioritised by TenneT and integrated in its projects to promote sustainability in its projects and the supply chain?***

This final sub-question aims to identify which sustainable objectives and aspects of the company should become the focus of the company and integrated in future projects. By identifying these aspects, TenneT can begin improving their level of maturity and by repeating the process, identify the next set of sustainability objectives which need to be addressed. Assessing the importance of the sustainable objectives and the performance of their associated measures, TenneT can identify the first steps needed to improve its sustainability performance and promote sustainability in its projects and in its supply chain better.



## 1.5 Theoretical and Practical Relevance

TenneT, in its goal to transmit electricity in the high-voltage grid needs to ensure technical capacity and reliability of its assets, as well as drive competition and incentivise reduced spending on their projects. On the other hand, the company also wishes to drive the Energy Transition, become more sustainable while increasing its performance on all three aspects of sustainability: environmental, social, and economic sustainability. TenneT wishes to lead by example, become an industry leader and incentivise its network of suppliers and contractors to do the same. This way, TenneT can also build a good reputation and good relationships with different stakeholders and ensure its financial health and prosperity. Additionally, the existing tender procedures, selection, and award criteria that TenneT needs to adhere to, challenges the company's ability to focus on all pressing matters of sustainability and technical reliability at the same time at their projects. There is an urgent need for prioritisation of goals and gradual but incremental integration.

Practically, the MSc Thesis aims to offer a solution to TenneT as to how to increase the level of sustainability and decide what sustainable goals need to be the focus of the company. As such, these goals need to be integrated in projects to promote sustainability in the projects themselves and in the supply chain of the company. The lack of a systematic decision-making process for integrating sustainable objectives and sustainable requirements in projects, is of practical relevance and this research aims at helping with that. Thus far, each project is evaluated on a separate basis and the selection and/or award criteria for the tender process may differ from project to project. This impacts project teams and requires lengthy discussions among departments each time a project needs to be tendered. Additionally, it makes it more difficult to assess the progress of sustainability objectives since these criteria are not applied consistently between projects and it disincentivises contractors and suppliers to commit to long-term sustainable change.

The theoretical relevance and contribution of this MSc Thesis is the incorporation of a MCDA method, namely the Best-Worst Method, as a mean to instigate conversation, identify relevant sustainability objectives for decision-makers and evaluating the importance of certain sustainability objectives over other ones. This MSc Thesis aims to test whether a MCDA approach and the specific method are suited in the corporate environment of TSOs to solve the problem of translating high-level sustainability goals in project specific measures and requirements. Additionally, decision support models such as the Maturity Model and Importance-Performance Matrix are also utilised and tested in their ability help decision-makers at TenneT identify and integrate sustainable goals in projects.

This MSc Thesis can provide a framework for the implementation of a sustainability strategy to iteratively identify the most important sustainability issues and monitor their real-life performance. This can decrease the time needed to decide on important selection and/or award criteria for projects, provide a more objective method to assess these objectives, result in an overall more cohesive sustainability strategy and provide opportunities for comparing and measuring the progress of sustainability within the company.

## 2. Research Design

This section of the MSc Thesis describes the research approach and sets the limitations of this research by defining the research scope (presented in Figure 3), explaining the selected methodology and presenting the general outline of the research.

### 2.1 Research Scope

The research follows a multidisciplinary approach to investigate the integration of sustainable objectives in TenneT's TSO projects, to stimulate sustainability in the projects and in the supply chain. Multi-Criteria Decision Analysis (MCDA) is necessary for the assessment of importance of the sustainable goals that TenneT has. As explained in Sections 3 and 4, due to limitations of the procurement process and the complex supply chain that TenneT operates in, prioritisation of sustainable objectives is required to achieve the goals in an incremental approach and increase the company's sustainable performance.

The first step is engaging with decision-makers at TenneT, specifically from the Supply Chain Management (SCM) and Corporate Social Responsibility (CSR) departments to discuss what the relevant sustainability aspects and goals are for the company. The focus is thus on the internal stakeholders in TenneT, who share a common understanding of the company's technical and sustainable goals and wish to maximise benefits for the company. Thus, the research focuses on the so-called "single decision-maker" approach (Azapagic & Perdan, 2005) and the multiple decision-makers approach, which includes organisations such as trade unions, contractors, non-governmental organisations (NGOs) etc., falls outside of the scope of the research. Next, TenneT's projects are examined from a life-cycle approach, meaning from the extraction of the raw materials necessary for their construction all the way to their decommission. This allows the research to thoroughly examine the adverse environmental, societal, and economic effects that projects can create.

This research also follows the procurement procedure at TenneT to examine the different possibilities, actions, and requirements in place for integrating the sustainable objectives in TenneT's projects and the four phases of the projects themselves, namely the Initiation, Planning, Execution (including Monitoring and Controlling) and Project Close out. Additionally, TenneT's projects are put out for tender according to EU Procurement Procedures. The focus is on Public Procurement and its associated principles and restrictions, while private procurement practices are out of the scope of the research. Finally, the proposed framework is an iterative one, however the identification of the sustainable objectives and the assessment of their maturity level and level of promoting sustainability in projects is performed once, to test its applicability and how easily it can be performed in practice.



Figure 3: Research Scope

## 2.2 Methodology

This section of the MSc Thesis describes the methodology used in the research to answer the research questions. Theoretical data were collected from the literature study where sustainability was examined via the various concepts and methods that are relevant for the scope of this research. Informal interviews with SCM professionals at TenneT were used to: better understand TenneT's context, sustainability goals and the limitations regarding integrating sustainable goals in the company's projects. Next, a workshop with decision-makers from TenneT was conducted to **i)** identify the sustainable objectives and **ii)** assess their importance. The decision-makers were selected by their knowledge of how TenneT's projects work and their intrinsic motivation to promote sustainability. The necessary empirical data and information from TenneT were collected from a desk study, focusing on already commissioned projects, and the assessment of the maturity level of the sustainability objectives was done by sending questionnaires to decision-makers at the company. The methodology is presented schematically in Figure 4 and can be divided into three main parts:

1) **The Theoretical Framework** that is necessary for the research is collected with the Literature Study which helps to understand and define sustainability and sustainable development and which aspects are used in projects and the public procurement processes to promote sustainability in the supply chain. The literature study focused on articles discussing sustainable development, sustainable procurement, sustainable project management and sustainable supply chain management and from there, a table containing the various sustainability aspects and possible assessment indicators is produced. This allows for a look at sustainability independently from TenneT's own, already-established goals, which can be useful for other TSOs, who do not have such detailed sustainability goals.

2) **The Empirical Research** begins with the informal interviews with SCM professionals at TenneT and the desk study to identify the sustainable aspects of TenneT and the existing challenges and limitations pertaining to the integration of sustainable objectives in projects and tender procedures that. Next, the sustainability workshop allows the decision-makers at TenneT to express their thoughts on sustainability and select the objectives and indicators that are relevant to TenneT. This will result in a decrease of the initial list (produced in the Theoretical Framework phase). Next, the importance of each sustainable goals is assessed, by the decision-makers using the Best-Worst Method. Finally, the performance of existing sustainable measures is assessed using a questionnaire, based a Maturity Model, namely the SPM3 Model by Silvius and Schipper (2015). The empirical research results in the identification of **i)** the most important sustainability objectives and **ii)** the low performing (low maturity level) sustainable measures.

3) **The Result** of the two previous phases is used to identify the important sustainability objectives and their measures that lack behind in terms of performance, (i.e., maturity in their ability to influence the supply chain and projects). A visual representation is achieved using an Importance-Performance Matrix, plotting the sustainable goals, and placing them in one of the four quadrants of the matrix. Each of these four quadrants can provide valuable information for TenneT. The IPA finally suggests where it would be preferable for decision-makers to place their focus and resources and which sustainable goals to prioritise. TenneT then needs to repeat all three phases of the research methodology to properly monitor any changes in the importance and performance of its sustainable goals and to gradually integrating more goals in its projects. More detailed recommendations are offered in Section 8.3

The steps conducted in this research and the overall research outline are summarised schematically in Figure 5.

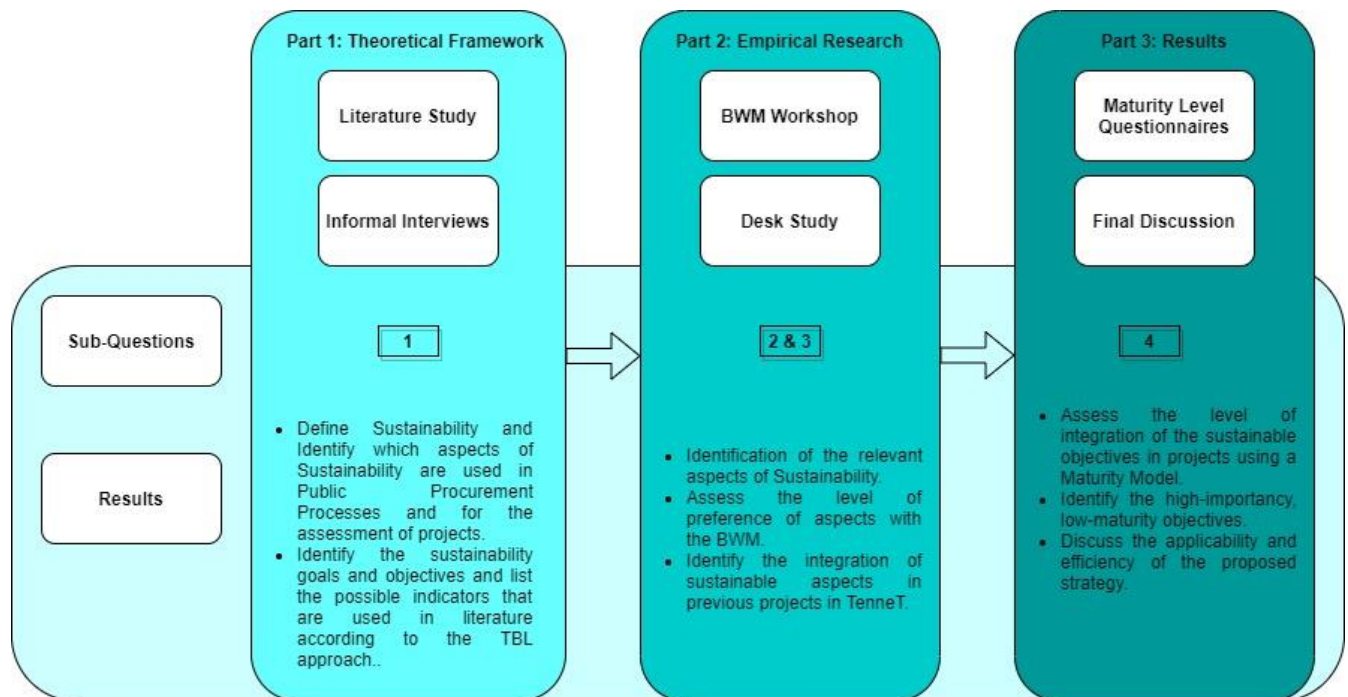


Figure 4: Research Methodology

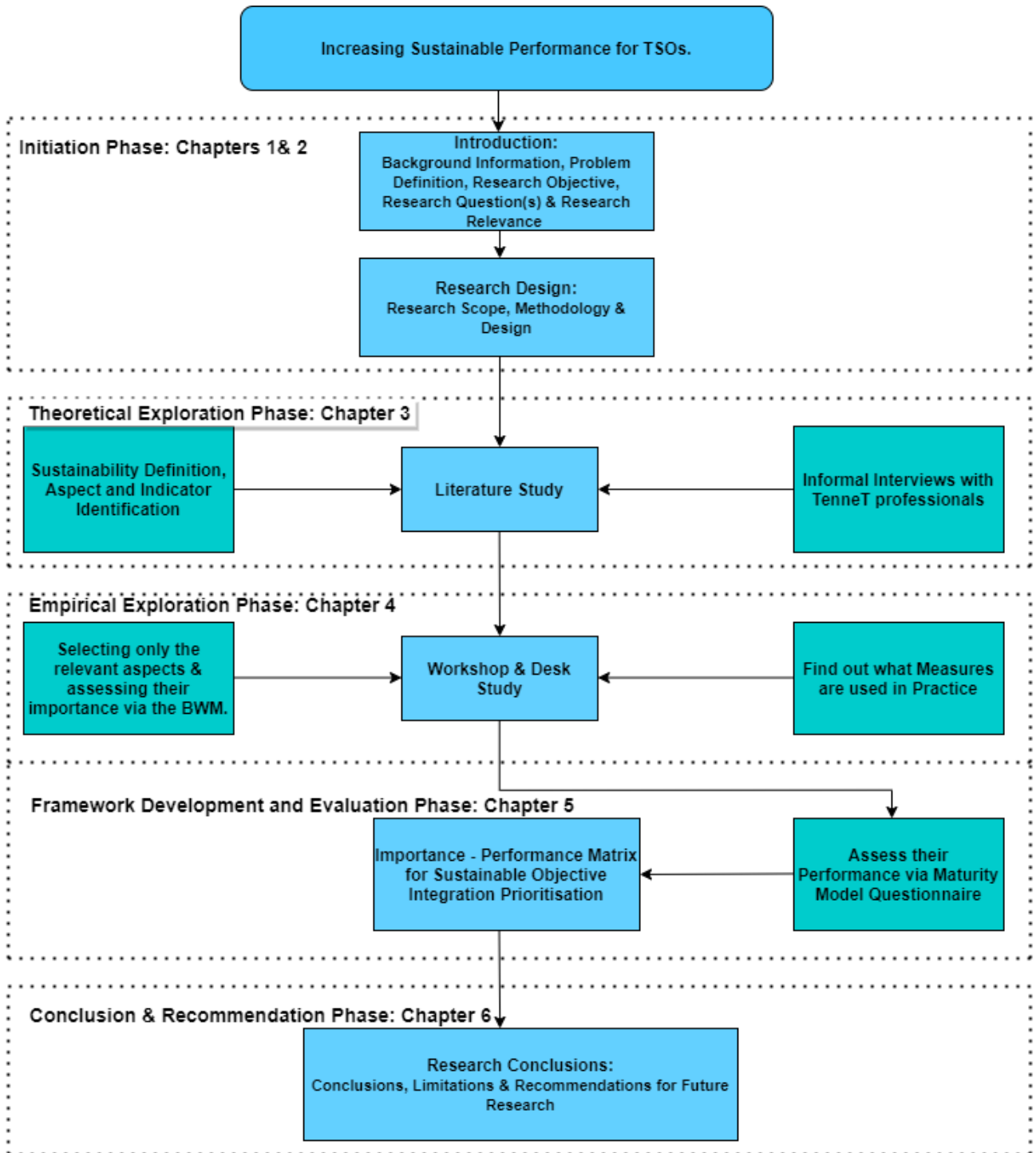


Figure 5: Research Outline

### 3. Literature Review

This section of the MSc Thesis aims to define sustainability and sustainable development, discuss the various sustainable goals associated measures and tools that are used to promote and assess sustainability. Projects and the procurement process are discussed as possible driving forces for sustainable development. Next, the section discusses Multi-Criteria Decision-Making (MCDM) and the assessment of sustainable performance for companies using Maturity Models. The efficacy of MCDM and Maturity Models for TenneT is also discussed. Finally, the research offers a long list of sustainability goals, sub-aspects and possible indicators, found in the literature study, that can be used to assess and promote sustainability.

This section answers the sub-question 1, “*What is the current state of sustainability and sustainable projects in the literature and how is decision-making associated with it?*”

#### 3.1 Sustainability in the Literature

There are many definitions of sustainability in the literature, however, most authors agree that sustainability essentially is the balance between the environmental, social, and economic aspects and consequences of any action (Talbot & Venkataraman, 2011). Today’s prevalent notion of sustainability can be traced back to John Elkington’s article “Partnerships from Cannibals with Forks”, which he wrote in 1998. In that article, Elkington introduced the concept of the Triple Bottom Line (TBL), as opposed to the Bottom Line, of an organisation. Elkington broadened the view an organisation should have and moved the focus from the financial bottom line, to the sustainable TBL, which incorporates the three important aspects: People, Planet and Profit (Elkington, 1998).

Development that is geared towards balancing the three aspects of the TBL, without compromising one over the other is considered Sustainable Development and has received a lot of focus in the years following Elkington’s work. The most widely used definition for sustainable development comes from the Brundtland Report which defines sustainable development as; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (Brundtland, 1987). This definition, however, offers little guidance to companies as to how to identify present and future needs, determine the necessary technologies for meeting their needs and balancing the responsibilities towards stakeholders, broader society, and the environment (Talbot & Venkataraman, 2011). Recent attempts to conceptualise the complex notion of sustainability were made by the United Nations. In 2015 the UN and their member states adopted a total of 17 Sustainable Development Goals (SDGs), presented in Figure 1, aimed at promoting sustainability and changing the way development is perceived and achieved. The UN defined the SDGs as “*a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity*”. The goals are centred around people, planet, prosperity, peace, and partnership and are comprised of 169 targets and a total of 232 indicators (Santika et al., 2019) and cover a wide range of issues like exterminating poverty and producing clean and affordable energy. The goals have since become a reference point for both public and private policymaking and have raised awareness for the need to consider every aspect of society when it comes to development (Kørnø, Lyhne, & Davila, 2020).



Figure 6: The UN's 17 Sustainable Development Goals.

Source: <https://sdgs.un.org/goals>

The three aspects of the TBL are interrelated and need to be addressed in a holistic and integrated approach and not in an individualistic manner, for example trying to mitigate the adverse environmental effects of a project. Carter and Easton explain that the TBL approach shifts the mindset of an organisation's from simply engaging in environmental and social activities which can help or not harm the organisation's bottom line to actively seeking the activities which lie in the intersection of these three aspects (Carter & Easton, 2011). Many organisations have had a skewed view of sustainability in the past and focused only on environmental issues. However, the integrated view of sustainability is extremely important as all three aspects are connected and interrelated (Meehan, 2011). Kirhgeorg and Winn (as cited in Meehan, 2011) offer an example, of the interrelatedness of the three aspects of sustainability, where an organisation's economic growth can adversely lead to an increase in its carbon footprint, however, it may offer long-term employment opportunities for local communities. That is why, any of the three aspects cannot be considered in a standalone fashion by the organisation.

In the TBL approach, organisations are not solely responsible for creating profit for their shareholders but are also tasked with a responsibility towards nature, the environment, and the broader society that the organisation is a part of. In that sense, the TBL approach exhibits similarities to Stakeholder Theory, as organisations try to create value and benefits for a broader group of stakeholders which can include for example local communities and environmental groups, which the organisation needs cooperate with to operate successfully in the modern complex environment (Freeman, 2015). Keeyes and Huemann suggest that the scope of sustainable development for organisations, through their actions, decisions, and projects, is to deliver value and benefits to the relevant broad group of stakeholders (Keeyes & Huemann, 2017). Stakeholder theory is a concept that comes up often in the literature ((Keeyes & Huemann, 2017),(Hörisch, Freeman, & Schaltegger, 2014), (Reed, 2008), (Labuschagne & Brent, 2006), (Sánchez, 2015), (Maxwell & Sheate, 2006)), as a means to properly understand the values and concerns of all the relevant parties, manage how to engage with them and inform them on critical issues and cooperate with them on the basis of achieving the sustainable goals and objectives.

A stakeholder is defined as “those groups or individuals who can affect or be affected by the actions of value creation and trade” (Freeman, 2015). Horisch et al. (2014), identify the similarities in both sustainable development and stakeholder theory and offer a framework which can be used by organisations to achieve consensus and achieve their sustainability objectives, based on shared values. The authors’ approach uses human beings or organisations as representative stakeholders for nature and by using three interrelated mechanisms (education, regulation, and value creation) organisations and these representative stakeholders can work together towards their mutual sustainable goals and interests.

