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Equity and Justice in the Green Transition: Towards Inclusive and Fair Climate Policies

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Abstract

The transition to a sustainable, low-carbon economy requires policies that not only address environmental challenges but also promote social equity. This thesis, *Equity and Justice in the Green Transition: Towards Inclusive and Fair Climate Policies*, explores the need for a climate policy approach in the European Union (EU) that prioritizes equity and social justice, with a particular focus on the European Green Deal (EGD). Recognizing the lack of a methodological tool to assess vulnerabilities arising from the negative impacts of climate mitigation policies, this research introduces a new vulnerability assessment framework tailored to the EU context. The framework employs an 11-dimensional matrix of well-being indicators, disaggregated by sex, age, and migration status, offering policymakers a practical tool for evaluating social vulnerabilities and ensuring that climate policies advance, rather than hinder, social equity.

This multidimensional approach enables policymakers to identify well-being gaps between at-risk and general populations and to design interventions that close these gaps, supporting a fair and just transition. Built by integrating elements from Eurostat's Quality of Life (QoL) framework, the OECD Well-being framework, and the UN Sustainable Development Goals (SDGs), this framework facilitates a more comprehensive assessment of policy impacts on fairness. Justice considerations are particularly relevant when climate policy impacts fundamental opportunities for well-being, rather than merely affecting non-essential preferences. Additionally, by linking identified vulnerabilities to specific well-being dimensions, the framework provides a structured foundation for targeted social policy responses.

Aligned with the *United Nations' 2024 Synergy Solutions for Climate and SDG Action* recommendations, this research underscores the importance of strengthening connections between climate action and sustainable development. The findings highlight the need for disaggregated well-being indicators to assess inequalities and guide inclusive policy. Ultimately, the proposed framework supports the EU's commitment to sustainable development and climate action, working toward a fair, inclusive, and resilient society across Europe.

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1 Introduction

In 2015, the world adopted two landmark international agreements: the Paris Agreement and the 2030 Agenda for Sustainable Development. The Paris Agreement committed its signatories to take collective action against climate change, aiming to keep global warming below 1.5°C and address the effects of climate change. The 2030 Agenda, with its 17 Sustainable Development Goals (SDGs), focuses on promoting prosperity while protecting the planet, with a particular emphasis on eradicating poverty.

Almost ten years later, the United Nation report S*ynergy Solutions for Climate and SDG Action (2024)* provides wide evidence that the objectives of the Paris Agreement and the SDGs are intrinsically linked—neither can be fully achieved without the other. More than 80% of the SDGs and their targets are linked to climate, either positively through co-benefits or negatively through trade-offs (UN, 2023b). These synergies offer significant opportunities to leverage climate change mitigation and adaptation policies in ways that advance the SDGs and promote equality, facilitating a just transition to a low-carbon economy. Conversely, poorly designed climate policies could hinder progress on multiple SDGs, particularly SDG 10 (reduced inequalities), and risk leaving behind marginalized individuals, communities, and regions. Therefore, the United Nation (2024) report stresses the importance of designing climate policies that not only address climate change but also align with broader sustainable development and equity goals.

The European Union is strongly committed to both the Sustainable Development Goals (SDGs) and the Paris Agreement, embedding the SDGs into all its policies and embarking on an ambitious and transformative climate agenda. Notably, the EU became the first continent to adopt a bold net-zero commitment by 2050 through the European Green Deal (EGD)—the most ambitious set of policies for ecological transformation globally (European Commission, 2019c). Launched in 2019, the EGD aims to transform the EU into a circular economy with no net emissions of greenhouse gases and economic growth decoupled from resource use, following the principle of ensuring that no person and no place is left behind during this transition.

However, the *2023/24 Europe Sustainable Development Report,* an independent quantitative assessment by expert teams at the Sustainable Development Solutions Network (SDSN) and SDSN Europe (Lafortune et al., 2024)*,* reveals that progress on the SDGs in Europe remains insufficient, with persistent gaps in living conditions and opportunities across different population groups. Despite the European Green Deal (EGD) and efforts to integrate the SDGs into EU policies, the EU still lacks a truly comprehensive strategy that aligns the EGD's climate-neutral ambitions with the broader social transformations necessary to achieve the SDGs in full (Lafortune et al., 2024; REAL DEAL Consortium, 2023).