According to Silvius (2013) the enlargement of a project’s scope to include all three aspects of sustainability, follow a life-cycle approach and focus on both local and global effects of the project increases the number of associated stakeholders as human rights groups and nature preservationists become interested in the project. Reed (2008) identifies how stakeholder participation can help in the decision-making process and in the co-creation of value and suggests eight features of what a “best practice” for stakeholder participation should look like, from literature. These features include the need for participation to be empowering, equal and to promote trust and learning. Reed focuses on the need for early stakeholder participation, before important and relevant decisions have been made. Another important feature is the analysis and systematic representation of all the relevant stakeholders, using any of the relevant stakeholder identification methods that exist in the literature. The participation process needs to be clear about the objectives and about the trade-offs necessary, instead of focusing on reaching consensus. Additional features of a “best practice” stakeholder participation process require highly skilled facilitators to handle the dynamics, ensure active participation and inspire trust and local and scientific knowledge to be incorporated in the process to investigate uncertainties, and develop more rigorous understanding of the situation. The final step, according to Reed, is the institutionalisation of stakeholder participation as a core process of the organisation, to ensure long-term success. Stakeholders are also important in recognising important issues and valid concerns, shared by one or more stakeholders, which can then be translated into the organisation’s strategic goals, actions, and processes (Sánchez, 2015).

Conclusively, although the identification, information, engagement and management of the stakeholders’ relations and attending to their concerns adds complexity to projects and organisations, it is recognised in the literature as helping sustainable development and enriching the decision-making and solution-seeking processes. It can however have adverse effects on the decision-making process as from a stakeholder theory perspective, the focus lies on the process itself and not necessarily on the outcome. Sustainable development on the other hand has specific goals within the three aspects of people planet and profit which need to be realised. For that reason, when it comes to sustainable development Azapagic and Perdan (2005) argue that the identification of stakeholders and their interests should be followed by a distinction as to which stakeholders should be involved in the decision-making processes when it comes to sustainable development.

### 3.2 Sustainability in Projects

A project is defined as a temporary endeavour, undertaken to achieve a unique result, product, or service by the Project Management Institute (PMI, 2020). It is temporary in the sense that it has a determined beginning and end and unique in the sense that a project does not constitute a routine operation but rather a set of specific operations designed to achieve a particular goal. Many authors in the literature, (Labuschagne & Brent, 2005), (Labuschagne & Brent, 2006), (Maxwell & Sheate, 2006) (Marcelino-Sádaba, González-Jaen, & Pérez-Ezcurdia, 2015), (Michaelides, Bryde, & Ohaeri, 2014), (G. Silvius, 2017) and (Sabini, Muzio, & Alderman, 2019), identify the role projects have, despite being temporary endeavours, in bringing lasting changes in an organisation’s processes, assets, products, and/or services.



As such, projects can act as agents of sustainable change and as means of producing environmental, social, and financial value on the long-term. Silvius (2013) defines Sustainable Project Management as planning, monitoring, and controlling the project delivery and its support processes, considering the social, environmental, and financial aspects of the life cycle of the project’s resource, processes, deliverables, and effects. This way, the project is aimed at realising the benefits for its stakeholders in a clear, ethical, and fair manner including the proactive participation of stakeholders. Both Silvius & van der Brink (2012) and Keays and Huemann (2017) have identified the differences between sustainability and sustainable development and the project management approach. Table 2 is an adaptation of their combined comments and presents the distinct Sustainable Project Management approach.

*Table 2: Differences between Project Management, Sustainability & Sustainable Project Management*

<b>Focus</b>	<b>Project Management</b>	<b>Sustainable Development</b>	<b>Sustainable Project Management</b>
Time Horizon	Short-term Focus	Short-term and Long-term	Temporary Organisation with Long-term Perspective
Orientation	Deliverable/Result Oriented	Life-Cycle Approach Orientation	Life-Cycle Orientation with Iterative Connection to Project's Products and Processes
In Interest Of	Project Owner, Sponsor and Project Stakeholders	Present and Future Generations	Social Benefit, Value Creation and Social Learning for all Stakeholders
Goals	Scope, Budget, Schedule (Iron Triangle)	People, Planet, Profit (Triple Bottom Line)	Linked Project & Investment Life Cycle. Can realise benefits beyond the project itself.
View on Complexity	Reduce as much as possible	Embrace and increase	Potential for Social Learning. Integrative and Iterative Process with Stakeholders.

*Sources: Adapted from Silvius & Schipper 2015 and Keays & Huemann 2017*

Keays and Huemann (2017) add that a project must engage in relationships with different groups of stakeholders and deliver benefits to them, through its life cycle, to survive. They suggest that a project’s values need to be co-created by its stakeholders through transparent cooperation, multilateral information exchange and sincere consideration of stakeholders’ concerns and values. The process of co-creation must also follow an adaptive and iterative process through a project’s initiation, planning, execution, and closeout/deliver phases. Silvius et al. (2017) discuss how a project’s scope is enlarged to accommodate the goals and objectives of sustainable development, making the project an instrument for societal change. Silvius & Schipper (2015) discuss how the emergence of sustainability in projects has extended project specifications, requirements and subsequently outputs, deliverables, and the notion of “project success”. They conclude however, that there is no consensus on how to measure and assess sustainability, thus this will need to be adjusted accordingly to each project’s context.

### 3.3 Sustainable Procurement: Integrating Sustainability in Projects

Procurement is an important function in the delivery of projects and its associated activities span from the identification of the project’s needs and requirements all the way to its closeout. This according to Ruparathna and Hewage (2015) constitutes procurement, as ideal for integrating an organisation’s strategic objectives in its purchasing decisions and its projects. Despite many available definitions in the literature, procurement involves mainly the acquisition of goods, services, or construction from a third party, at the best possible price, in appropriate quantity and at the right time and place. (Ruparathna & Hewage 2015).

Procurement has a key role in implementing sustainable development guidelines and practices and needs to extend beyond the traditional boundaries of an organisation and into the supply chain (Meehan & Bryde, 2011). As such, awarding contracts for works, materials and/or services using sustainability decision-criteria, rather than just selecting the cheapest option, is a way to incentivise contractors and suppliers to act in a sustainable way and deliver added value for their clients to win the tender. That notion forms the basis behind the increasing use of MEAT or Most Economically Advantageous Tender award criteria in Europe and in the Netherlands. Following the MEAT enables contractors and suppliers to consider criteria that reflect qualitative, technical, and sustainable aspects of the tender and allows for innovative solutions (Sebastian, Claeson-Jonsson, & Di Giulio, 2013). The Dutch and European public procurement laws, which TenneT must adhere to, dictate certain procedures for certain types of contracts and projects (see Appendix A: The Public Procurement Process, for more details). Apart from the award phase, Public Procurement processes allow for additional criteria such as pre-qualification and selection criteria, which contractors and suppliers must meet to enter the tender process.

Following public procurement TenneT needs to adhere to certain principles, providing an equal footing for all tender participants and ensure that the awarding of contracts is based on non-discriminatory criteria. However, the identification of the MEAT award criteria can be difficult, especially in the context of Transmission System Operators like TenneT. What aspects of quality, technicality and sustainability are to be integrated in the process? The following section discusses these challenges, as TenneT experts from the Supply Chain Management department were interviewed about the challenge of sustainability and stimulating sustainability in projects.

### 3.4 Assessing Sustainability: The Different Perspectives

The practice of assessing sustainable development is an emerging topic in the literature and is comprised of methodologies, frameworks, models, and tools which tackle sustainability at different levels and from different points of view. The objective however is the promotion of sustainable development by integrating sustainable objectives through an organisation's projects, operations and in the supply chain. Aspects and sub-aspects of sustainability were identified and discussed along with possible indicators or measurement tools. Table 3 provides an overview of the sustainability aspects and goals for promoting sustainable development and possible assessment indicators, collected from the literature.

Labuschagne & Brent (2005) reviewed existing sustainability frameworks which aim to help integrating sustainability reporting in several industries. These frameworks include the Global Reporting Initiative (GRI) which aims to improve the quality of sustainability reporting, as well as the Institution of Chemical Engineers' (IChemE) Sustainability Metrics and the Wuppertal Sustainability Indicators. The authors developed a four-level operational sustainability framework, based on a corporate strategy which covers both core activities and other social investment activities of a company. The authors offer a long list of sustainability criteria and conclude saying that there are two prevalent ways of evaluating the sustainable performance of a company: Translating all impacts into financial terms or following a qualitative route using a Multi-Criteria Decision-Analysis (MCDA) process and assigning weights of preference or importance of these decision criteria. The authors state that the MCDA route is preferred as it is difficult to translate all environmental and/or social sustainability elements into monetary terms, while it is possible to express preference over all criteria. Quantifiable and non-quantifiable. Carboni et al. (2016) in the P5 Standard for Sustainability in Project Management identify a global shift from an operations focus to projects focus and add that 30% of the world's GDP in 2014 was spent on projects. The authors go on to add sustainability constraints to the Iron Triangle of Project Management (Cost, Scope and Time) and discuss the differences of a project's product and its associated processes. Both a project's product and its supporting processes are examined with a life-cycle approach against the elements of the P5 framework

which are collected through internationally recognised standards, treaties, conventions, and declarations. The authors conclude providing their suggestions about the impact analysis of a project’s product or process. This is done by scoring the product or process against an element of the P5 framework using a simplified version of the Analytical Hierarchy Process (a MCDA method). Products or processes with high negative scores on P5 Elements are then incorporated in a Sustainability Management Plan which translates the sustainability objectives into project objectives which project managers can attend to so they can meet or exceed the project’s objectives.

The first version of Silvius’ and Schipper’s (2010) maturity model was developed to translate abstract concepts of sustainability into more practically applicable actions. This can allow companies to set their own ambitions, according to the company’s values, monitor, report and prompt a discussion about how to improve the company’s sustainable performance. The authors begun by creating a sustainability checklist which covers all three aspects of the TBL. Their maturity model is based on the “depth” of a company’s vision regarding sustainability, and it has four levels and an initial non-existing level. The levels consider sustainability activities on the incremental levels of Resources, Business Processes, Business Model and the Products and Services delivered by a company. Companies can assess the different products or processes on their actual and desired levels of sustainable maturity. Figure 7 can then act as a graphical conversation starter for transforming a company and its projects and increasing the overall sustainable performance of the company by first understanding what lacks behind.

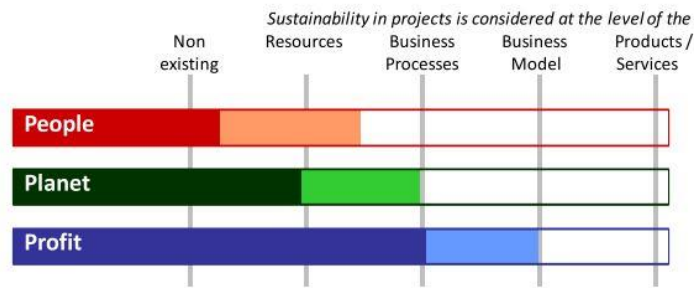


Figure 7: Graphical Representation of the Maturity Model for Integrating Sustainability

Source: Silvius & Schipper 2010

Special attention is paid in two sustainable assessment and development methodologies. Azapagic and Perdan (2005) propose a step-by-step procedure which can aid decision-making in the context of sustainable development and Silvius and Schipper (2015) developed a maturity model which builds on their 2010 version (Silvius & Schipper, 2010) to assess the level of implementation of sustainable development goals in projects and their associated processes. Decision support activities and tools are of special interest to this MSc Thesis as the scope of the research is to propose a decision-support framework with which Aratis can help TSOs, in this case TenneT, identify the most important sustainability objectives and the ones that do not perform well in terms of promoting sustainability in projects. This in turn helps TSOs prioritise which aspects need to be attained to first, in an integrative and iterative sustainability increase strategy. For that reason, the two following methodologies were selected to structure the problem of identifying what is important to the company and what lacks behind in terms of sustainable performance. Following a supply chain perspective is important for the scope of this research, as the activities that lie outside the boundaries of TenneT need to be improved as well. Adopting this supply chain perspective, allows TSOs to exert their influence on their supply chains, by integrating sustainability goals, measures and requirements in projects which are then put out to tender. Contractors and suppliers can then be incentivised and stimulated to act in a more sustainable way which in turn can influence the whole supply chain. Procurement, in literature

and in practice, is often looked through the lens of the supply chain as well and in the case of sustainability, any decisions regarding procurement need to be analysed about their possible effects on the suppliers in terms of the TBL approach (Meehan & Bryde, 2011). Incorporating sustainability-driven initiatives, requirements, and activities in the supply chain via projects can have a large effect on the TBL related outcomes and objectives of any organisation (Meehan & Bryde, 2011) Maturity models can act as conversation starters for increasing the sustainable performance of a company, by first identifying and describing what that higher-level of sustainability looks like and the incremental manner in which they describe a company's improvement in regards to sustainability is suited well in the complex supply chain and industry that TenneT is placed in, as radical improvements or a radical integration of sustainability requirements and measures in the tender processes and projects cannot be successful. Silvius and Schipper (2015) focused on sustainable project management and the promotion of sustainability through projects, as ideal agents of change. They created a list of 22 indicators for assessing sustainability within the aspects of the TBL. The SPM3 model follows 4 distinct maturity levels that range from a "do no harm" approach all the way to a "purposeful positive contribution" for each indicator and aims to capture both the actual and the desired level of a sustainability aspect's integration in a project's products and processes. The assessment of the actual and desired integration of sustainability is done via a questionnaire which describes level 1 as considered implicitly with the company's laws and regulations but there are no specific policies in the specific project. Level 2 is characterised as an explicit consideration of the aspect but aims at not compromising the interests of the different stakeholders of the project. A level 3 assessment means that an aspect is one of the areas that the project actively contributes to and level 4 means that contributing to the specific aspect is one of the drivers of the project.

### 3.5 Sustainability: A Multi-Criteria Decision-Making Problem

The integration of sustainable objectives and measures in projects by TSOs constitutes a MCDA problem, since it requires the identification of goals to be achieved, the selection of associated sustainability measures, and their integration in the tender process. Decisions are being made at every step as decision-makers decide between what is relevant to projects, what can be achieved and try to balance technical requirements with all three aspects of sustainable development (Azapagic & Perdan, 2005) and other constraints, specific to the context of TSOs. While sustainability as defined by Elkington (1998) and as it used for the scope of this research, is defined by its three aspects of Planet, People and Profit (alternatively Environmental, Social and Economic Sustainability) its sub-aspects, objectives and possible indicators used to assess the sustainable performance of companies (or to select amongst alternative options) can vary a lot. This is the case due to the different activities, phases, points of view and industries researchers, academics and practitioners choose to focus on. Companies focus on specific sub-aspects and indicators according to their ambitions and other context-related constraints. MCDA can provide structure and limit the number of sustainable goals decision-makers need to focus on at each project. Following MCDA, comparing the different goals and eventually assigning weights to the various sustainable goals, an order of importance can be established. MCDA is also shown in the literature to help with the identification of important sustainability goals and their integration in projects (Carboni et al., 2016), ((Labuschagne & Brent, 2005) and (Salimi, 2021). The Best-Worst method was selected as the preferred MCDA method for this research, as it offers clarity and structure, allowing a decision-maker to offer consistent comparisons. This is achieved by selecting the best and worst criteria in the beginning of the process, which reduces anchoring bias, as the two opposite reference points (the best and worst) are considered. The BWM has been already implemented in various problems relating sustainability, such as assessing the social sustainability in supply chains, sustainability in location selection problems etc. Additionally, it is very data-efficient as well as time-efficient, as it requires fewer comparisons than other MCDA methods (Rezaei, 2015) and (Salimi, 2021).

Table 3: List of Sustainable Assessment Objectives and Indicators from the Literature

TBL Aspect	Sub-Aspect	Objective	Possible Indicators
Planet	Energy	Minimise Energy Consumption	<ol style="list-style-type: none"> <li>1. Energy Consumption</li> <li>2. Energy Consumption in the Supply/Value Chain</li> <li>3. Energy Efficiency &amp; Consumption Reduction Plan</li> </ol>
Planet	Energy	Increase Renewable Energy	<ol style="list-style-type: none"> <li>1. Percentage of Renewable Energy</li> <li>2. Actualised Possibilities for Renewable Energy Production at the Project's Different Phases</li> </ol>
Planet	Emissions	Reduce the Emissions of Polluting Gases	<ol style="list-style-type: none"> <li>1. Direct GHG Emissions</li> <li>2. Indirect GHG Emissions</li> <li>3. GHG Emissions from the Supply Chain</li> <li>4. GHG Emission Reduction Plan</li> <li>3. Compliance with the country's/region's relevant legislation</li> </ol>
Planet	Water	Minimise Water Consumption	<ol style="list-style-type: none"> <li>1. Use of Potable Water</li> <li>2. Collection &amp; Use of Rainwater</li> <li>3. Freshwater Use</li> </ol>
Planet	Water	Ensure Adequate Water Quality	<ol style="list-style-type: none"> <li>1. Percentage of Effluent Water that Receives Treatment</li> <li>2. Policies for the protection of local bodies of water (e.g., rivers, lakes etc.)</li> <li>3. Monitoring the amount and type of pollutants in water effluents and runoffs</li> </ol>
Planet	Waste	Minimising Waste	<ol style="list-style-type: none"> <li>1. Volume/Weight of Waste Generated</li> <li>2. Percentage of Waste Reused or Recycled</li> </ol>
Planet	Waste	Waste Disposal Management	<ol style="list-style-type: none"> <li>1. Waste Management &amp; Disposal Plan</li> <li>2. Design for the Project's Product(s) Disposal in Mind</li> <li>3. Project Life Cycle Cost Including Disposal Costs at End-of-Life</li> </ol>
Planet	Transport	Minimising the Adverse Effects of Transport on Nature	<ol style="list-style-type: none"> <li>1. Local Procurement of Works, Services and Materials</li> <li>2. Digital Work Possibilities &amp; Limitation of Unnecessary Travel</li> </ol>

Planet	Biodiversity	Proactively Protect Flora and Fauna	<ol style="list-style-type: none"> <li>1. Species of flora and fauna at danger</li> <li>2. Measures for the protection of flora and fauna during the project's execution and operation</li> <li>3. Percentage of budget allocated to protecting flora and fauna species</li> </ol>
Planet	Biodiversity	Reactive Measures for the Restoration of Flora and Fauna	<ol style="list-style-type: none"> <li>1. Percentage of the budget allocated to minimising the effect on nature and restoration measures</li> <li>2. Measures for the restoration of the natural environment</li> </ol>
Planet	Materials & Natural Resources	Avoid the Depletion of Natural Resources & Non-Renewable Minerals	<ol style="list-style-type: none"> <li>1. Identification and Report of the Origin of Materials</li> <li>2. Percentage of Recycled Materials Used</li> <li>3. Resource Use Reduction Plan</li> <li>4. Percentage of Responsibly Sourced Materials/Resources</li> <li>5. Monitoring of the Incorporated Energy Used in Materials</li> </ol>
People	Health & Safety	Preventive Measures for Ensuring Health and Safety	<ol style="list-style-type: none"> <li>1. Occurrence of Safety Incidents/Deaths</li> <li>2. Lost Time Due to Injury</li> <li>3. Health &amp; Safety Management Plan</li> </ol>
People	Health & Safety	Reactive Measures to Handle Health and Safety Incidents	<ol style="list-style-type: none"> <li>1. Handling Plan for Safety Incidents/Deaths</li> <li>2. Remuneration for accidents/deaths</li> </ol>
People	Labour Practices & Decent Work	Provide Employment Opportunities	<ol style="list-style-type: none"> <li>1. Number of Jobs Created</li> <li>2. Employee Turnover Rate - Job Stability</li> <li>3. Full time vs. Part Time Employment</li> <li>4. Employed Minorities</li> <li>5. Employed Disabled People</li> </ol>
People	Labour Practices & Decent Work	Non-Discrimination & Diversity Policies	<ol style="list-style-type: none"> <li>1. Management - Employee Relations</li> <li>2. Equal Pay</li> <li>3. Non-Discriminatory Hiring/Promoting Practices</li> <li>4. Male to Female Ratio in Management</li> <li>5. Male to Female Employee Salary Ratio</li> <li>6. Appropriate Employment Conditions</li> <li>7. Social Benefits and Security</li> </ol>
People	Capacity Development	Training & Education	<ol style="list-style-type: none"> <li>1. Percentage of Budget Allocated to Employee Training</li> <li>2. Total Hours of Employee Training</li> <li>3. Career Development Opportunities for Employees</li> </ol>