As highlighted in the Real Deal Consortium's *Gap Assessment of the European Green Deal* (2023), one of the largest collaborative analyses by European civil society network, this gap is mainly due to the EGD's primary focus on economic and industrial development, often treating the social dimensions of the transition as secondary. The EGD's definition of the social dimension mainly centers on economic aspects, overlooking other critical social rights such as access to quality education, good health, and overall well-being. This narrow, economic-driven focus tends to neglect the integration of social and environmental challenges, limiting the EGD's capacity to address both environmental degradation and social inequality simultaneously (Lafortune et al., 2024; REAL DEAL Consortium, 2023)..

To overcome these limitations, it is crucial to strengthen the links between the environmental and social dimensions of the EGD. The environmental and social crises must be understood as deeply interconnected, requiring a holistic approach that recognizes their mutual influence (Lafortune et al., 2024; REAL DEAL Consortium, 2023; UN, 2024). Following UN (2024) recommendations, it is essential to assess the potential side effects of climate policies and ensure their design protects those most vulnerable to these impacts. Special attention should be given to supporting individuals and groups who are disproportionately affected by climate policies.

This approach aligns with the concept of a *Just Transition*, which acknowledges that while climate policies aim to reduce the harmful and unequal effects of climate change, they may unintentionally reinforce existing inequalities and vulnerabilities or create new ones as 'side effect'. Embedding a Just Transition strategy within both short- and long-term climate plans enables leaders to prioritize rapid decarbonization while also achieving fair and inclusive outcomes.

The importance of the *Just Transition* is increasingly recognised worldwide, with both the Paris Agreement and European policy guidelines emphasizing the need to consider the effects of climate change and mitigation strategies on vulnerable populations (European Commission, 2015; UNFCC, 2015). However, the inequality effects of climate policies—including considerations of vulnerability—remain underexplored (Markkanen & Anger-Kraavi, 2019). Research has primarily focused on vulnerability to climate change and adaptation-related challenges, leaving a significant gap in understanding the social vulnerabilities associated with climate mitigation policies.

Within the European Green Deal (EGD), the Just Transition strategy is embodied by the Just Transition Mechanism (JTM), which provides financial support and technical assistance to regions, industries and workers most impacted by the shift to a green economy (European Commission, 2020c). However, to ensure that mitigation policies under the EGD effectively address the core challenges of a Just Transition, it is crucial to focus on the social vulnerability of individuals and communities affected by these policies (REAL DEAL Consortium, 2023). This necessitates a redefinition of approaches to inequality and social justice, expanding beyond a focus solely on economic impacts to encompass a broader view of social equity.

This thesis aims to provide a methodological tool to better understand the dynamics of climate policies and to improve policy design in a way that protects those most at risk of being adversely affected. The next chapter will lay the foundation for this work by clarifying the links between social vulnerability, equality, and justice, demonstrating the importance of addressing social vulnerability in climate policy design and research.

1.1 Social vulnerability, equality and justice: a focus on well-being

Climate change poses wide-ranging and adverse impacts on humanity and well-being, bringing the issue of social vulnerability to the forefront of social scientific studies on climate change. Social vulnerability refers to the ability of communities and individuals to cope with the harms and stresses caused by climate change (Kelly and Adger, 2000). While different definitions emphasize various aspects of vulnerability, they all share three key elements: exposure, sensitivity, and adaptive capacity.

- **Exposure** refers to the extent and nature of stress that communities or individuals experience, such as heatwaves or rising sea levels.
- **Sensitivity** measures how severely those affected will suffer from exposure; for instance, the elderly or chronically ill are more sensitive to heatwaves.
- **Adaptive capacity** is the ability of individuals or communities to manage or mitigate these negative impacts, for example, by acquiring air conditioning during heatwaves. (Adger et al., 2006: 269-270).

Overall vulnerability depends on all three factors, with differentiation in sensitivity and adaptive capacity influenced by person-specific, community-level, and environmental conditions that shift over time (Otto et al., 2017). Vulnerability is a constitutive aspect of human life and cannot be completely eradicated. However, different vulnerabilities and their distribution across populations must be acknowledged (Barry, 2012), as they are significantly shaped by societal circumstances. High differentiation in vulnerability within a society reflects inequality, indicating that different groups have unequal opportunities to safeguard their well-being in a world affected by climate change (Otto et al., 2017).