People	Capacity Development	Research & Development	<ol style="list-style-type: none"> <li>1. Percentage of Budget Allocated to R&amp;D</li> <li>2. Number of Patent Applications</li> </ol>
People	Stakeholders & Society	Stakeholder Participation & Influence	<ol style="list-style-type: none"> <li>1. Stakeholder Identification</li> <li>2. Managing Stakeholder Information</li> <li>3. Proactive Stakeholder Involvement and Engagement</li> <li>4. Coordination &amp; Collaboration Amongst the Supply Chain</li> </ol>
People	Stakeholders & Society	Ensuring Society & Local Community Support	<ol style="list-style-type: none"> <li>1. Philanthropy, Donations &amp; Community Investments</li> <li>2. Nuisance to the Community (Odour, Traffic, Noise, Dust Particles etc.)</li> <li>3. Community Support &amp; Public Commitment</li> <li>4. Number of Complaints from the Local Community</li> </ol>
People	Human Rights		<ol style="list-style-type: none"> <li>1. Monitor Against Child Labour and Forced Labour</li> <li>2. Freedom of Association and Collective Bargaining</li> <li>3. Respect for Indigenous People Rights</li> <li>4. Disciplinary and Security Practices</li> </ol>
People	Professional Ethics	Transparent Corporate Practices	<ol style="list-style-type: none"> <li>1. Investment and Procurement Practices</li> <li>2. Transparent Integrated Sustainability Reports</li> </ol>
People	Professional Ethics	Anti-Corruption, Anti-Bribery and Anti-Competition Behaviour	<ol style="list-style-type: none"> <li>1. Respect for Intellectual Property Rights</li> <li>2. Safe Whistleblowing Practices</li> <li>3. Prohibiting Collusive Tendering, Bid-Fixing and Price-Fixing</li> <li>4. Anti-Bribery, Anti-Corruption Policies (e.g., training) in place</li> </ol>
Profit	Financial Performance		<ol style="list-style-type: none"> <li>1. Direct Economic Benefits of a Project</li> <li>2. Life Cycle Cost</li> <li>3. Indirect Economic Impact</li> <li>4. Operating Expenses</li> </ol>
Profit	Local Development & Procurement Practices		<ol style="list-style-type: none"> <li>1. Percentage of Local Employees</li> <li>2. Incorporate local employment targets in supplier contracts</li> <li>3. Use locally sourced materials</li> </ol>
Profit	Business Longevity & Continuity		<ol style="list-style-type: none"> <li>1. Innovation and Technology</li> <li>2. Market Presence</li> <li>3. Organisational Learning</li> </ol>

## **Conclusion**

Section 3.1 provided an introduction in the theme of sustainability and valuable information regarding the definition of sustainability and several sustainability goals set at an international level were identified. In Section 3.2 the role that projects play in realising these sustainability goals and the shift from the “old-school” project management school towards a sustainable project management school of thought was distinguished. In Section 3.3, the role procurement plays in the integration of sustainable objectives via associated measures and requirements. By awarding projects based on qualitative, technical, and sustainable criteria, contracting authorities can stimulate and promote sustainability through projects. Section 4.1, provided a valuable insight in TenneT’s supply chain management department which revealed the challenges of integrating sustainable measures in projects. TSOs and their supply chains seem ready to innovate and become more sustainable, but TenneT’s experts believe that this needs to a step-by-step approach, where prioritisation is needed. Finally, Section 3.4 dived into more detail in the ways that sustainability is further divided into sub-aspects, goals and possible assessment indicators which be used in projects, to promote sustainability. Special attention was paid to two methodologies, namely a decision-support framework, which followed a MCDA method to assign importance weights to sustainable decision criteria and a maturity model, used to assess the performance of sustainability goals in projects.

Concluding the literature review, Table 3 was created as an overview of the sustainability aspects of the Triple Bottom Line and the sub-aspects, objectives and possible indicators for their assessment collected from the literature review. The complete table, including the list of authors associated with each sustainable goal and indicator is presented in Appendix F: Full List of Sustainability Objectives, Indicators and Associated Authors. The table can act as a conversation starter for the role of TSO and TenneT and the identification of goals that are relevant to the company.



## 4. The Current Sustainability Context of TenneT

This Section of the MSc Thesis offers an insight in the corporate context of the Dutch Transmission System Operator, TenneT. The aim is to understand the challenges and limitations of integrating sustainable objectives in the company's projects by studying TenneT's own objectives and their associated measures and actions. In Section 4.1, input is gathered through informal interviews with professionals from the Supply Chain Management (SCM) department. Several challenges and limitations in the practical complexity of sustainable procurement are identified and discussed. Next, in Section 4.2, TenneT's mandated goals and own internal goals are analysed through a desktop study, with the aim to identify why TenneT needs and wants to become more sustainable. Finally, Section 4.3, offers a third-party opinion on TenneT's existing sustainable goals and measures.

### 4.1 Informal Interviews: Why sustainability measures need to be prioritised

The informal interviews with people from the SCM department helped provide an insight in the practical implementation of sustainable objectives and initiatives in TSO projects. Interviewees shared their thoughts on the relationship between TenneT and its supply base, the specific characteristics of a TSO and the things that make the integration of sustainable objectives in projects difficult to a certain degree. The interviews were semi-structured, with the same basic core of questions, however, they were also of open nature which allowed the interviewees to express their thoughts and concerns based on their personal experience and perception of the matter at hand. Five interviewees shared their experience on working in TenneT's projects, in proximity with contractors and suppliers. Their thoughts and concerns are presented in Table 4.

The overall sentiment expressed in these informal interviews is that the company is really motivated to become more sustainable and promote sustainability in the supply chain. According to the interviewees, TenneT has been taking steps in the right direction and has already implemented measures in projects and used requirements in tender processes. TenneT's role as a TSO is important and as such the company can influence its supply chain of contractors and suppliers, however there are mixed feelings and thoughts, about how this can and should be achieved. On the one hand, certain interviewees believe that most of the suppliers in the market are ready for acting more sustainably and can successfully incorporate TenneT's sustainability ambitions. Others, however, feel like abruptly increasing the number of sustainability objectives in projects can be overwhelming for contractors. This can have a chain effect and affect the number of contractors willing to bid for TenneT's projects, thus limiting competition which is an important element for TenneT as a TSO and as a contracting authority, working under EU Public Procurement frameworks. The key issues to take away from these conversations are the need for integrating sustainability objectives and initiatives, in projects and in their associated tender processes, and the need for doing that in an incrementally increasing manner, to stimulate the market to become more sustainable while at the same time ensuring high levels of competition and not overwhelming these market parties. Thus, there needs to be prioritisation regarding the integration of sustainability measures and requirements in projects.

Table 4: Collected Information on TenneT's Context from the Informal Interview

Interviewee	Sustainable Objectives & the Existing Situation at TenneT	Limitations for Integrating Sustainable Goals in Projects	TenneT's Context: TSO Supply Chain & Market Characteristics
<b>A</b>	<ul style="list-style-type: none"> <li>• No standard set of Sustainable Objectives in Projects.</li> <li>• The use of maturity-level models in the award and qualification criteria (like the Cultural Safety Ladder and the CO2 Prestatie ladder) can help TenneT and its suppliers become more sustainable.</li> </ul>	<ul style="list-style-type: none"> <li>• It is difficult to set hard sustainability related criteria in the qualification phase of tenders. It is better to place such criteria in the award phase (e.g., in the MEAT criteria).</li> </ul>	<ul style="list-style-type: none"> <li>• Currently there are different interpretations of labour conditions and employer-employee relations around the world.</li> <li>• Cooperation in the early stages of a program (e.g., the 2GW etc.) can incentivise contractors to act more sustainably.</li> </ul>
<b>B</b>	<ul style="list-style-type: none"> <li>• The creation of a toolbox for all the tenders can properly assess and motivate contractors and suppliers and can be shared with the market as well.</li> <li>• The use of continuous requirements in projects can show to the market that TenneT is reliable in what it asks from its supplier base. Launching pilot projects to test the market readiness of certain tender requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• TenneT needs to account for all its spending (Audited by the Authority of Consumers and Markets) and this makes the buyers hesitant to try out new thing with contractors and suppliers, regarding sustainability.</li> </ul>	<ul style="list-style-type: none"> <li>• In recent meetings, contractors expressed their willingness to opt for greener choices (e.g., use of electric vehicles and machinery etc.). They simply added that it will add extra costs, which will need to be accounted for. This can be achieved by securing work in TenneT's projects.</li> </ul>
<b>C</b>	<ul style="list-style-type: none"> <li>• Choosing to not set strict criteria in the award phase (in the MEAT) but opt for cooperating with the contractors in the execution phase can increase competition and solve problems for the contractors.</li> <li>• As a TSO we should require social responsibility from our suppliers. The Raw Material Passport and/or Audits could help there.</li> <li>• Avoid sustainable criteria which cannot be assessed objectively</li> </ul>	<ul style="list-style-type: none"> <li>• The supply market is limited. By adding extra sustainability requirements, contractors may feel that their bids will not be competitive enough and opt to bid for other projects, since the demand in the market is high for these kinds of projects now.</li> </ul>	<ul style="list-style-type: none"> <li>• High demand in the market can drive suppliers away if the contract requirements are too strict.</li> <li>• Cultural obstacles in agreeing as to what constitutes as sustainable in the three aspects of TBL.</li> </ul>

<p><b>D</b></p>	<ul style="list-style-type: none"> <li>• Sustainability has been incorporated in some projects, however not in every process at the company. It is still a learning environment for the company.</li> <li>• Sustainability requirements in the tender phase can play an important role.</li> <li>• The Raw Material Passport is a good foundation, a "steppingstone" for what needs to come next.</li> </ul>	<ul style="list-style-type: none"> <li>• Properly communicating on the company's objectives is crucial and a strong marketing tool.</li> <li>• Additionally, monitoring the emissions of CO2 can be used in the tender phase as an award criterion, a qualification criterion or even as a ground for exclusion. Placing it in the award criteria, however, incentivises contractors to limit their emissions and act more sustainably.</li> <li>• Issuing certifications for "green factories" from our supply chain is a good step for the future. Maybe only companies with "green factories" will be allowed to enter our tenders.</li> </ul>	<ul style="list-style-type: none"> <li>• The ambitions of the Energy Transition come directly from the Dutch Government and can sometimes be used as a political tool.</li> <li>• Public Procurement law does not allow TenneT to favour any local supplier or contractor over someone else from another country (equal opportunities).</li> <li>• Limited supplier base capable for projects in the 2GW program.</li> <li>• Staying on schedule is of the essence for the Energy Transition.</li> <li>• Little time to figure things out.</li> </ul>
<p><b>E</b></p>	<ul style="list-style-type: none"> <li>• Balance is needed between the CSR requirements and the amount of effort on the suppliers' side to compete for the tenders.</li> <li>• Since most of TenneT's suppliers do not have all functions "in-house" and tend to outsource, a good goal for the sustainability goals would be to incentivise not only the company's contractors but the sub-contractors and sub-suppliers as well.</li> </ul>	<ul style="list-style-type: none"> <li>• Abundance of TSO projects available now. Threat of contractors and suppliers opting to bid for these other projects.</li> <li>• TenneT's need to balance its sustainability goals and the level of competition and good relations with its supplier base.</li> <li>• Staying on schedule is equally important as being sustainable as it enables more renewable energy in the grid sooner than later, thus decreasing emissions etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Being in the middle of the "conversation" makes things difficult. On the one hand TenneT wants to achieve goals such as reduction of CO2 emissions and virgin copper use and influence the supply chain and on the other hand, suppliers often complain that these requirements increase their workload in tenders.</li> </ul>

4.2 Sustainable Objectives: What TenneT needs and wants to do

**Statutory and Mandated Goals**

The Dutch government, following the sustainable goals of the EU and the Paris Climate Agreement has focused its efforts in the so-called Energy Transition. A process through which the Netherlands can achieve an energy regime, free from CO<sub>2</sub> emissions, by 2050. As such, renewable energy plays a large role in the efficiency of the Energy Transition and that is why the National Climate Agreement and the Wind Energy at Sea frameworks have set a schedule for the construction of offshore wind farms and their connection to the electricity grid by TenneT. As such, TenneT's projects and operations (for the connection of electricity generated from offshore wind) are mandated from the government. As TenneT is owned solely by the Ministry of Finance, its goals, operations, and investments are mandated by the Ministry. and audited by the Authority of Consumers and Markets (ACM). This is to ensure that the projects are justified from an economic standpoint and do not cause additional costs for the electricity TenneT provides its customers. As such, the statutory requirements for TenneT are twofold; first TenneT is responsible for the transmission

services (section 16(1) of the Electricity Act) and is also responsible for the transmission system as whole (Overbeeke, 2015). This includes the construction, maintenance and expansion of the network and the assurance of adequate quality and capacity. The process that is used to assess the efficiency of the company's both routine and major investments is as follows: The Ministry of Finance assesses the need for investment in the first place and the expected monetary return of these investments. The ACM is tasked with the audit procedure of these investments and their associated projects afterwards. It assesses whether the cost of the investment was efficient in terms of construction and in terms of its tender process. The ACM, however, does not check if TenneT has opted for the cheapest solution, as it regards the choice as a given. The focus is on the way that costs occurred and where money was spent. TenneT as one of the signing parties of the National Energy Agreement, is responsible for investing in the necessary infrastructure to connect renewable energy to the grid and provide its customers with it, thus reducing the carbon emissions related to electricity. Following the Offshore Wind Energy Map, TenneT is expected to connect offshore wind farms located in the North Sea, thus increasing its capacity, and transmitting more renewable energy to its customers. Other statutory requirements for TenneT include the assurance of a reliable electricity transmissions, even in the event of a disruption in the supply of electricity. This applies to maintenance work as well. As such, the reliability of the electricity transmission is an important goal for TenneT.

In conclusion, TenneT's mandated activities and statutory goals are primarily focused on its financial health and in avoiding increased costs for the consumers and of a technical nature, focusing on the reliability of the electricity grid and its capability to transmit renewable electricity. Environmental or social goals are not explicitly mentioned, however, TenneT's contribution in the Climate Agreement, the Offshore Wind Roadmap and the Energy Transition is pivotal. Completing the connections on schedule and by not incurring added costs, that ultimately need to be paid by the Dutch taxpayers, are essential to the successful connection of more end-consumers to renewable energy and the avoidance of carbon emissions, because of that.

### **TenneT's own Goals & Requirements**

TenneT's has a multifaceted role where despite its high-level mandated goals of increasing renewable energy transmission and reducing CO<sub>2</sub> emissions, the company has been granted adequate freedom to decide how to go about the various projects that are needed to do so. Despite the projects' end-product being inherently sustainable (i.e., increasing the share of renewable energy in the Netherlands and simultaneously decreasing carbon emissions), the projects themselves need to be designed and executed following sustainable processes as well. The 2015 UN SDGs play an important role in the company's high-level sustainability strategy and are interconnected with the CSR Ambition Goals for 2025. Additionally to the funding received from the government, TenneT raises capital by following a "Green Financing" or "Green Bond" scheme, through which the necessary investment capital is collected from investors. This structure currently only involves projects with the specific purpose of transmitting renewable electricity from offshore wind power plants into onshore electricity, high-voltage, grid using either direct or alternating current technology (Oekom Research AG, 2018).

TenneT realises its power and influence as a purchasing authority and tries to use this influence to drive the energy transition and promote sustainability in its supply chain. A clear message conveying the direction the company wants to follow should be transmitted to all phases and parties of this complex supply chain which is illustrated in Figure 8, taken from the 2019 Annual Report (TenneT Holding B.V., 2019). In a recent letter aimed at the contractors and suppliers working in the electricity market, TenneT alongside with other European TSOs have expressed their goals and wishes as to how to move forward. In the letter titled "The Greener Choice", the mission of TSOs is expanded from providing sufficient capacities for the

transportation of renewable energy, ensuring the reliability of network infrastructure, and doing that at an affordable cost for their customer towards the sustainable goals of the Energy Transition. TSOs are now part of a larger conversation which needs them to be at the forefront of green investments. The letter clearly states their intention to pay closer attention to the impact the procurement of equipment and services has for environmental, biodiversity, circularity, and social issues. All suppliers, established, new and aspiring are encouraged to contribute to this shift, aiming for the long-term goal of minimising the environmental and social impact. Future selection and/or award criteria are expected to reflect this. In closing, the letter emphasises the unilateral encouragement by these European TSOs towards their contractors and suppliers to set and start working on sustainability targets. Simply put, the letter assures the shift of the market towards making the “Greener Choice” wherever possible and the need for contractors and suppliers to keep up and contribute.

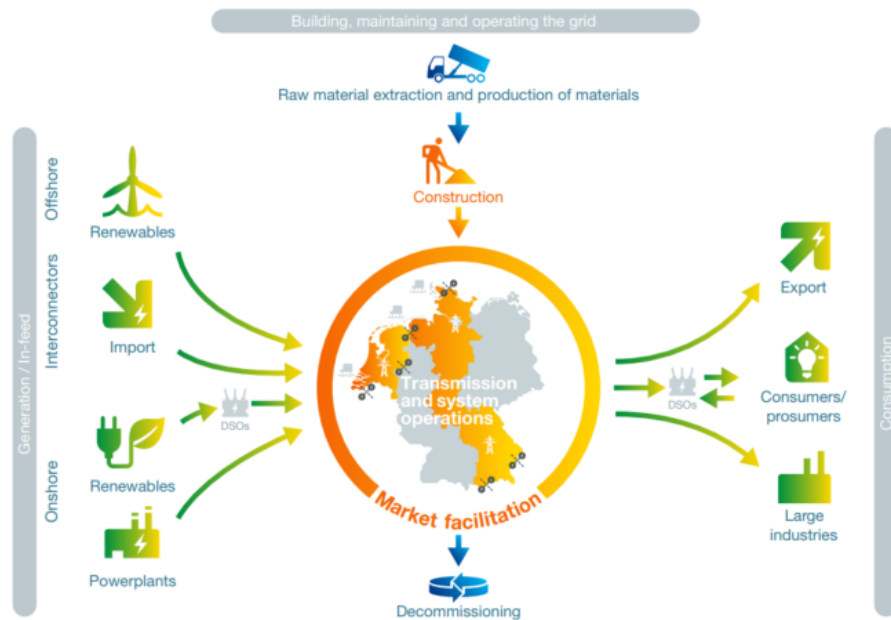


Figure 8: TenneT's role in the TSO Supply Chain

Source: TenneT TSO B.V., 2021

### Measures in Practice

The following measures were identified and collected via the desktop study and by examining the latest cable project, the Hollandse Kust west Beta cable project (HKWB) and have been used in practice by the company. These measures have been used at different points in time and different phases of the tender process, however, they all aim at improving the company's sustainability performance and stimulate sustainability in projects. The measures were collected from various documents and presentations through the desktop study at TenneT. This section discusses these measures and provides a short description for each one.

- **Environmental Cost Index (ECI)**

The Environmental Cost Index is a measure closely related to the Climate ambition area, within the Planet aspect of sustainability. It aims at monitoring the use of GHG gases and other polluting material and deriving an associated cost, by assigning monetary costs per a certain unit of measure of each element.

TenneT believes that ECI can be an impactful measure and decrease contractors' CO<sub>2</sub> emissions by 20 000 tonnes. In addition, there is no evidence of a market price increase associated to the ECI. Along with the reduced CO<sub>2</sub> and GHG emissions, the ECI has a positive impact on TenneT's reputation with various stakeholders (e.g., customers, investors, NGOs etc.). Despite its potential impact, ECI was not included in the latest tender process for the HKwB project as an award criterion, as it contradicts the Total Cost of Ownership criterion (see next page).

- **Raw Material Passport (RMP)**

The Raw Material Passport is a document that requires contractors and suppliers to specify the origin of the materials they use for TenneT's projects. This measure is related to the Circularity aspect of TenneT's CSR ambitions for Planet; however, it has not been used as a MEAT award criterion in the recent HKwB cable project. While the company has set a concrete goal about reducing the amount of virgin material used in its projects and operations, it is still in the initial stages of collecting data and reporting on the usage and origins of materials in its projects. The Raw Material Passport is considered by the company, in their Integrated Annual Report for 2020, to be a good starting point for collecting useful data and information.

- **Supplier Code of Conduct (SCC)**

The Supplier Code of Conduct relates to environmental, ethical, moral, and safe working conditions standards and is based on UN principles. By asking suppliers detailed questions and requiring their adherence to sustainable practices, as stated in this document, the company ensures that none of the suppliers are involved directly or indirectly in practices that do not meet its policies (e.g., concerning quality, environmental or human rights aspects). According to the company's integrated annual report of 2019, 32 supplier visits were conducted to inspect the performance and the standards under which suppliers operate. 9 total cases of non-conformity were identified, and these suppliers were disqualified from entering future tenders for projects, services, or products (TenneT Holding BV, 2019). An industry-wide scan is currently taking place, to collect issues pertaining to human rights. Some of these issues include child and forced labour, wage and remuneration, discrimination, freedom of association etc. These issues are mainly related to the company's supply chain, as TenneT procures goods and services from the worldwide market.

- **Safety Culture Ladder (SCL)**

Safety is not only considered a top priority for TenneT's own employees, but also regarding the employees of contractors and suppliers that are involved in TenneT's projects. As such, the Safety Culture Ladder certificate was rolled out to these contractors, with over 100 contractors having obtained the certificate thus far (TenneT Holding BV, 2020). The SCL certification ensures that contractors and suppliers who obtain it, have instruments and systems in place for securing the safety of their employees, that these systems are correctly implemented and that their employees have the knowledge that is required to use using these instruments and systems.

- **Total Cost of Ownership (TCO)**

Total Cost of Ownership is a measure used in the most recent HKwB cable project in the MEAT award criteria. Bidding contractors are asked to optimise the design of the sea and land cables required to connect the offshore platform to the land station and focus on minimising energy losses. This is quantified by assigning monetary values to a baseline of energy losses. Tender offers with cable energy losses below that baseline are expected to get a deduction in their Best and Final Offer (BAFO), which in turn helps TenneT reduce maintenance and repair costs, as well as decrease energy losses. There is however a discrepancy related to TCO. To ensure increased reliability for the cables, contractors and suppliers may end up using

greater quantities of metals, which in turn increases their GHG emissions for the project. The quality of these metals is also important, as recycled materials tend to perform worse than virgin materials.

- **Nature Inclusive Design (NID)**

The Nature Inclusive Design is a measure that focuses on “Nature”, within the Planet ambition area of Sustainability according to the company’s CSR ambitions. It includes a variety of designs in projects associated with offshore wind (e.g., platforms, sea cables and land stations) and goes from a “low-hanging fruit” approach towards complicated solutions for preserving biodiversity, minimising the impact of projects on nature, and restoring nature to its original state or even improve on that. The designs included in NID range from ecological landscaping (i.e., planting specific plant species), to artificial reefs and fish hotels integrated with the platform design. Contractors are welcomed via the MEAT award criteria mechanism to offer innovative designs and solutions and thus there is the opportunity for added value.

- **Stakeholders and Society**

Although stakeholders and society do not constitute an explicit measure in projects it is an important aspect for the company, especially at the earlier stages of a project. Beginning from spatial planning, TenneT is actively aiming to share information with projects’ stakeholders (e.g., local municipalities, NGOs etc.). This is done both online with newsletters, websites and with physical presence via workshops, site visits etc. TenneT is also cooperating with NGOs to come up with innovative sustainable ideas such as Nature Inclusive Design ideas for its platforms, cables, and land stations.

In conclusion, TenneT has designated resources, measures, and requirements in place to ensure that its projects and operations safeguard and stimulate sustainability. These measures show that TenneT is actively trying to promote sustainable practices in its supply chain and its projects. However, some measures achieve that to a larger extent than others. In the next Section, the importance of the sustainability goals is assessed using the BWM (a MCDA method) and their real-life performance is explored using a Maturity Level questionnaire. Decision-makers are asked to compare the various sustainability goals and assess their maturity level. The added goals and measures that the company has in place, additional to the ones mandated by the Dutch government are presented in Figure 9, where the company’s efforts to tackle sustainability in a broader and more holistic manner is demonstrated.



Figure 9: TenneT's Mandated Goals & Own Goals Regarding Sustainability

### 4.3 Sustainable Performance: What TenneT is doing

Additional to the subjective assessment of performance by the decision-makers in the research, the maturity of the company’s goals and measures is collected through a second-party opinion. In 2020, TenneT assigned ISS ESG with a second-party assessment of their sustainability performance. ISS conducted a report on the sustainability quality, regarding the issuing of TenneT’s Green Bonds, where the company’s Green Bonds principles, its use of proceeds and the process of project evaluation and selection were assessed. An overview is presented shortly in Figure 10. In more detail, ISS has identified TenneT’s significant contribution in the transmission of renewable energy and the development, construction, and reconstruction of the energy grid to enhance its capacity for this renewable energy. In that way TenneT creates access to renewable energy and contributes to the avoidance of CO<sub>2</sub> emissions which are connected to SDGs 7 and 13 respectively.

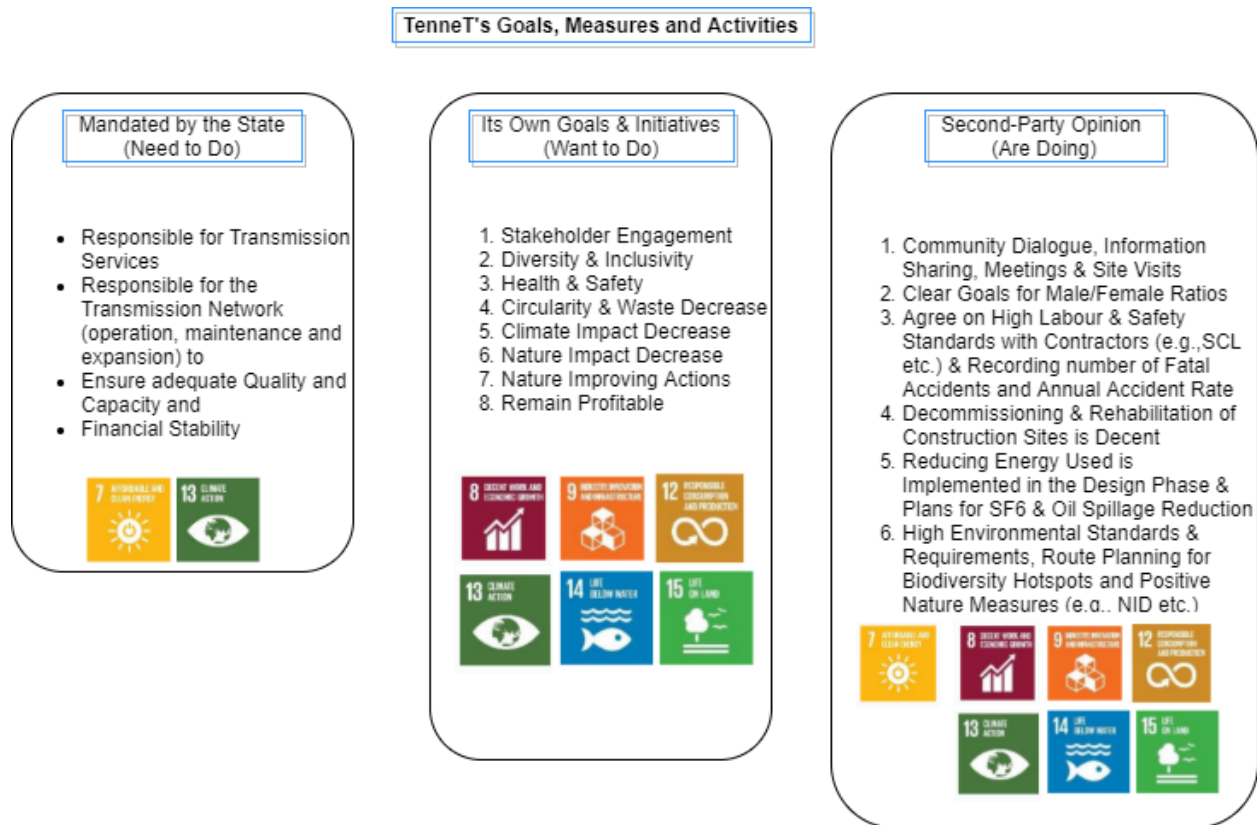


Figure 10: What TenneT needs to and wants to do and what is doing, regarding sustainability

Source: Adapted from ISS ESG (2020)

The performance assessment regards the projects financed under the Green Bond Structure, which include offshore platforms, offshore and onshore cables, onshore stations, and substations as well as onshore lines and pylons. ISS Corporate Solutions identified the Key Performance Indicators (KPIs) regarding sustainability in these types of projects:

- Comprehensive environmental and biodiversity impact assessments were conducted with respect to possible affecting marine mammals, birds, and other animals. Measures such as “route planning” for cables were conducted in the planning phase, aiming to minimise environmental impact. Low impact construction methods were also used in sensitive periods (e.g., breeding periods etc.).



Compensation payments are also in place for any affected areas in consultation with state authorities.

- Community dialogue is another aspect where TenneT performs well according to ISS, as comprehensive measures to inform affected communities are taken in the early stages and landowners whose property is crossed by cable routes are compensated.
- Labour and working condition standards are applied within the supply chain which cover child and forced labour, discrimination, wages etc. For all projects, high labour standards regarding working time, rest periods, minimum wage and the freedom of association are in place in accordance with the national legislation.
- Regarding Health and Safety, TenneT requires high standards from contractors and subcontractors as well as comprehensive health and safety systems to be implemented. TenneT's Lost Time to Injury (LTIF) is below the common industry standard but was unstable over the past years.
- Waste management standards in place for offshore platforms, including safe removal, disposal, and possible recycling of certain materials, onshore in the Netherlands (or in Germany). The rehabilitation of the landscape is ensured after the removal of construction equipment.

In conclusion, ISS Corporate Solutions highlights the extent to which TenneT goes to ensure adequate environmental and social standards in its projects and in its supply chain with contractors, sub-contractors, and suppliers. Figure 9 and Figure 10, illustrate the expansion of the company's agenda regarding sustainability, beyond its mandated goals. There is a distinct difference between the mandated goals and the company's own goals and their associated UN SDGs, actions, and measures in its projects. While the company's statutory goals focus mostly on clean and affordable energy and climate action, the scope is broadened to include social issues such as Decent Work and Economic Growth (SDG nr.8) and nature and climate issues such as Responsible Consumption and Production (SDG nr. 12) and Life Under Water and on Earth (SDGs nr. 14 & 15). Issuing the Green Bonds and focusing on an extensive set of sustainability goals, implementing measures to achieve these goals, and additionally reporting extensively on these goals, makes TenneT stand out in the Network Operator sector and rank 5<sup>th</sup> among the 43 companies rated by ISS ESG (ISS ESG, 2020).

## 5. The Proposed Decision-Support Framework and the Importance-Performance Analysis

This Section of the MSc Thesis presents relevant decision-support methodologies and tools for structuring the problem of integrating sustainable objectives in TSO projects, found in literature. Section 5.1, provides an insight in the proposed decision-support framework, by linking the framework to TenneT's limitations and challenges, regarding the integration of sustainable objectives in projects. Next, in Section 5.2, the selected Multi-Criteria Decision Analysis methodology is presented and linked to the decision-support framework. Next, in Section 5.3, the need for additionally assessing the real-life performance of sustainable goals is explained and the applicability of maturity models is discussed. Finally, in Section 5.4, the resulting Importance-Performance Analysis is discussed along with what it can offer TenneT.

### 5.1 The Decision-Support Framework: Systematic Integration of Sustainable Goals in Projects

The need to select a limited number of sustainability sub-aspects, goals and indicators to focus on and use for the assessment of sustainable performance introduces decision-making complexity and the need for methodologies to aid decision-makers reach objective decisions and consensus (Hajonides Van Der Meulen 2017). Despite the availability of a large set of sustainability decision criteria, there is no existing and complete sustainability "decisions-criteria set" or a one-size-fits-all approach. Additionally, such a set is not favourable for the specific characteristics and constraints of the procurement processes TenneT follows and the need for expert judgement and the ever-changing nature of sustainability and the goals related to it. This showcases the need for a methodology which can stimulate discussions to firstly identify the decision criteria, select the most relevant and then assess their importance to TenneT and do that in incremental and iterative fashion for all the projects of the company. To do so, the research proposes a decision-support framework, building on the work of Azapagic's and Perdan's (2005). The complete decision-support framework is presented in Appendix B: The Decision-Support Framework. Decision-makers from TenneT were selected as the company's internal stakeholders to identify the sustainable goals they consider relevant to the company and TSOs. To solve the challenges related with integrating sustainable goals in projects and offer a structured approach for decision-making (within the context of sustainable development) the authors propose a systematic approach to the problem, which can be divided into three distinct parts; Problem Structuring, Problem Analysis and Problem Resolution as is showcased in Figure 20, in Appendix B: The Decision-Support Framework. Steps 5 and 8 through 12 are outside of the scope of the research as the identification of alternatives concerning the selection of contractors and suppliers is governed by the EU Public Procurement Laws for most of TenneT's projects as explained in Section 3.3. Steps 1 through 7 (excluding 5) however, can be used in a decision-support, step-by-step process to help Aratis and TenneT prioritise the actions needed to increase sustainability by integrating the most important aspects in its projects.

### 5.2 Multi-Criteria Decision Analysis and the Importance Assessment of Sustainable Goals

Increasing the sustainable performance of TSOs by integrating sustainable measures in projects requires looking at two main characteristics of the sustainability goals. First, the importance of each sustainable goal needs to be assessed. The goals and sustainability sub-aspects that matter more for a decision-makers or are more in line with its core activities should be prioritised over objectives where the decision-makers deem less important, as the motivation of people to contribute to specific sub-aspects of sustainability in a company, is an important driver for the successful implementation of these aspects and their associated measures in projects (Maxwell & Sheate, 2006). In the decision-support framework by Azapagic and

Perdan (2005), an important step is the use of a MCDA tool to assess the preference of certain aspects of sustainability over others. This results in the assignment of weights for each aspect and sub-aspect as seen in Figure 11. This MSc Thesis, follows a MCDA method, called the Best-Worst Method (BWM). The BWM follows a structured pairwise comparison of decision criteria, leading to more reliable comparisons and more reliable results. It requires less pairwise comparisons and gives the opportunity for checking the consistency of these comparisons (Salimi, 2021). Decision-makers get a clear understanding by selecting the best and worst decision criteria, which reduces the possibility of anchoring bias, by using two opposite points of reference to conduct the pairwise comparisons. The first series of comparisons is between the decision-maker's preference of the best criterion over the rest and the second series focuses on the decision maker's preference of all the decision criteria over the worst criterion. To assess the importance of the sustainable goals, first the meaning of importance needs to be established. For the scope of this research, Importance relates the ability of a specific aspect, measure, or requirement in a project to promote sustainability in the project itself and in the supply chain of TSOs like TenneT. This means that measures and requirements which incentivise contractors and suppliers to act more sustainably, are regarded as more important. The BWM has five steps: First, the decision-makers need to determine the set of decision-criteria. Next, the Best and Worst decision criteria are selected. For the research scope, best means the decision-criterion best able to promote sustainability in the project and down the supply chain and worst means the decision criterion that has the least influence on promoting sustainability. Next, decision-makers determine the preference of the best criterion over the all the other criteria using a scale between 1 and 9. Next, decision-makers determine the preference of all the decision criteria over the worst criterion using the same scale. Finally, optimal weights are calculated by finding a solution to a min-max problem, presented in detail in Appendix D: The Best-Worst Method.

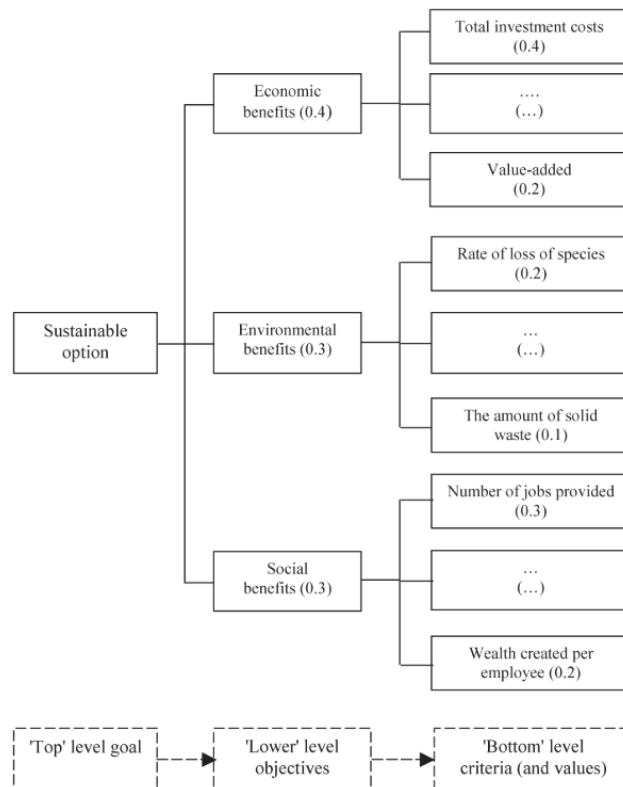


Figure 11: Representation of Importance Assessment of Decision Criteria Using a MCDA tool

Source: Azapagic & Pedran, 2005

### 5.3 Maturity Models and the Performance Assessment of Sustainable Measures

Maturity models were initially developed to address the lacking performance of software project delivered to the United States Department of Defence by improving the engineering processes from an ad hoc to a more systematic state (Chilik, et al. 2019). They have ever since evolved and are used to assess the step-by-step evolution of an organisation along an expected, desired, and logical path towards improvement and maturity. Maturity models are used to assess different dimensions and aspects of a company and in the last three decades they have been increasingly used to support companies to navigate towards sustainability and a systemic integration of sustainability in all business levels. Sustainability maturity models (SMMs) aim to support companies review all the relevant aspects of sustainability, follow a structured approach, and create an incremental roadmap towards higher levels of sustainable maturity. For this MSc Thesis and in the context of TSOs and TenneT, sustainable maturity is viewed as the degree to which specific sustainability goals have been implemented in projects and operations and the degree to which they stimulate sustainability in the supply chain. The SPM3 maturity model identifies the incremental increase of sustainable maturity as the transition from implicit identification of sustainable goals to their purposeful integration as drivers for projects' products and processes (Silvius & Schipper 2015). The notion of increased sustainable performance or maturity in the supply chain is observed by Reefke et al. (2014) who propose a maturity model to capture the degree of collaboration in the supply chain and the reduction of uncertainty.