Thus, vulnerability is closely linked to social equality (Barry, 2012; Schlosberg et al., 2017), making it a key concept in evaluating and shaping public policies (Adger et al., 2006). Its connection to justice requires clarification about what type of equality matters for justice and broader societal goals. Many approaches to justice emphasize equality of well-being or equal opportunities for well-being as essential measures of societal fairness (Arneson, 1989; Dworkin, 1981; Sen, 1979). From this perspective, climate mitigation and adaptation policies should aim to reduce the vulnerability of people and communities to climate change, evening out disparities in this respect to protect equal prospects for well-being. Special attention must be given to the social groups most vulnerable due to heightened sensitivity or limited adaptive capacity.

Social vulnerability to the negative impacts on well-being of climate mitigation policies deserves particular attention for several reasons. First, focusing on social vulnerability helps distinguish between inequalities that pose serious justice concerns and those that may cause disappointment but are of lesser importance. Climate policies should not be considered unjust simply because they limit certain forms of consumption. In fact, numerous studies suggest that individuals in high-consumption societies could significantly reduce their material consumption without compromising their well-being (Helne and Hirvilammi, 2015; Koide et al., 2019).

The primary objective of climate policies should be to ensure that all individuals are able to meet a minimum threshold of well-being, enabling them to lead fulfilling lives without exceeding the planet's ecological limits. This is why integrating well-being aspects into the definition of vulnerability is central to this thesis, rather than focusing solely on the typical vulnerability dimensions like exposure, sensitivity, and adaptive capacity. The inclusion of well-being ensures that climate policies account for the fundamental needs of individuals and communities, rather than just their capacity to withstand environmental changes.

By prioritizing the most pressing vulnerabilities, climate policies can be more effective in ensuring social justice. In this context, basic needs—the essentials required for individuals to participate meaningfully in social life—are universal and non-negotiable, regardless of individual preferences (Gough, 2017). Failing to meet these basic needs leads to significant harm and inequality, which is why ensuring that they are met must be at the heart of climate policy design.

Given the finite resources and ecological limits of our world, a needs-based approach to climate policy is essential. This approach shifts the focus away from individual consumption preferences, emphasizing instead social equality and justice (Gough, 2015, 2017). In doing so, climate policies can aim to reduce material consumption where possible without compromising well-being, while ensuring that no one is left behind in the transition to a sustainable and equitable future.

Furthermore, addressing social vulnerability strengthens the substantive legitimacy of climate policies. Substantive legitimacy means that policies must have an overall positive impact—or at least avoid negative impacts—on the welfare and living conditions of affected populations. Additionally, the benefits and costs of these policies must be distributed fairly (Fiack & Kamieniecki, 2017). Social vulnerability also influences the social acceptance of climate policies. Reducing the loss of well-being experienced by vulnerable populations can improve the acceptance of climate policies and promote a just transition (McCauley & Heffron, 2018).

Finally, addressing vulnerability to climate policies is crucial for achieving procedural justice. Principles of justice and equality demand participatory approaches that engage local communities in identifying their specific vulnerabilities (Loo, 2014; Measham et al., 2011; Schlosberg et al., 2017). This participatory process should extend to evaluating the impacts of climate policies as well, ensuring that affected communities have a say in shaping policies that influence their well-being and life prospects.

1.2 Research objectives

This thesis aims to contribute to a more integrated approach to Just Transition within EU climate strategies, particularly within the European Green Deal (EGD). Expanding beyond the economic focus, this research seeks to incorporate a broader perspective on social equity, reducing potential impacts on global warming while promoting an inclusive, equitable society. This goal aligns with the United Nation's (2024) *Synergy Solutions for Climate and SDG Action*, which advocates leveraging synergies between climate and development agendas to accelerate progress on both fronts.

The core objective is the development of a methodological tool, a vulnerability matrix, to better understand the social impacts of climate policies. This tool provides policymakers with a structured approach to identify and address social inequalities within climate policy impacts. Despite the recognized importance of mitigating social inequalities in climate policies (Markkanen & Anger-Kraavi, 2019), practical tools to assess these impacts remain limited. The proposed framework addresses this gap by systematically collecting multidimensional well-being indicators. The matrix aims to improve policy planning and monitoring by highlighting vulnerability “hotspots”, such as particularly affected groups or key drivers of vulnerability, allowing for a more targeted and effective policy response.