### 5.4 Combining the Two: The Importance-Performance Analysis

Two important stages in the formulation of any strategy are the identification of the set of factors or aspects that an organisation deems important (e.g., quality, cost etc.) and the assessment of the company's performance relating to these goals and factors (Slack, 1994). Salimi (2021) argues that identifying only the important areas or goals of a company does not guarantee business success, as aspects which already perform well may not be a smart choice for investing time and resources for their improvement. Thus, companies and management can explore the relationships between importance, performance, and the need for prioritisation of improvement. Decision-makers at TenneT need to decide on what aspects of sustainability can be integrated in the company's projects to promote sustainability, however, their choice is affected by a variety of constraints and other difficulties inherent to decision-making procedures and the TSO context. It is thus suggested that the prioritisation process should also take into consideration the actual performance of sustainable measures. Thus, more insight about each sustainable goal can be revealed which can help decision-makers take more informed decisions, regarding integrating these goals in TenneT's projects. As such, TenneT can begin improving its sustainability performance in incremental steps and at the same time allow its supply chain to keep up and gradually become more sustainable.

## 6. Empirical Research

This Section of the MSc Thesis describes the use of two methods, the Best-Worst Method and the Maturity Model developed by Silvius and Schipper (2015), to assess the company's importance regarding sustainable goals and assess the performance of their existing sustainable measures. A sustainability workshop was organised, where decision-makers from TenneT were invited to discuss sustainability and the various sustainable goals related to TenneT. Next, the BWM method was explained and used to identify the relevant sustainable objectives for TenneT's decision-makers and assess their importance via pairwise comparisons. Finally, the assessment of real-life Performance of measures and requirements associated to the sustainable goals is performed by sending a Maturity Model questionnaire used to the decision-makers.

This section answers sub-question 2 *“What do decision-makers at TenneT believe are the most important sustainability objectives in terms of promoting sustainability in their supply chain, that need to be integrated in its projects?”* and 3 *“What do decision-makers at TenneT think of the level of maturity, in terms of project integration, for the sustainability objectives and associated measures and requirements?”*

### 6.1 Workshop

The purpose of the workshop was to implement the proposed decision-support framework, based on the Best-Worst method, the SPM3 Maturity Level Model and the Importance-Performance Matrix. The workshop begun with an introductory conversation regarding sustainability, based on the long list of sustainability goals and assessment criteria identified in the literature (see Table 3). Five TenneT decision-makers in total, from the Corporate Social Responsibility (CSR), Supply Chain Management (SCM), Large Projects Organisation (LPO) and the Offshore Development departments took part in the workshop. These decision-makers were experienced professionals that had both knowledge of the issues surrounding sustainability at the company and real-life experience in the company's projects. These individuals were selected due to their experience on working with contractors and suppliers in engineering projects for a TSO and their motivation to improve the sustainable performance of TenneT and integrating sustainable goals in the company's projects. The sustainable goals, sub-aspects and indicators collected from the literature review were used to initiate conversation and allow each decision-maker to express their own view on sustainability. Instead of beginning by focusing on TenneT's existing sustainable goals serves two purposes. First, it allows decision-makers to have a more objective conversation, focused on their own preferences and values. Secondly, it allows for the decision-support framework to be applied to other TSOs, that might not have such a thorough and explicit sustainability strategy, goals, and targets. Sustainable goals that were characterised as relevant by three or more decision-makers, were then selected, and added in the BWM and the Maturity Model questionnaire. The nine sustainability goals (five for Planet and four for People) that were selected in the workshop, closely resemble the goals of TenneT, expressed in the 2025 CSR Ambition Document and Green Bond financing structure. This shows that these decision-makers are aligned with the company's goals and perceive them as relevant to the company's sustainable targets.

Following the workshop, the decision-makers were asked to assess the Importance of the collected sustainability goals using the Best-Worst Method. An Excel document was used for the pairwise comparisons where the consistency of the comparisons was tested, and the optimal weight of each goal was calculated. The results are presented and discussed in Sections 7.1 and 8.2. Following the BWM, the decision-makers assessed the real-life performance using a Maturity Model questionnaire which was sent to them. The results are presented and discussed in Sections 7.2 and 8.2.

## 7. Results

The results of the Importance and Performance analyses, following the Best-Worst Method and the Maturity Model questionnaire are presented in this section. The sustainability aspects that are considered important by the decision-makers are discussed and presented first in Section 7.1, followed by how the associated measures of the company perform in real life in Section 7.2. Finally, the Importance-Performance analysis combines the two sets of results into a graphic representation with the Importance-Performance matrix where “Circularity and Waste” is identified as the sustainable goal for prioritisation and integration in TenneT’s projects. This Section aims to answer sub-questions number 4: *What are the sustainability objectives and measures that need to be prioritised by TenneT and integrated in its projects to promote sustainability in its projects and the supply chain?*

### 7.1 Sustainability Objectives Importance

The initial discussion in the sustainability workshop produced interesting findings and each decision-maker shared their thoughts on what is relevant for TenneT. Sustainable goals that were identified as relevant by three or more decision-makers were then used for the Best-Worst Method comparisons. These comparisons produced the weights presented in Table 5. Overall, the Planet aspect was selected as the most important element of sustainability with a (global) weight of 0.5635 (out of 1). Profit was the least important or worst aspect to promote sustainability with a weight of 0.1631. Four out of five decision-makers selected Planet as the most important element, which shows their primary focus on environmental sustainability as more ideal to promote sustainability. Going down further and examining the sub-aspects of the Planet aspect, “Reducing Emissions” was selected as the most important goal, with a weight of 0.3559 while, “Materials and Natural Resources” scored the lowest at 0.1454. Finally, within the People aspect, “Health and Safety” was considered the most important, with a weight of 0.3496 while “Labour Conditions and Decent Work” scored the lowest (0.1977). The aggregation of the results of the BWM method was done according to the geometric mean and then each weight was corrected (if the summation of all the aspects that were compared did not equal 1). The final aggregated weights are presented analytically in Table 5 and, in a decision-tree manner, in Figure 12.

Table 5: Aggregated and Corrected BWM Weights per Decision-Maker

Aspect	A	B	C	D	E	Aggregated Result	Corrected Result	
Planet	0.7361	0.6042	0.1970	0.5833	0.5417	0.4880	0.5635	
People	0.1806	0.3125	0.7121	0.1111	0.1667	0.2368	0.2734	
Profit	0.0833	0.0833	0.0909	0.3056	0.2917	0.1413	0.1631	
People								
Health & Safety	0.1964	0.4583	0.2586	0.5217	0.1818	0.2943	0.3496	
Human Rights	0.5179	0.2083	0.4655	0.0725	0.0606	0.1857	0.2205	
Labour Conditions and Decent Work	0.0893	0.2500	0.1034	0.2029	0.2727	0.1665	0.1977	
Stakeholders & Society	0.1964	0.0833	0.1724	0.2029	0.4848	0.1956	0.2323	
Planet								
Energy Consumption	0.0663	0.0693	0.4303	0.2431	0.0534	0.1207	0.1437	
Reducing Emissions	0.1547	0.6009	0.2459	0.4222	0.2478	0.2990	0.3559	
Biodiversity	0.4144	0.0924	0.0615	0.1215	0.0991	0.1232	0.1466	
Materials & Natural Resources	0.1823	0.1079	0.1639	0.0512	0.1652	0.1222	0.1454	
Circularity and Waste	0.1823	0.1294	0.0984	0.1620	0.4346	0.1750	0.2083	
	<b>SUM</b>						<b>0.8402</b>	<b>1</b>

The weights for the sub-aspects of the People and Planet aspects of Table 5 and Figure 12, are called local weights. To determine the global weight of sub-criteria in the last level of the hierarchical tree, their local weight is multiplied by the weight of the category to which they belong. The global weights are presented alongside the local ones in Table 6.

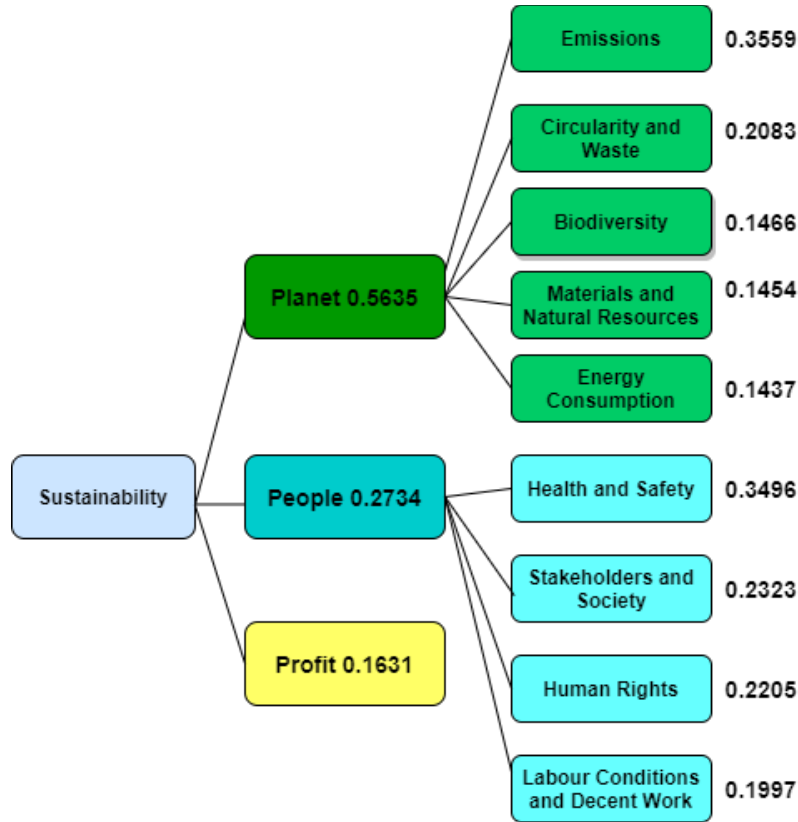


Figure 12: BWM Final Aggregated Weights Hierarchical Tree

Table 6: Relative Sustainability Aspects Weights

Aspect	Weight	Sub-Aspect	Local Weight	Global Weight
People	0.2734	Health and Safety	0.3496	0.0956
		Human Rights	0.2205	0.0603
		Labour Conditions and Decent Work	0.1977	0.0540
		Stakeholders	0.2323	0.0635
		Energy Consumption	0.1437	0.0810
Planet	0.5635	Reducing Emissions	0.3559	0.2006
		Biodiversity	0.1466	0.0826
		Materials	0.1454	0.0820
		Circularity and Waste	0.2083	0.1174
		Profit	0.1631	

## 7.2 Sustainability Objectives Performance

Decision-makers answered the Maturity Model questionnaire (available in Appendix E: The Maturity Model Questionnaire) and shared their thoughts about the current level of integration of certain sustainability goals and measures in projects and their ability to influence the market and promote sustainability.

Decision-makers from different departments view the different measures and requirements that currently exist in the company's projects differently. This relates to a measure's ability to stimulate sustainability on a different level. Certain decision-makers consider the applicable international rules and regulations regarding Human Rights and the company's Supplier Code of Conduct, as high-performing measures (e.g., Maturity Level 3). Others, argue that since these measures are only placed in the pre-selection phase of the tender process, they do little to incentivise contractors and suppliers to stimulate sustainability further.

The individual answers of the decision-makers were aggregated using the arithmetic mean and then were rounded to the closest integer, to properly associate with the four existing maturity levels and offer clarity. The Maturity Level of each of the sub-aspects of sustainability are presented in Figure 13. Three out of five sub-aspects from the Planet aspect and two out of four sub-aspects from the People aspect are shown to score low in terms of maturity in real-life projects. Specifically, "Circularity and Waste" and "Materials and Natural Resources" score the lowest with a Maturity Level of 1 and 2 respectively. The goals of reducing Energy Consumption, safeguarding Labour Conditions and Decent Work and Human Rights also score in the lower end, with a Maturity Level of 2.

This means that although several measures are in place to guarantee that these aspects of sustainability are promoted in projects, there is still room for improvement and additional integration of sustainable measures in projects.

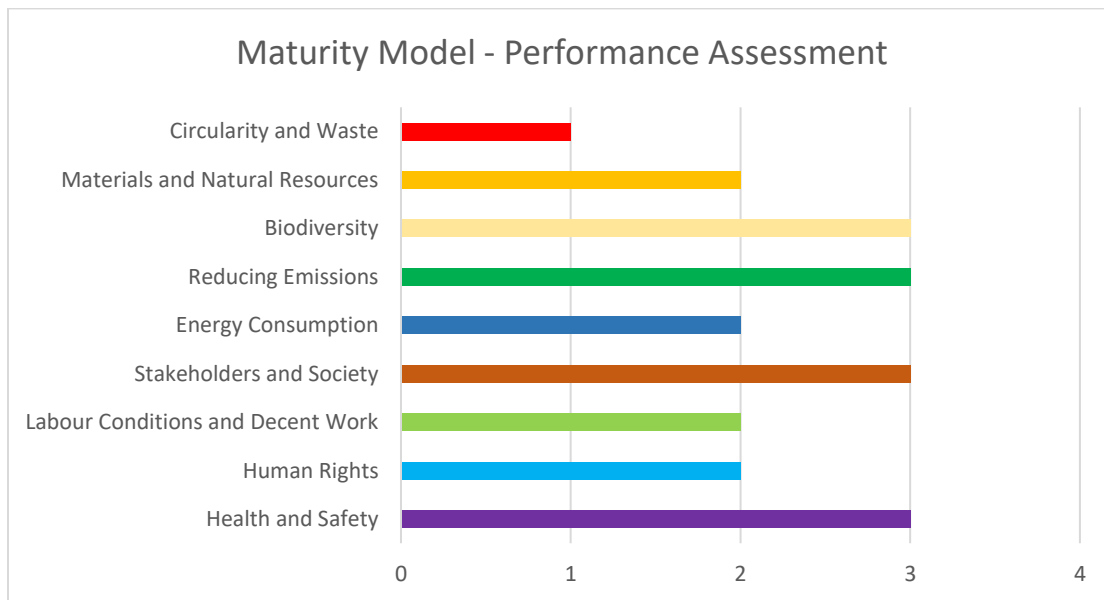


Figure 13: Maturity Scores for the Sustainability Sub-Aspects



### 7.3 The Importance Performance Matrix

By combining the data collected via the Best-Worst Method (BWM) and the Maturity Level questionnaire respectively, the Importance-Performance analysis is conducted with the primary goal of prioritising sustainable goals for project integration. By looking at Section 7.1, several sustainability goals have been identified by the decision-makers to be important. These include among others Human Rights, Health and Safety, Reducing Emissions, Circularity and Waste etc. Considering the real-life performance of the aspects' associated measures the focus is shifted elsewhere. Specifically, Human Rights, Materials and Natural Resources, as well as Circularity and Waste. These aspects, according to the decision-makers that took part in this research do not perform as well as the rest of the sustainable measures, associated with the sustainable goals. This low performance translates to the lack of sustainable measures, such as the Raw Materials Passport in the projects' tender phases. Thus, contractors and suppliers are not incentivised to act in a more sustainable way or to deliver added value, regarding these specific aspects. The two most important sustainable goals, "Health and Safety" and the "Emission Reduction" however, perform well in terms of maturity in projects and are associated with measures in both the pre-qualification phases of a tender process and in the actual award criteria (see Section 4.2: Sustainable Objectives).

Table 7: Importance - Performance Analysis

Aspect	Importance	Performance
Health and Safety	0.0956	3
Human Rights	0.0603	2
Labour Conditions and Decent Work	0.0540	2
Stakeholders	0.0635	3
Energy Consumption	0.0810	3
Reducing Emissions	0.2006	3
Biodiversity	0.0826	2
Materials and Natural Resources	0.0820	2
Circularity and Waste	0.1174	1

Table 7 offers an overview of the global weights of the sustainable sub-aspects and their real-life performance, expressed through their maturity level and by using these weights and maturity levels, the Importance-Performance matrix was plotted (Figure 14).

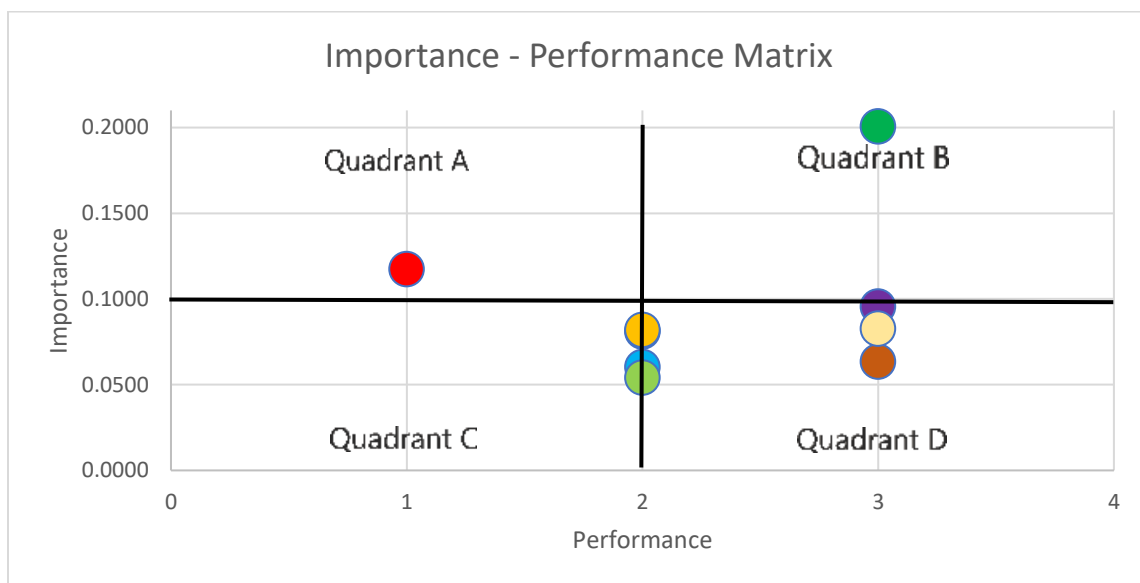


Figure 14: Importance - Performance Chart

## 7.4 Results and Discussion

The decision-makers involved in the research shared different views regarding the importance (in terms of promoting sustainability in projects) of the sustainable goals and the performance of the existing measures used in the company's projects. Following the Best-Worst Method, decision-makers were asked to pairwise compare sustainability at its high-level (i.e., between the three aspects of People, Planet and Profit) and then compare the sub-aspects for the People and Planet aspects. Next, the decision-makers assessed the real-life performance of the existing measures at TenneT via the Maturity Model questionnaire. The combination of these two methods, allows for an Importance-Performance analysis of the results, based on the importance-performance analysis from marketing literature by Martilla & James (1977). The results of this analysis are presented below:

- “Circularity and Waste” is placed in quadrant A. The competitive capabilities in this quadrant are considered very important, however the performance levels are low. This means that any improvement efforts should begin from aspects that are placed in this quadrant. Following the research and the data collected from the decision-makers, “Circularity and Waste” are to be prioritised and integrated further in TenneT's projects. This can happen by adding additional measures pertaining to this aspect or by incorporating existing measures, such as the Raw Material Passport (RMP) in the tender and procurement processes. It can be placed either as a pre-qualification, selection, or award criterion (according to the MEAT).
- “Reducing Emissions” and “Health and Safety” are placed in quadrant B. There, the capabilities of promoting sustainability are considered as very important, as well as the performance of the measures associated with these sustainable goals. In this situation, investing more time and energy in these sustainable aspects is not necessary, as they already get enough attention as is.
- The remaining sustainable goals are placed in quadrant D, where the capabilities for promoting sustainability are less important and the performance of the associated measures is high. Aspects in this quadrant are considered over-emphasized, meaning that instead of continuing focusing on these aspects, TenneT could benefit more by focusing on aspects in quadrant A. “Materials and Natural Resources”, “Biodiversity” and “Labour Conditions and Decent Work” are placed between quadrant C and quadrant D. Quadrant C, according to Martilla and James (1977) is an area where companies should avoid focusing on, as it is of low priority. However, all three of these aspects are included in TenneT's own goals, expressed in the CSR 2025 Ambition Document (see Table 1), and are not of low priority. According to the decision-makers however, and the importance-performance analysis, they should not be of further focus, as aspects in quadrant A need to be prioritised.

Different decision-makers have different perspectives on sustainability goals and their associated issues in projects. In both the importance assessment and the performance assessment of the goals and measures, decision-makers graded the same aspects with a different importance and/or performance grade. This discrepancy shows that there existing differences in the perception of sustainability between the different decision-makers and possible the different departments of the company. These differences are presented in Figure 15-Figure 17, where the distribution of the weights is visible in the “box and whiskers” plots. While certain decision-makers believe that a focus on reducing emissions and energy consumptions others feel a focus on biodiversity is more appropriate to stimulate sustainability in projects. Similarly, certain decision-makers perceive that the company is doing well regarding its efforts to safeguard labour conditions and decent work, while others disagree and believe that the maturity level of the specific aspect is low (e.g., Level 1). These discrepancies pose a double threat for the company. On the one hand, it makes it more difficult to develop a company-wide sustainability culture and additionally, it can lead to lengthy discussions about these aspects of sustainability, given the fact that different people have different views on the matter and perceive the goals and actions necessary to achieve these goals in a different way.

The plots show the distribution of data, the maximum and minimum values, along with the arithmetic mean and median values. Because of that, there is a discrepancy between the plots and the weights of the sustainable goals in Table 7, which were calculated using the geometric mean.



Figure 15: Pairwise Comparison of High-Level Sustainability Aspects with the BWM Method

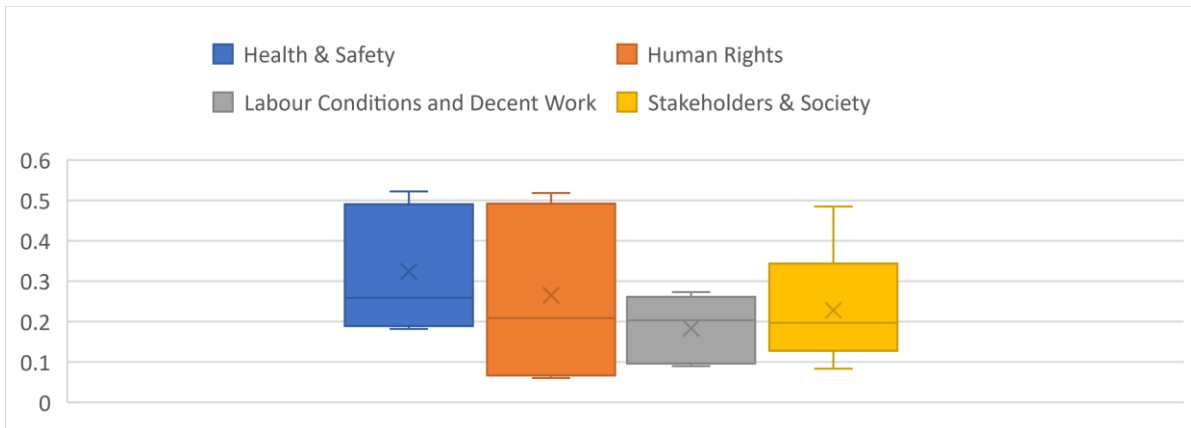


Figure 16: Pairwise Comparison of the People Sub-Aspects with the BWM Method

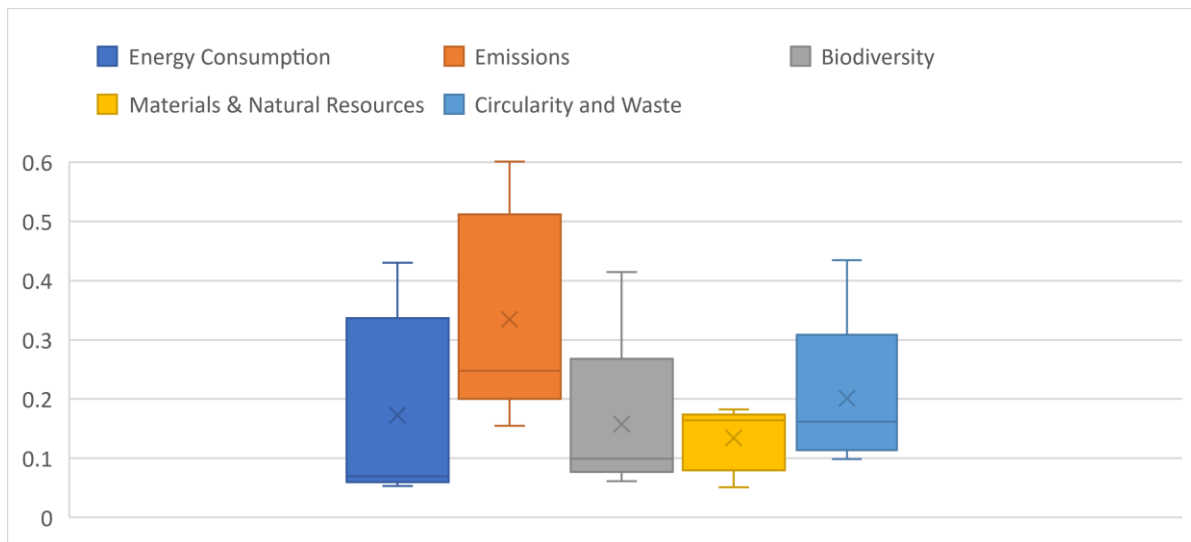


Figure 17: Pairwise Comparison of the Planet Sub-Aspects with the BWM Method

## 8. Conclusions, Limitations and Future Recommendations

This section of the MSc Thesis discusses the conclusions of the research based on the Importance-Performance analysis as well as any additional conclusions drawn from the decision-support processes, including the workshop, the Importance Assessment, and the Performance Assessment. The limitations of this research are presented first in Section 8.1, the research conclusions are presented next in Section 8.2 and lastly, recommendations for future research and practice are presented in Section 8.3.

### 8.1 Research Limitations

An important limitation of the research is the lack of representation of external stakeholders. Although TenneT is responsible for putting its projects out for tender, evaluating the offers, and awarding the final contract, a lot of external actors influence the process, as was understood during this research. The actors within TenneT's electricity transmission market, affect the effectiveness of sustainable measures in a direct way. For example, in Sections 4.1 and the Authority of Consumers and Markets (ACM) and its role in TenneT's context, was highlighted. The ACM audits TenneT's project spending and evaluates it. Decision-makers are conscious of this and prefer to be on the conservative side, meaning, spend only what is financially justifiable. This, however, hinders sustainability-related progress. Other actors also exert influence, including NGOs, local municipalities, other government bodies as well as the contractors and suppliers and their willingness for sustainable innovation. By including representatives from these entities in the research, more insight and knowledge about sustainability and the decision-making processes associated with it (at TenneT) could be exploited. An additional limitation was the limited availability of decision-makers for the workshop and the questionnaire, due to their busy schedule. It was difficult finding a common timeslot for more than five people for the workshop, as decision-makers at TenneT have a busy schedule.

### 8.2 Research Conclusions

Regarding the Best-Worst Method, decision-makers at TenneT used pairwise comparisons to express what they think is important for the company and the goal of stimulating sustainability in the projects. Although their answers varied, most decision-makers believe that Planet or Environmental Sustainability should be the prime focus of the company for promoting sustainability. Some decision-makers emphasised the social goals that the company's projects can help promote, such as Human Rights and Health and Safety. Decision-makers seem to agree that the company's existing pre-qualification measures, such as the Cultural Safety Ladder and the Supplier Code of Conduct and award criteria, such as Nature Inclusive Design and the Total Cost of Ownership allow their associated sustainable goals to perform well in projects. The performance of sustainable goals such as Health and Safety, Biodiversity, Stakeholders and Society and Emissions Reduction ranked highest, according to the decision-makers. This can be an indication that integrating measures either as pre-qualification or entry requirements or as award criteria plays a crucial role in increasing the actual performance of the associated sustainability goals.

The Importance-Performance analysis indicates that TenneT's decision-makers place Circularity and Waste in quadrant A of the Importance-Performance Matrix. This means that the specific sustainability goal is important and lacks behind in terms of integration in projects, and real-life performance. The analysis suggests that although implicit measures for the specific element exist, they do not perform well enough in real-life, to stimulate sustainability in the projects and in the supply chain. Additionally, the importance of this aspect of sustainability is highlighted in the CSR Ambition Goals for 2025 (see Table 1), with the goals of reducing the use of virgin copper and non-recyclable waste by 25%, within the ambition area of "Circularity". Although Materials and Natural Resources was defined as a separate sustainability goal from the literature review (see Table 3), it is closely related to Circularity and Waste. These two sustainable goals

are encapsulated in TenneT’s Circularity ambition area and can be jointly prioritised, becoming the focal point for project integration. This can be achieved using existing measures, such as the Raw Materials Passport. This will improve TenneT’s performance and can allow the company to meet its goals relating its “Circularity” ambition area (see Table 1). TenneT can continue in the direction of its already successful measures and focus on Circularity and Waste by assigning explicit requirements and measures in its projects associated with that specific goal. As such, contractors and suppliers can be incentivised to work towards innovative solutions which can in turn help TenneT achieve its goals pertaining Circularity. As such, the first step is to focus on “Circularity and Waste” and integrate this aspect more in the company’s projects. This can be achieved by using the existing measure of the Raw Material Passport in projects, either in the MEAT award criteria or in the qualification phase. Additionally, setting certain minimum targets to be achieved by the contractors and leaving room for sustainable innovation and added value within the Raw Material Passport can stimulate sustainability.

An additional look into the performance of sustainability measures at TenneT is offered in a second-party opinion prepared by ISS ESG. This second-party assessment ranks the performance of certain sustainability aspects and measures higher than what decision-makers do. This difference in perception is interesting and can serve as a conversation starter between upper management and decision-makers, as to how and why they have this different perception. While TSOs select their sustainability goals at a high level, the decision-support framework used in this MSc Thesis focused on decision-makers, who are involved in the company’s projects (i.e., the lower level). As such, decision-makers are placed close to contractors and suppliers and can experience first-hand the applicability and efficacy of the sustainable measures. The findings of the research can help TenneT identify the reasons behind the difference in perception and the decision-makers’ thoughts on performance. By addressing the decision-makers’ perceptions on performance TenneT can create a more cohesive sustainability culture, which is an important driver in promoting sustainability (Hajonides Van Der Meulen, 2017).

Finally, it is the recommendation of this research that this decision-support is repeated, to properly capture the dynamic nature of sustainability. Figure 14 is helpful for assessing the existing situation at TenneT, however it depicts a moment in time, while sustainability is dynamic and changes with time. By performing the analysis again, any progress made in the performance of measures can be captured and monitored. Also, due to the dynamism of sustainability and projects in general, sustainable measures that perform well at the time, might regress in the future. Thus, it is necessary to monitor the situation by repeating the decision-support framework. Finally, as sustainability is evolving, new aspects of sustainability may become relevant and/or important to the company. This iterative method is summarised schematically in Figure 18.

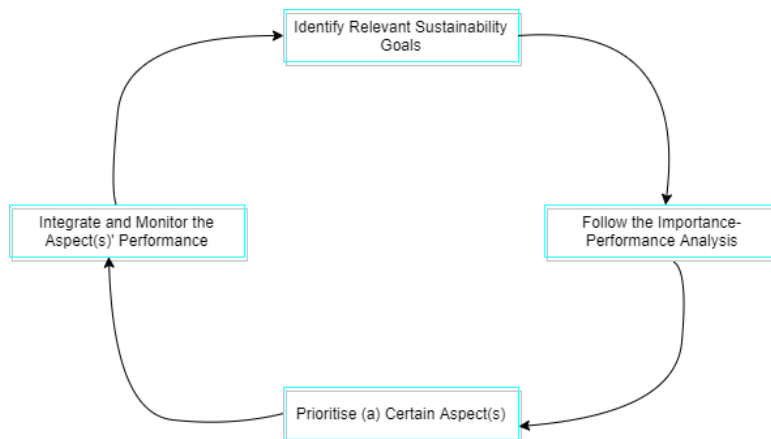


Figure 18: Research Recommendation: Iterative Importance-Performance Analysis

This report aimed at answering the main research question by first answering the four research sub-questions:

## **1 What is the current state of sustainability and sustainable projects in the literature and how is decision-making associated with it?**

There is no universally recognised definition for sustainability, however the overwhelming majority of research papers and articles in literature, view sustainability from the lens of the Triple Bottom Line (TBL), conceptualised by Elkington (1998), in his publication “Partnerships from Cannibals with Forks”. The TBL defines sustainability as the intersection of the three aspects; People, Planet and Profit, which are equally important. This approach is also used within TenneT for the clear distinction and identification of sustainable goals, ambition areas and targets pertaining these three aspects.

Sustainability principles are somewhat constant; however, the aspects used to operationalise them and transform them into decision-criteria and actions can differ. The different fields, departments and phases of projects can focus on different sustainable goals by decision-makers. Using a systematic approach, for the identification and prioritisation of sustainable goals allows the decision-making process to become clearer and more structured. However, an overflow of criteria can hinder decision-making and complicate the process further (Hajonides Van Der Meulen 2017). A TSO like TenneT, however, can only use decision-criteria which are relevant to its goals, operations, and projects. The field that deals with analysing and facilitating the selection of decision-criteria and their ranking in terms of preference or importance to companies and individuals is called Multi-Criteria Decision Analysis (MCDA). Sustainability decision criteria can be further divided down to sub-criteria which are used to fully capture the aspects that fall within a certain criterion. On the lower level of decision-making, indicators are used to assess the performance of the sustainability sub-criteria. Indicators are the variables which comprise the data collected to measure the performance of their respective sub-criteria. This structured approach is required to limit subjective judgement and personal opinions.

## **2 What do decision-makers at TenneT believe are the most important sustainability objectives in terms of promoting sustainability in their supply chain, that need to be integrated in its projects?**

The aim of this sub-question is to identify what aspects of sustainability decision-makers at TenneT find important, in promoting sustainability in projects. The preference of one sustainable objective over another, for the purpose of this research question, focuses on the ability of a specific objective to better promote sustainability in the project and in the supply chain of the TSO.

The five decision-makers that took part in the workshop went over the large list of sustainability goals and indicators from Table 3 and shared their own opinions on what they thought was relevant for the company. Sustainable goals that were considered relevant for TenneT by at least three decision-makers were selected for the BWM and Maturity Model analyses. As a result, the three aspects of sustainability (People, Planet and Profit) and nine sub-aspects were identified, closely relating to TenneT’s own goals and ambitions (see Table 1). From there, decision-makers were asked to compare these aspects at the appropriate level, and decide which ones were the Best and Worst for stimulating sustainability in the company’s projects. Planet scored the highest and was selected as the best aspect by four out of five decision-makers. Within the Planet aspect, Reducing Emissions was selected as the best, followed by Circularity and Waste. In the People aspect, Health and Safety was selected as best followed by Stakeholders and Society. All four of these sub-aspects of sustainability are important for TenneT and have clear targets associated with them, within the Green Bond scheme and in the CSR Ambition 2025 goals.

### **3 What do decision-makers at TenneT think of the level of maturity, in terms of project integration, for the sustainability objectives and associated measures and requirements?**

The aim of this sub-question is to identify what the real-life performance of the existing sustainable measures is, focusing on TenneT's projects. Maturity for the scope of this MSc Thesis is perceived as the degree to which a measure stimulates contractors and suppliers to act more sustainably in projects. Decision-makers were asked to assign a level of maturity to sustainability aspects, keeping in mind the existing measures and requirements used by TenneT in its projects. Overall, Stakeholders and Society was selected by the decision-makers as the most mature aspect of sustainability, as there are several mechanisms the company uses to inform and communicate with its stakeholders (e.g., email lists, meetings, site visits etc.). This is also confirmed by the second-party opinion by ISS Corporate Solutions, who highlight TenneT's efforts for community dialogue especially in the planning and design phases of projects. Health and Safety also performs well, according to the decision-makers (Level 3 Maturity Level) and according to ISS who highlight TenneT's performance in Health and Safety as above the industry's average.

The aspects which do not perform as well in real-life according to the decision-makers are Circularity and Waste and Materials and Natural Resources. While the company's goals for minimising the use of virgin copper by 25% and non-recyclable waste by the same amount by 2025, its measures in practice seem to be underperforming, regarding meeting these targets. ISS's assessment of the situation however states that TenneT has measures in place for the proper decommissioning, disassembly and recycling of offshore platforms and the proper onshore management of offshore waste, however, it does not mention anything about promoting these measures within the projects.

### **4 What are the sustainability objectives and measures that need to be prioritised by TenneT and integrated in its projects to promote sustainability in its projects and the supply chain?**

By combining the results of the Best-Worst method and the Maturity Model questionnaire, the Importance-Performance matrix was created and was presented in Figure 14. The purpose of this figure is to schematically represent the importance of sustainable goals and their real-life performance, in stimulating sustainability in projects. Circularity and Waste stands out in quadrant A and is characterised by high importance and low performance. It is thus the conclusion of this research that TenneT needs to prioritise this aspect, by integrating measures and requirements in projects. This can be achieved by prioritising the integration of measures like the Raw Material Passport as a hard, pre-qualification criterion for contractors and suppliers, with certain targets to be achieved and/or using it as an award criterion within the MEAT, creating thus the opportunity for innovation, competition, and the creation of added value. TenneT should also keep up the good work for the sustainable aspects within quadrant B (high importance and high performance), while for the rest of the aspects it is advised to not keep focusing on them at the moment, to properly prioritise quadrant A (i.e., Circularity and Waste).

### **How can Transmission System Operators prioritise the integration and promote sustainable objectives in their projects and their supply chain?**

This research focused on helping Transmission System Operators (TSOs) prioritise the integration of their sustainable goals in their projects. By studying the Dutch TSO, TenneT, this research identified the need for prioritisation as a necessity due to external forces acting on the company's decision-makers and its place in the energy transmission industry with its current market conditions. These include, among others, the high availability of energy transmission projects, the absence of a systematic and structured decision-making approach, and the uncertainty relating to the company's sustainable goals in the individual projects.

As such, the research examined ways through which the assessment of sustainability goals can be achieved implementing a structure and systematic process. From that, the decision-support framework used in this research was identified. Next, the need for assessing an order of importance on the plethora of sustainability goals was identified and Multi-Criteria Decision-Analysis became a focal point of the research. The Best-Worst Method was selected over other MCDA methods and was used in this research mainly due to its time-efficiency and removal of anchoring bias, using the two opposite reference points, the Best and Worst decision-criteria. Additional to the importance analysis using MCDA, there was still a need to assess how the various sustainable goals fared in practice. Analysing the real-life performance of the sustainable goals at TenneT could thus prevent focusing on already well-performing sustainability goals, making better use of time and resources, and focusing on under-performing sustainability goals. Maturity Models are a well-known method to assess real-life performance and are used within TenneT as well. Thus, a Maturity Model that focused on the integration of sustainability aspects in engineering projects (i.e., The SPM3 Maturity Model by Silvius and Schipper, 2015) was identified in the literature and incorporated in the research.

Using TenneT as a case study, the research was able to identify an important element of sustainability “Circularity and Waste” for which the company has set bold goals. This aspect however is not performing well in projects, as measures to incentivise contractors and stimulate sustainability are not mature enough. Following the Importance-Performance analysis, it became clear that TenneT needs to prioritise this aspect and integrate it further in its projects. By following this systematic approach, based on the two methods (the BWM and the Maturity Model), other TSOs can identify their own aspects of high importance and low performance and prioritise on them to promote sustainability.