The framework is intended for both *ex-ante* evaluation (during policy planning) to prevent widening well-being disparities and *ex-post* monitoring (after policy implementation) to assess its impact on different social groups. This dual application supports a proactive and responsive approach to policy planning, ensuring that climate policies reduce inequalities and protect everyone’s prospects for well-being.

1.3 Methodology

The purpose of this thesis is to establish a methodological tool for climate policy research: a vulnerability matrix that identifies and assesses social vulnerability to climate policies. The focus is on mitigation policies, though the matrix could also be applied to adaptation policies. The framework primarily addresses horizontal inequalities (differences across social groups), excluding vertical inequalities and material deprivation measures. The methodological approach of the study involves a literature review, a comparative analysis of existing frameworks and databases, and the development of a framework informed by the findings of this analysis.

1.3.1 Literature review

The literature review began by exploring how the social dimensions of environmental transitions are addressed at the European level. This analysis highlighted a significant gap: there is limited research on vulnerability to climate mitigation policies and a notable absence of methodological tools for assessing their impact on vulnerable groups. Consequently, the review shifted focus to defining social vulnerability in the context of climate policies and examining its connections to social justice and equity. Research on Google Scholar and Scopus, guided by keywords such as "climate change mitigation policies," "social vulnerability," "inequalities," "just transition," "European Green Deal," and "European Union," provided valuable insights.

This review process informed a central assumption underlying this thesis: equitable climate mitigation policies can reduce inequalities in well-being across individuals, social groups, households, and communities, whereas inequitable policies risk exacerbating existing disparities. Although equitable cost and benefit distribution is essential in global climate policy, this thesis focuses specifically on social impacts within Europe.

Incorporating well-being dimensions into the matrix, rather than focusing solely on vulnerability as exposure, sensitivity, and adaptive capacity, is motivated by two primary assumptions:

- justice considerations: An individual's vulnerability to unintended impacts of climate policies is shaped by their exposure, sensitivity, and adaptive capacity in response to these impacts. Even when exposed to the same policy, people may experience different levels of vulnerability due to variations in sensitivity or adaptive capacity. This differentiated vulnerability is crucial for addressing social equity and justice. However, not all cases raise justice concerns. For instance, increased flight costs for affluent leisure travelers do not challenge equity, as they affect a non-essential luxury rather than core well-being. Justice considerations apply when policy impacts interfere with fundamental opportunities for well-being (see Introduction).

- pragmatic policy application: Addressing social vulnerabilities within specific well-being domains enables more targeted and effective policy responses. By directly linking vulnerabilities to well-being dimensions, policymakers can identify and address the particular social challenges most affected by climate policies, facilitating a more nuanced and impactful approach to social policy.

To operationalize well-being and vulnerability in the climate policy context, international frameworks on sustainability and well-being were reviewed at global and European levels. National frameworks within EU countries were excluded. At the global level, influential frameworks, such as the OECD Well-being Framework and the UN Sustainable Development Goals (SDGs), were selected, while Eurostat's Quality of Life (QoL) Framework was used for the European Union. This research emphasized a multidimensional approach to well-being, encompassing social, environmental, and economic dimensions.

1.3.2 Comparative analysis of frameworks and indicators

The comparative analysis aimed to identify the strengths and limitations of existing frameworks and indicators for measuring well-being and sustainability. This analysis focused on the Eurostat QoL framework, the OECD Well-being framework, and the UN SDG Indicator Framework. Each framework's domains, data sources, and indicators were compared, with special attention to how well-being is integrated with sustainability, environmental impacts on well-being are measured, and horizontal inequalities across different population groups are addressed.

1.3.3 Framework Development

The final methodological outcome is a vulnerability assessment framework with eleven dimensions of well-being, based on the Eurostat QoL framework, chosen after the comparative analysis. Each dimension's development followed a structured process:

1. Reviewing Eurostat's final report guidelines (2017) for building each dimension, supplemented by additional information from Eurostat publications and "Statistics Explained" articles.
2. Refining insights with guidelines from OECD's *How's Life?* (2020) report to include aspects not covered in the Eurostat framework.
3. Integrating relevant SDGs, assessing which targets apply to each dimension.
4. Aligning with EU policies and strategies raleted to climate mitigation and to sustainable development goals. For example, in the natural environment dimension, additional topics were incorporated to support the Zero Pollution Action Plan.

Columns in the matrix were established to support demographic disaggregation by sex, age, and migration status, based on their relevance to discrimination and inequality in the EU and data availability in the EU-SILC database, the primary source for the Eurostat QoL framework. Critical factors like ethnicity or sexual orientation are excluded, as Eurostat does not readily provide this data. The adopted definitions of the disaggregation categories are the following:

- Sex/Gender: Recorded as an individual-level characteristic in censuses, surveys, and administrative records. In Eurostat, sex is classified as male and female based on biological and physiological traits, though this could be expanded to include intersex as a third category. Gender, however, involves social, cultural, and behavioral expectations related to sex traits and may not align with the sex assigned at birth. Despite often being used interchangeably with sex, gender identity is complex and varies across individuals.
- Age: Defined by completed years of life, with broad categories aimed at highlighting age-related biases and discrimination, especially for youth and elderly populations. Eurostat classifies young people as ages 15-29 and the elderly as those over 65. In work-related dimensions, indicators for the elderly are generally excluded due to the assumption that most are retired, with the typical retirement age across Europe ranging from 60 to 67.
- Migration Status: Assessed by Eurostat using two indicators: country of birth and citizenship.
    - Country of Birth: Refers to the place of birth, generally the mother's usual residence at the time of birth or, by default, the country of birth itself. Broad categories include the reporting country, other EU countries (excluding the reporting country), and non-EU countries.
    - Country of Citizenship: Defined as the legal connection between an individual and a state, with classifications similar to country of birth: reporting country, other EU countries (excluding the reporting country), and non-EU countries.

1.3.4 Indicators selection

The indicator selection followed a systematic approach established for the framework's structure. Initially, indicators were identified within the Eurostat Quality of Life (QoL) dataset and then cross-referenced in the Eurostat research engine to find disaggregated versions. Additional indicators were sourced from the OECD Well-being database and both the global and EU SDG datasets. When relevant indicators were not available in the primary datasets, supplementary data was obtained from the EEA datahub and other OECD databases. The results chapters will examine each framework dimension in depth, providing detailed reasoning behind each chosen topic, subtopic, and indicator.

1.4 Structure of the thesis

This thesis is organized into five chapters, each progressively building toward a tool to assess vulnerabilities to climate policy impacts. Chapter 2 analyzes and compares existing well-being and sustainability frameworks—Eurostat's Quality of Life, the OECD Well-being framework, and the UN SDGs—highlighting their strengths and limitations in addressing social equity. Chapter 3 then presents the development of the new framework focused on equal opportunities for well-being, detailing its eleven dimensions, their topics, sub-topics, and selected indicators. Chapter 4 discusses findings from the framework's development, offering recommendations for additional indicators to improve the assessment of climate mitigation impacts. Finally, Chapter 5 concludes with the key findings of the thesis and offers directions for future research to enhance the assessment of equitable climate policies and their impact on well-being.

2 Analysis of existing frameworks and indicators to assess well-being and sustainability

In recent years, there has been a growing recognition of the need to assess societal progress beyond traditional economic metrics like Gross Domestic Product (GDP). This shift reflects the increasing integration of sustainability and well-being into policy frameworks worldwide. Landmark moments, such as the UN Millennium Declaration in (2000) and the Stiglitz-Sen-Fitoussi report in (2008), marked a turning point in international development policy, emphasizing the need for more inclusive and sustainable measures of progress. Since then, sustainability has become a core concept in global development, while well-being has also emerged as an essential metric for tracking social progress.

At the global level, the 2030 Agenda for Sustainable Development, adopted at the UN Summit in (2015), introduced the 17 Sustainable Development Goals (SDGs) as a comprehensive framework to foster prosperity while protecting the planet, with a strong focus on eradicating poverty and ensuring that "no one is left behind." In 2016, the European Commission adopted a strategic approach to implementing the SDGs, aligning them with EU policies and embedding sustainability across all EU actions (EC, 2016). To monitor sustainability progress, the EU developed its own SDG Indicator Set, which aligns with global indicators while offering a regional perspective Eurostat, the EU's statistical office, regularly monitors progress using a tailored SDG Indicator Set, which provides insights into both short- and long-term sustainability trends across Europe.