### 8.3 Future Recommendations

Several future recommendations derive from the research for both practitioners and researchers. These are presented in Sections 8.3.1 and 8.3.2 respectively.

#### 8.3.1 Recommendations for future practice

- During the informal interviews, a lack of clarity regarding TenneT’s own goals and how these goals related to the company’s projects in practice, was identified. Translating these goals into more explicit targets for the projects could help the people that are directly involved with these projects. A better understanding of the goals and a more cohesive connection to the overarching targets can improve the decision-makers’ ability to communicate with contractors, suppliers, and other stakeholders.
- Additionally, while the Authority for Consumers and Markets (ACM) plays an important role and audits the company’s spending, the people interviewed at TenneT, did not have a clear picture what was justifiable in terms of spending and what was not. This resulted in a conservative approach towards spending, innovation, and what was asked by the contractors and suppliers, which were more than happy to use more sustainable ways of working but wanted to be compensated for any added costs. By clarifying the audit procedure by the ACM, decision-makers at TenneT and especially buyers in the Supply Chain Management department can follow a more progressive approach towards sustainable innovation.

#### 8.3.2 Recommendations for future research

- From the Best-Worst Method and the Maturity Model questionnaire, different ways of thinking and different perceptions of sustainability were revealed. Aspects that were considered important by some were considered less important by others. This shows that within the company, sustainable goals are perceived in a spectrum and not every decision-maker sees things the same way. By using the decision-support framework in a bigger workshop, where more people from each department



can participate, TenneT could identify how big this discrepancy is and maybe try to understand its root causes. More data about how sustainability is perceived will be gathered, which can provide an insight about these differences between departments. This can offer higher management the opportunity to start focusing on building a shared understanding and focus between departments, which can then result in the creation of a company-wide culture. Variables such as age, professional background, gender etc. can be considered when analysing the data, which can provide valuable insight as to how people at TenneT understand sustainability, what they believe are the more important aspects to focus on and how the measures in place fare in real-life.

- To combat a limitation of this research, it is recommended that external stakeholders are included in future renditions of the decision-support framework, the BWM and the Maturity Model. By inviting these different stakeholders, their different agendas, points of view, and overall thoughts on sustainability could be understood better. Each group's awareness of the several sustainable goals and measures could be explored and used as a conversation starter bridging the gaps and create a shared understanding of sustainability within the entirety of the electricity transmission industry and market.
- Many decision-makers found it difficult at first to engage with the BWM and were confused especially at the Others to Worst comparison. The confusion was less, regarding well formulated and quantifiable aspects of sustainability rather than the more qualitative ones. It is thus a suggestion that the BWM is performed in a similar setting to compare quantitative measures for sustainability, at an even lower level, in the same context. For example, comparing the different cable routes in the planning phase of a project.
- The differences in perspective between colleagues can be an interesting point of future research within the MCDA field, despite not being its primary focus. Understanding and studying the awareness of people working together can be another field where MCDA is used for.
- The role of the enabler in the BWM assessment played an important role in helping the decision-makers understand the method and especially the Others to Worst series of comparisons. By having the enabler performing one or two mock-assessments, his/her ability of helping the decision-makers can increase, thus helping decision-makers make more reliable comparisons.

## Reflection

I would now like to take the time and reflect on these past seven months and the wild journey that this research has been for me. While researching the topic of integrating sustainable goals in projects for Transmission System Operators (TSOs), I had the privilege to work with people from the Dutch TSO, TenneT, under the guidance of my company supervisor at Aratis B.V., and other esteemed colleagues. I had the pleasure of meeting motivated people at both companies and discussing about sustainability and their personal views and experience. Everyone was eager to become more sustainable as a professional and as an individual. This intrinsic motivation is extremely important for achieving any sustainable goal, whether that is integrating sustainable measures in TSO projects or simply reducing one's carbon footprint. It became apparent to me that I made the right choice, regarding the research topic and the people I chose to surround myself with. As a person who deeply cares about the environment and social issues, working with likeminded people really helped me develop my own perception about sustainability. The limitations for implementing sustainable goals in TSO projects, derive mainly from a conservative approach towards costs and the difficulty of focusing on all aspects of sustainability at the same time, due to market restriction and fear of competition hindrance. That is when it became clear that the way forward was the prioritisation of sustainable goals and requirements. Following the Best-Worst method and the Maturity Model questionnaire I was able to gain more insight in the experts' way of thinking and their perception about the company's goals, their importance and real-life performance. The main takeaways are:

- Intrinsic motivation by the individuals and their willingness to promote sustainability is paramount for achieving the sustainable goals of TenneT.
- Despite having clear sustainable goals and targets, different people perceive the importance of these goals differently and believe that stimulating sustainability in projects follows different routes.
- Additionally, different decision-makers, perceive the real-life performance of measures in a different way. Each decision-maker's department, professional background and personal beliefs can affect in their perception of real-life situations.
- To bring people together and create a shared organisational culture, centred around sustainability, awareness and shared understanding are pivotal. Bridging the gaps that personal biases, professional backgrounds, and experience create, should become a priority for any organisation that wishes to become more sustainable and lead the way in transforming their supply chain as well.

I am proud to say that the results and conclusions of the research can help TenneT identify discrepancies between their sustainable goals and their associated measures' performance in real-life. This insight can help them focus their resources and prioritise on certain aspects. This prioritisation is expected to help ease the integration of sustainable measures in projects and stimulate sustainability.

Closing, I would like to highlight the difficulties I faced over these seven months. It was difficult to connect with people. The working environment was mainly online, due to COVID-19 restrictions and many times my emails and calls remained unanswered. In the process of completing this report I faced challenges in its structure, the overall story, and the cohesion of the various sections. The feedback I got from the committee, although being for my own best interest, sometimes had a negative effect on me, as I would focus on the negative comments and lose my drive and motivation. The recent postponement of my Green Light meeting was something disheartening, however, it acted as a driving force which allowed me to make significant progress on the report and present it in a way that earned me the valuable Green Light, two and half weeks later. After all the exciting and valuable experiences, the difficult times and disappointments, the journey is coming to an end. As I am writing this final chapter of the MSc Thesis report, I am preparing for a whole new chapter of my life, a whole new and different journey for which I feel ready and prepared for, partly due to these past seven months.

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## Appendix A: The Public Procurement Process

In this section, the Dutch procurement procedures are listed and explained with an emphasis on the European Public Procurement procedure, since the research scope focuses on the procurement processes used by TSOs and specifically TenneT.

In the Netherlands, contracts with a combined value over a predetermined threshold cost must be put out for tender according to the European procedure. This is the case for contracting authorities, whereas non-contracting authorities may opt to follow the procedure voluntarily or choose to choose their contractors or suppliers via another route (Chao-Duivis, M., 2013). Contracting authorities include the State, provincial and municipal authorities, water boards and bodies governed by public law. The latter can be any body established for the specific purpose of meetings general interests and not for industrial or commercial purpose and that is financed by the most part by the state or any public body or is subject to management supervision by the state or another public body (Chao-Duivis, M., 2013). TenneT, as it owned fully by the Dutch Ministry of Finance, can be categorised as a purchasing authority, and does in fact follow the available European Public Tender Procedures when the cost of a contract exceeds the thresholds. Even if contracts are below the threshold, TenneT stills puts the contracts out for tender to ensure non-discrimination, fair competition and adequate quality and prices for their customers (TenneT, 2020).

The thresholds for the different types of contracts that need to be put out for tender according to the European Procurement procedure are presented in Table 8.

*Table 8: Public Procurement Thresholds for Contracts' Costs*

<b>Thresholds under Directive 2014/24/EU</b>	
Type of Contract	Limit Threshold
Works Contracts	€ 5 350 000
Supply Contracts	€ 139 000
Services Contracts	€ 139 000

The main difference for the Procurement procedure to be followed, lies then whether the contract amount surpasses or remains below these thresholds. In the case the contract amount is below the threshold, the procurement of works, goods or services can be delivered by a single supplier or contractor who is invited to submit a bid, which can be negotiated, and possible agreed to. Alternatively, there can be a negotiated tender procedure between the buying company and a limited number of tenderers (usually 3-5), where the contract is awarded on objective grounds using the lowest price assessment method. Finally, the contract can be put out to a national level tender, where the open or restricted procedures can be used, and assessed via Competitive Dialogue (CD), the Most Economically Advantageous Tender (MEAT) or Best Value Procurement (BVP) award criteria.

### **Tender Procedures**

When the threshold amount regarding the total contract cost is exceeded, the purchasing authority (or a private organisation) must put out the contract for a tender according to the European Procurement Law, which follows mostly either one of two common tender procedures. These are the open procedure, which is a single-phase tendering procedure where any interested tenderers may choose to bid, and their offer is assessed using the MEAT award criteria. All the tenderers are assessed in a single round, resulting to the designation of the winning contractor or supplier. The second most used procedure is the Restricted, two-phase, procedure. Here, interested parties can apply as candidates, given they demonstrate that no grounds

for exclusion apply to them, and they meet the selection criteria. From these candidates, the contracting authority must select at least five, based on pre-announced criteria, which are then invited to join the tender. Then, the selection of the winning bid is again done using the MEAT award criteria, similarly to the open procedure. Beyond these two, there are other tender procedures that a purchasing authority can use to select the most appropriate contractor or supplier. All the available tender procedures are presented in Table 9 which is adjusted from European Commission (2015) and Chao-Duivis (2013).

*Table 9: Different Types of Tender Procedures*

	<b>Tender Procedures</b>	<b>Description</b>
<b>Below the Threshold</b>	Single Negotiated	A single party is asked to submit a bid, which after negotiation can be awarded the contract.
	Negotiated	3-5 parties are asked to submit a bid and the winner is selected on objective grounds.
	National	Parties can submit bids on the national level and either of the restricted and open procedures can be used.
<b>Above the Threshold</b>	Open Procedure	Any interested party is permitted to tender, there is no limit in the number of tenderers and the award of the contract occurs in one round for the selection of the winning bid. This procedure can always be used.
	Restricted Procedure	A two-phase procedure where a limited number (min.3) is pre-selected and allowed to tender and to be awarded the contract based on criteria published in advance.
	Competitive Dialogue	A selection procedure between minimum three candidates with which the contracting authority enters into dialogue with. The contracting authority may hold these discussions in rounds, consecutively reducing the number of candidates at each round. At the end of the negotiation round, sufficient competition must be ensured. This process is mostly used for complex public contracts.
	Negotiated Procedure with Prior Publication of Contract Notice	A procedure where the contracting authority selects from a broad group of interested parties. After the selection, a negotiation procedure begins with at least three candidates. This procedure is only used in special cases according to Article 30(1) of the Public Contracts Procurement Rules Decree.
	Negotiated Procedure without Prior Publication of Contract Notice	Like the Negotiated Procedure with Prior Publication, however it differs in its use. It is used in cases where there are no (suitable) tenderers or for technical or artistic reasons where exclusive rights need to be protected.
	Concession Procedure	A works type of contract allowing a contractor to carry out the works or in that right together with remuneration.

<p>Framework Agreement</p>	<p>An agreement between one or more contracting authorities and one or more contractors, for establishing the governing terms of contracts which are to be awarded during a specific period. This can be done with either a single contractor or a number (minimum 3) of contractors. Contracts awarded under the framework agreement do not need to follow the full tendering procedure.</p>
<p>Design Contest</p>	<p>This procedure enables a contracting authority to acquire a plan or design, after calling for competition and selection by an independent jury which may or may not select a winner. Next, the winner of the competition can be awarded the contract following the Negotiated Procedure without prior Publication of Contract Notice. If the competition results in more than 1 winners, all winning parties take part in the negotiations.</p>



The Procurement process stages for the open, restricted, and competitive dialogue process are presented in Figure 19. The first step in the process is the announcement of the contract and the publication of any associated documents. In the Netherlands this is done through advertising, for example in COBOUW or TenderNed and for European Publicly tendered projects this is done in the dedicated EU website, Tenders Electronic Daily (TED). Then, the contractors who have subscribed to the announcement will be analysed based on selection criteria and if they do not meet any grounds for exclusion will be invited to tender. If the process to be followed is the Restricted process, then the invitation for pre-qualification and an analysis of the prequalified parties precedes this step. In the case of the Competitive Dialogue process, dialogue rounds are held after the invitation to tender. Next, the tenderers submit their bids which are assessed based on the published in advance, assessment award criteria and the decision on the winning bid is made. After the announcement of the winner, tenderers who disagree with the decision have fifteen days to institute summary proceedings and after the fifteen days the contracting authority can enter into a contract with the winning contractor (Chao-Duivis, M., 2013, Limpers, W., 2020.).

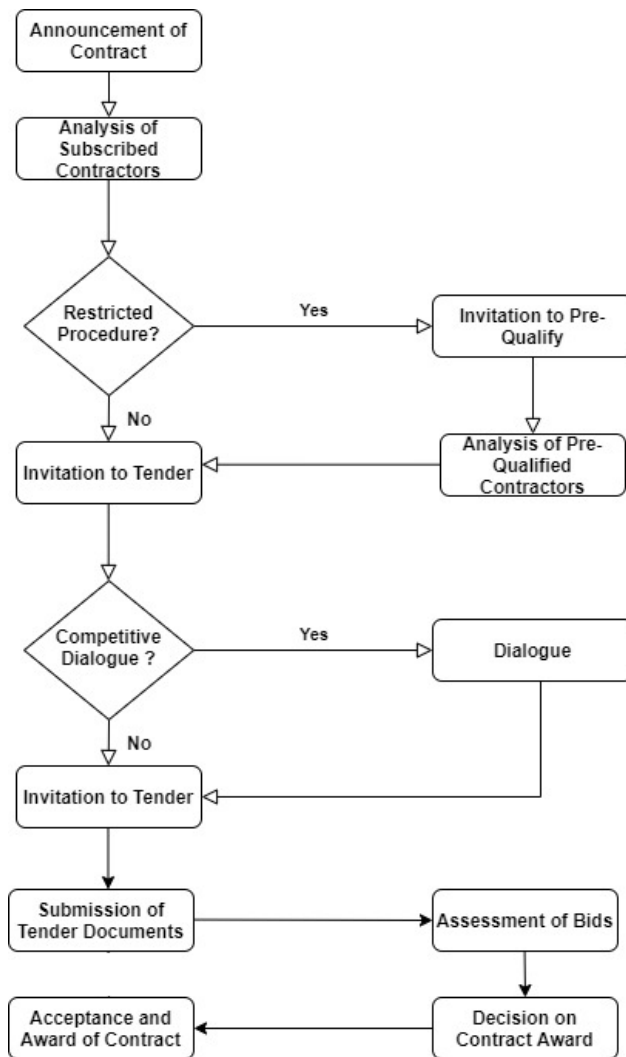


Figure 19: The Procurement Process, Open, Restricted and Competitive Dialogue Procedures

## Criteria

The tender procedure must result in choosing, the most appropriate tenderer based on criteria that were published, in a clear formulation in advance and remained unchanged. These criteria must also be proportionate to the size of the project at hand and must be substantively related to the contract in an objective matter. The most important criteria in the process are the grounds for exclusion, minimum requirements, suitability technical and financial requirements, selection criteria and ultimately the award criteria.

### 1. Grounds for Exclusion:

These criteria relate to the bidders and their potential exclusion from the tender and are divided in mandatory criteria (e.g., conviction for money laundering, participation in a criminal organisation etc.) and optional criteria (e.g., bankruptcy) for exclusion.

### 2. Minimum Requirements:

Requirements of qualitative nature that a bidder must meet to be eligible to participate in the tender for the contract.

### 3. Suitability Requirements:

These requirements pertain to the contractor's financial and technical ability to undertake the contract. The purchasing authority may need information on the contractors' economic and financial situation and their technical abilities.

## Assessment Methods for Procurement

According to the 2012 Procurement Act, contracting authorities need to award their contracts based on the best price-quality ratio and not on the lowest price criterion. This is to be done only if it is justified in the tender documents and in cases of high availability in the market and major differences in quality are not to be expected and the content and scope of the assignment can be clearly recorded (PianOo, 2020). According to the Most Economically Advantageous Tender (MEAT), the purchasing authority assesses the tenders based not only on price, but also on specified qualitative award criteria which incentivise market parties to come up with solutions that add value to the tenders (PIANOo, Limpers 2020).

The two main ways of assessing the award criteria are the weighted factor method and the method of value awarding. Value awarding discounts the price offered by the contractor in its bid, according to the score or grade each qualitative criterion gets, resulting in a fictional price. The contractor with the lowest fictional price is then awarded the contract. Otherwise, following the weighted factor method, each qualitative criterion is given a weighted factor, according to its importance to the purchasing authority and the contractor's bid is then evaluated. The contractor with the higher total score, regarding the criteria, is then awarded the contract. (PIANOo, Limpers 2020).

The minimum requirements of the tender need to be determined and expressed to the interested parties in a clear way and additionally, the qualitative award criteria can relate to matters such as Performance, Project Management, Delivery Time, Schedule or Delivery Date, Competencies, Environmental Characteristics and Sustainability, Running or Lifetime Costs, Nuisance Environment, Technical Merit etc. EU Procurement Law does not limit the number of qualitative criteria to be used, however, it limits them in the sense that they need to be related to the assignment at hand and that they need to be objective, transparent and proportional (Chao-Duivis, M., 2013). EU Procurement law does not prescribe the weight of the award or sub-award criteria and purchasing authorities are free to determine these weights.

## Appendix B: The Decision-Support Framework

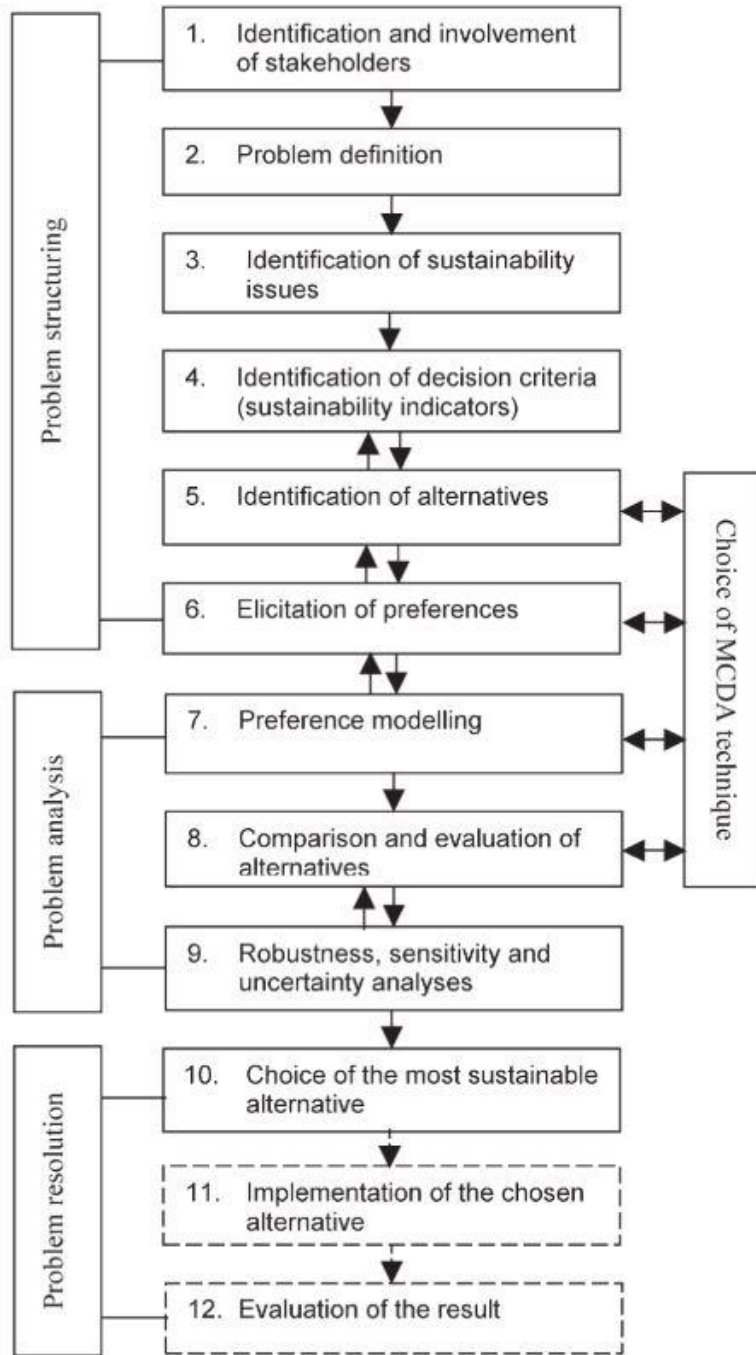


Figure 20: Decision-Support Framework within the Context of Sustainable Development

Source: Azapagic & Pedran 2005

## Appendix C: Structure of the Informal Interviews

The Semi-Structured Interview Questions aimed at creating an open dialogue with people from the Supply Chain Management / Procurement department at TenneT. From that conversation valuable insight about the various aspects which hinder sustainability and the company's ability to do more were revealed. Although the basic structure of the interviews was the same, and some questions were asked to all interviewees, different people offered different answers which lead to unique conversations and takaways.

A short list of questions is presented in this Section:

- What do you think are some barriers to sustainability in TenneT's projects and operations?
- What are some drivers for sustainability?
- How can we make the whole process of TenneT's operations more sustainable?
- What is the procedure for engaging and dealing with the several stakeholders of TenneT? For example, NGOs, local communities, suppliers, and contractors etc
- How would you describe the relationship TenneT has with its suppliers, when it comes to issues regarding sustainability?
- What are the goals and ambitions of the offshore department for the coming projects? What can be done better?
- What are some problems you saw in previous projects that you would like to avoid in the future?

## Appendix D: The Best-Worst Method

BWM is a pairwise comparison-based method which helps the decision-maker/expert to find the weights of the criteria. To do so, the expert (decision-maker) is asked to choose the best (most important) and worst (least important) criteria from among a list of criteria and conduct a pairwise comparison among these two reference points and the other criteria. Formulating and solving a minmax problem, we can find the weights of the criteria. In this article, we used the linear version of BWM. Here, we briefly describe the phases of the BWM:

- 1) Determine a set of decision-making criteria  $\{c_1, c_2, \dots, c_n\}$  by experts/decision-makers. These criteria may be presented at different levels.
- 2) Have experts/decision-makers to identify the best (B) and worst (W) criteria. The best criterion can be, for instance, the most desirable or the most important one, while the worst criterion can be the least desirable or the least important one. These criteria are identified based on the opinions of the decision-maker(s)/expert(s). In this MSc Thesis, the best criterion refers to the most important sustainable goals in terms of its ability to stimulate sustainability in TSO-related projects for and, consequently, the worst criterion refers to the sustainability goal least able to do so.
- 3) Determine the preference of the best over all the other criteria by a number from 1 to 9 (where 1 is “equally important” and 9 is “extremely more important”) by the expert(s)/decision-maker(s). The result of best-to-others comparisons is vector  $BO = (a_{B1}, a_{B2}, \dots, a_{Bj}, \dots, a_{Bn})$ , where  $a_{Bj}$  shows the preference of criterion B over criterion j.
- 4) Determine the preference of all the criteria over the worst criterion selected by the expert(s)/decision-maker(s). The result of others-to-worst comparisons is vector  $OW = (a_{1W}, a_{2W}, \dots, a_{jW}, \dots, a_{nW})$ , where  $a_{jW}$  refers to the preference of criterion j over criterion W.
- 5) Compute the optimal weights  $(w_1^*, w_2^*, \dots, w_n^*)$ . The optimal weights are calculated by minimizing the maximum absolute differences of  $\{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$  for all j, which is translated into the following optimization problem

$$\min_w \max_j \{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$$

*Equation 1: MinMax Optimisation Problem*

Such that:

$$\sum_{j=1}^n w_j = 1 \quad w_j \geq 0, \text{ for all } j. \quad (1)$$

Model 1 is converted into

$$\min \xi$$

such that

$$\begin{aligned}
|w_B - a_{Bj}w_j| &\leq \xi, \quad \text{for all } j \\
|w_j - a_{jW}w_W| &\leq \xi, \quad \text{for all } j \\
\sum_{j=1}^n w_j &= 1, w_j \geq 0, \quad \text{for all } j
\end{aligned}
\tag{2}$$

$w^* = (w_1^*, w_2^*, \dots, w_n^*)$  that is the optimal weight of the criteria is the result of model 2.  $\xi^*$ , the optimal value of objective function in model 2, indicates the consistency rate. This MSc Thesis deals with a MCDM problem with more than one level. So, the results of Model 2 are called local weights. To determine the global weight of sub-criteria in the last level of the hierarchical tree, their local weight is multiplied by the weight of the category to which they belong.

## Appendix E: The Maturity Model Questionnaire

### Question 1:

How is attention for the **Health and Safety** of the employees involved in the project in the manufacturing, transportation, execution, and operation phase, integrated in the project's processes and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]                      This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]                      This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]                      This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]                      Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 2:

How is attention for **Human Rights**, for example monitoring against child and/or forced labour, the freedom of association and collective bargaining, respect for indigenous peoples' rights etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]                      This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]                      This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]                      This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]                      Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 3:

How is attention for **Professional Ethics and Ethical Behaviour**, for example preventing bribery, anti-competitive and anti-corruption behaviour, transparent business practices etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 4:

How is attention to **Labour Practices and Decent Work**, for example non-discrimination, equal opportunities, diversity, fair compensation, employee training and education, integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?



### Question 5:

How is attention for **Stakeholders and Society**, for example, stakeholder information and participation, ensuring societal and local support, contributing to local society etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]                      This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]                      This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]                      This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]                      Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 6:

How is attention for **Reducing Emissions** into the air, water, and soil, for example emissions from the transportation of materials, emissions from suppliers' factories etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]                      This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]                      This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]                      This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]                      Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 7:

How is attention for **Waste Minimisation and Management**, for example, monitoring the volume of waste generated, the percentage of waste recycled, design for project disposal, having a waste disposal management plan etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 8:

How is attention to **Energy Consumption**, for example, monitoring and/or reducing the amount of energy used in the project, incorporating renewable sources of energy, minimising energy losses in the project etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 9

How is attention for **Nature and Biodiversity**, for example, proactive measures for minimising the effects on nature, reactive measures compensating for any damage done to nature etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]            This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]            This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]            This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]            Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 10:

How is attention for **Materials and Natural Resources**, for example, the identification of the origin of materials, resource reduction plans, percentage of recycled and/or reused materials used, percentage of responsibly sourced materials/resources etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ]            This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ]            This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ]            This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ]            Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 11:

How is attention to the **Financial Performance**, for example, the direct economic benefits, return on capital, life-cycle cost, operating expenses etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

### Question 12:

How is attention to **Local Development and Procurement Practices**, for example, the percentage of local employees, contractors and suppliers, the use of locally sourced materials etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

- Level 1: [ ] This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
- Level 2: [ ] This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
- Level 3: [ ] This aspect explicitly considered as one of the areas that the project contributes to.
- Level 4: [ ] Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

**Question 13:**

How is attention to **Business Longevity and Continuity**, for example, innovative solutions, market presence, organisational learning etc., integrated in the project's processes, and in the way that these processes are organised, executed and their associated resources selected for the project?

Level 1: [ ]                      This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.

Level 2: [ ]                      This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.

Level 3: [ ]                      This aspect explicitly considered as one of the areas that the project contributes to.

Level 4: [ ]                      Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project

What are some measures, requirements or actions that have been implemented, that you know of, regarding this specific sustainability aspect?

## Appendix F: Full List of Sustainability Objectives, Indicators and Associated Authors

Table 10: Full List of Sustainable Objectives and Indicators from the Literature with Associated Authors

<b>TBL Aspect</b>	<b>Sub-Aspect</b>	<b>Objective</b>	<b>Possible Indicators</b>	<b>Authors</b>
Planet	Energy	Minimise Energy Consumption	<ol style="list-style-type: none"> <li>1. Energy Consumption</li> <li>2. Energy Consumption in the Supply/Value Chain</li> <li>3. Energy Efficiency &amp; Consumption Reduction Plan</li> </ol>	<ol style="list-style-type: none"> <li>1. Montalbán-Domingo et al. (2020)</li> <li>2. Silvius &amp; Schipper (2015)</li> <li>3. Roca and Searcy (2012)</li> <li>4. Carvalho &amp; Martens (2017)</li> <li>5. García-Segura et al. (2020)</li> <li>6. Roca and Searcy (2012)</li> </ol>
Planet	Energy	Increase Renewable Energy	<ol style="list-style-type: none"> <li>1. Percentage of Renewable Energy</li> <li>2. Actualised Possibilities for Renewable Energy Production at the Project's Different Phases</li> </ol>	<ol style="list-style-type: none"> <li>1. Montalbán-Domingo et al. (2020)</li> <li>2. Silvius &amp; Schipper (2015)</li> <li>3. Carboni et al. P5 Framework (2016)</li> </ol>
Planet	Emissions	Reduce the Emissions of Polluting Gases	<ol style="list-style-type: none"> <li>1. Direct GHG Emissions</li> <li>2. Indirect GHG Emissions</li> <li>3. GHG Emissions from the Supply Chain</li> <li>4. GHG Emission Reduction Plan</li> <li>3. Compliance with the country's/region's relevant legislation</li> </ol>	<ol style="list-style-type: none"> <li>1. Silvius &amp; Schipper (2015)</li> <li>2. Carboni et al. P5 Framework (2016)</li> <li>3. Montalbán-Domingo et al. (2020)</li> <li>4. Roca and Searcy (2012)</li> <li>5. Labuschagne et al. (2005)</li> </ol>
Planet	Water	Minimise Water Consumption	<ol style="list-style-type: none"> <li>1. Use of Potable Water</li> <li>2. Collection &amp; Use of Rainwater</li> <li>3. Freshwater Use</li> </ol>	<ol style="list-style-type: none"> <li>1. Montalbán-Domingo et al. (2020)</li> <li>2. Silvius &amp; Schipper (2015)</li> <li>3. Roca and Searcy (2012)</li> </ol>

Planet	Water	Ensure Adequate Water Quality	<ol style="list-style-type: none"> <li>1. Percentage of Effluent Water that Receives Treatment</li> <li>2. Policies for the protection of local bodies of water (e.g., rivers, lakes etc.)</li> <li>3. Monitoring the amount and type of pollutants in water effluents and runoffs</li> </ol>	<ol style="list-style-type: none"> <li>1. Carvalho &amp; Martens (2017)</li> <li>2. Silvius &amp; Schipper (2015)</li> <li>3. Roca and Searcy (2012)</li> <li>4. Carboni et al. P5 Framework (2016)</li> </ol>
Planet	Waste	Minimising Waste	<ol style="list-style-type: none"> <li>1. Volume/Weight of Waste Generated</li> <li>2. Percentage of Waste Reused or Recycled</li> </ol>	<ol style="list-style-type: none"> <li>1. Roca and Searcy (2012)</li> <li>2. Montalbán-Domingo et al. (2020)</li> <li>3. García-Segura et al. (2020)</li> <li>4. Carboni et al. P5 Framework (2016)</li> <li>5. Carvalho &amp; Martens (2017)</li> <li>6. Silvius &amp; Schipper (2015)</li> </ol>
Planet	Waste	Waste Disposal Management	<ol style="list-style-type: none"> <li>1. Waste Management &amp; Disposal Plan</li> <li>2. Design for the Project's Product(s) Disposal in Mind</li> <li>3. Project Life Cycle Cost Including Disposal Costs at End-of-Life</li> </ol>	<ol style="list-style-type: none"> <li>1. Carboni et al. P5 Framework (2016)</li> <li>2. Roca and Searcy (2012)</li> <li>3. Montalbán-Domingo et al. (2020)</li> <li>4. Silvius &amp; Schipper (2015)</li> </ol>
Planet	Transport	Minimising the Adverse Effects of Transport on Nature	<ol style="list-style-type: none"> <li>1. Local Procurement of Works, Services and Materials</li> <li>2. Digital Work Possibilities and Limitation of Unecessary Travel</li> </ol>	<ol style="list-style-type: none"> <li>1. Carboni et al. P5 Framework (2016)</li> <li>2. Silvius &amp; Schipper (2015)</li> </ol>

Planet	Biodiversity	Proactively Protect Flora and Fauna	<ol style="list-style-type: none"> <li>1. Species of flora and fauna at danger</li> <li>2. Measures for the protection of flora and fauna during the project's execution and operation</li> <li>3. Percentage of budget allocated to protecting flora and fauna species</li> </ol>	<ol style="list-style-type: none"> <li>1. Silvius &amp; Schipper (2015)</li> <li>2. Montalbán-Domingo et al. (2020)</li> <li>3. García-Segura et al. (2020)</li> </ol>
Planet	Biodiversity	Reactive Measures for the Restoration of Flora and Fauna	<ol style="list-style-type: none"> <li>1. Percentage of the budget allocated to minimising the effect on nature and restoration measures</li> <li>2. Measures for the restoration of the natural environment</li> </ol>	<ol style="list-style-type: none"> <li>1. Silvius &amp; Schipper (2015)</li> <li>2. Montalbán-Domingo et al. (2020)</li> <li>3. García-Segura et al. (2020)</li> </ol>
Planet	Materials & Natural Resources	Avoid the Depletion of Natural Resources & Non-Renewable Minerals	<ol style="list-style-type: none"> <li>1. Identification and Report of the Origin of Materials</li> <li>2. Percentage of Recycled Materials Used</li> <li>3. Resource Use Reduction Plan</li> <li>4. Percentage of Responsibly Sourced Materials/Resources</li> <li>5. Monitoring of the Incorporated Energy Used in Materials</li> </ol>	<ol style="list-style-type: none"> <li>1. Labuschagne et al. (2005)</li> <li>2. Silvius &amp; Schipper (2015)</li> <li>3. Carvalho &amp; Martens (2017)</li> <li>4. García-Segura et al. (2020)</li> <li>5. Carboni et al. P5 Framework (2016)</li> </ol>
People	Health & Safety	Preventive Measures for Ensuring Health and Safety	<ol style="list-style-type: none"> <li>1. Occurrence of Safety Incidents/Deaths</li> <li>2. Lost Time Due to Injury</li> <li>3. Health &amp; Safety Management Plan</li> </ol>	<ol style="list-style-type: none"> <li>1. Labuschagne et al. (2005)</li> <li>2. Roca and Searcy (2012)</li> <li>3. Montalbán-Domingo et al. (2020)</li> </ol>



People	Health & Safety	Reactive Measures to Handle Health and Safety Incidents	1. Handling Plan for Safety Incidents/Deaths 2. Remuneration for accidents/deaths	1. Labuschagne et al. (2005) 2. Roca and Searcy (2012) 3. Montalbán-Domingo et al. (2020)
People	Labour Practices & Decent Work	Provide Employment Opportunities	1. Number of Jobs Created 2. Employee Turnover Rate - Job Stability 3. Full time vs. Part Time Employment 4. Employed Minorities 5. Employed Disabled People	1. Silvius & Schipper (2015) 2. Montalbán-Domingo et al. (2020) 3. Labuschagne et al. (2005) 4. Carboni et al. P5 Framework (2016)
People	Labour Practices & Decent Work	Non-Discrimination & Diversity Policies	1. Management - Employee Relations 2. Equal Pay 3. Non-Discriminatory Hiring/Promoting Practices 4. Male to Female Ratio in Management 5. Male to Female Employee Salary Ratio 6. Appropriate Employment Conditions 7. Social Benefits and Security	1. Silvius & Schipper (2015) 2. Montalbán-Domingo et al. (2020) 3. Labuschagne et al. (2005) 4. Carboni et al. P5 Framework (2016)
People	Capacity Development	Training & Education	1. Percentage of Budget Allocated to Employee Training 2. Total Hours of Employee Training 3. Career Development Opportunities for Employees	1. Silvius & Schipper (2015) 2. Montalbán-Domingo et al. (2020) 3. Carboni et al. P5 Framework (2016)

People	Capacity Development	Research & Development	<ol style="list-style-type: none"> <li>1. Percentage of Budget Allocated to R&amp;D</li> <li>2. Number of Patent Applications</li> </ol>	<ol style="list-style-type: none"> <li>1. Silvius &amp; Schipper (2015)</li> <li>2. Montalbán-Domingo et al. (2020)</li> </ol>
People	Stakeholders & Society	Stakeholder Participation & Influence	<ol style="list-style-type: none"> <li>1. Stakeholder Identification</li> <li>2. Managing Stakeholder Information</li> <li>3. Proactive Stakeholder Involvement and Engagement</li> <li>4. Coordination &amp; Collaboration Amongst the Supply Chain</li> </ol>	<ol style="list-style-type: none"> <li>1. García-Segura et al. (2020)</li> <li>2. Carboni et al. P5 Framework (2016)</li> <li>3. Silvius &amp; Schipper (2015)</li> </ol>
People	Stakeholders & Society	Ensuring Society & Local Community Support	<ol style="list-style-type: none"> <li>1. Philanthropy, Donations &amp; Community Investments</li> <li>2. Nuisance to the Community (Odour, Traffic, Noise, Dust Particles etc.)</li> <li>3. Community Support &amp; Public Commitment</li> <li>4. Number of Complaints from the Local Community</li> </ol>	<ol style="list-style-type: none"> <li>1. Silvius &amp; Schipper (2015)</li> <li>2. Carvalho &amp; Martens (2017)</li> <li>3. Roca and Searcy (2012)</li> <li>4. Montalbán-Domingo et al. (2020)</li> </ol>
People	Human Rights		<ol style="list-style-type: none"> <li>1. Monitor Against Child Labour and Forced Labour</li> <li>2. Freedom of Association and Collective Bargaining</li> <li>3. Respect for Indigenous People Rights</li> <li>4. Disciplinary and Security Practices</li> </ol>	<ol style="list-style-type: none"> <li>1. Carboni et al. P5 Framework (2016)</li> <li>2. Roca and Searcy (2012)</li> <li>3. Montalbán-Domingo et al. (2020)</li> <li>4. Labuschagne et al. (2005)</li> <li>5. Silvius &amp; Schipper (2015)</li> </ol>

People	Professional Ethics	Transparent Corporate Practices	1. Investment and Procurement Practices 2. Transparent Integrated Sustainability Reports	1. Carboni et al. P5 Framework (2016) 2. Silvius & Schipper (2015)
People	Professional Ethics	Anti-Corruption, Anti-Bribery and Anti-Competition Behaviour	1. Respect for Intellectual Property Rights 2. Safe Whistleblowing Practices 3. Prohibiting Collusive Tendering, Bid-Fixing and Price-Fixing 4. Anti-Bribery, Anti-Corruption Policies (e.g., training) in place	1. Silvius & Schipper (2015) 2. Carvalho & Martens (2017) 3. Carboni et al. P5 Framework (2016)
Profit	Financial Performance		1. Direct Economic Benefits of a Project 2. Life Cycle Cost 3. Indirect Economic Impact 4. Operating Expenses	1. Silvius & Schipper (2015) 2. Roca and Searcy (2012) 3. Carboni et al. P5 Framework (2016)
Profit	Local Development & Procurement Practices		1. Percentage of Local Employees 2. Incorporate local employment targets in supplier contracts 3. Use locally sourced materials	1. Montalbán-Domingo et al. (2020) 2. Roca and Searcy (2012)
Profit	Business Longevity & Continuity		1. Innovation and Technology 2. Market Presence 3. Organisational Learning	1. Silvius & Schipper (2015) 2. Labuschagne et al. (2005)