Similarly, the OECD has been a pioneer in advancing well-being as a measure of progress since the 1970s, recognizing that societal progress extends beyond economic wealth. The OECD's Better Life Initiative, launched in 2011, assesses quality of life across various well-being dimensions—such as health, education, and environmental quality—becoming a benchmark for understanding multidimensional well-being. Likewise, in its (2009) *GDP and Beyond* memorandum, the European Commission emphasized the need for more inclusive indicators that encompass environmental and social dimensions, leading to the development of the Eurostat Quality of Life framework.

Despite these advancements, well-being and the SDGs are often treated separately, potentially missing opportunities for synergy and hindering the "Leave No One Behind" principle. This chapter, therefore, analyzes Eurostat's Quality of Life Framework, the OECD Well-Being Framework, and the UN SDGs, highlighting their strengths and limitations. This analysis lays the foundation for a new framework proposed in this thesis, which integrates well-being and SDG metrics to create a more comprehensive tool for assessing societal progress.

2.1 Overview of Major Frameworks

2.1.1 Global SDG Indicator Framework

The Sustainable Development Goals (SDGs) emerged as a continuation of the Millennium Development Goals (MDGs), which ran from 2000 to 2015. While the MDGs primarily focused on challenges in developing countries, the SDGs represent a universal framework that applies to all nations, recognizing that sustainable development is a shared global responsibility. The SDGs are part of the broader *2030 Agenda for Sustainable Development*, adopted by 193 UN member states in (2015), which provides a roadmap for achieving a more sustainable, equitable, and resilient world. The 17 SDGs target critical global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. Each SDG is underpinned by 169 targets and 230 indicators, offering a detailed action plan for measuring and achieving progress. These goals are divided across social, economic, and environmental dimensions, but they are interconnected, meaning progress in one area, such as education or clean energy, often supports progress in others, like reducing inequality or addressing climate change.

Figure 1: The 17 Sustainable Development Goals. Source: (UN, 2022).

Key features of the SDG framework include its universality, meaning it applies to all countries, integration, emphasizing the interconnectedness of social, economic, and environmental well-being, and the focus on multi-stakeholder partnerships (SDG 17) to ensure cooperation from governments, the private sector, civil society, and individuals. Central to the agenda is the principle of "Leave No One Behind (LNOB)", which ensures that sustainable development efforts reach the most marginalized and vulnerable populations, prioritizing inclusivity in global progress (UN, 2015).

In the EU, the SDG framework is aligned with global SDG indicators but is adapted to a regional perspective through the development of the EU SDG Indicator Set. 102 indicators have been selected in consultation with member states to track sustainability comprehensively across Europe. Eurostat, the EU's statistical office, plays a central role in publishing annual monitoring reports, offering data-driven insights into short- and long-term trends in sustainability. The European Commission has integrated the SDGs into its core policy strategies, particularly the European Green Deal (Eurostat, 2024f).

2.1.2 Eurostat Quality of Life

The Eurostat Quality of Life (QoL) framework was developed in response to the European Commission's communication on "GDP and Beyond — Measuring Progress in a Changing World" (2008), and the findings of the Stiglitz/Sen/Fitoussi (SSF) Commission (2008). The SSF Commission highlighted the need for more comprehensive measures of societal well-being that extend beyond traditional economic indicators like GDP. To further this aim, an expert group was convened in 2012 to prioritize and refine these indicators. Their efforts culminated in the publication of the "Expert Group's Final Report" in (2017), which was endorsed by the European Statistical System. This report outlines the framework's structure, defines its indicators, and explains their rationale.

Building on the recommendations from the "Final Report of the Expert Group on Quality of Life Indicators," a set of both subjective and objective indicators was developed. These indicators are organized into nine statistically measurable dimensions (see Figure 2). Objective indicators, such as income and homicides, provide tangible measures of living conditions, while subjective indicators, like life satisfaction and feelings of safety, capture personal perceptions and experiences. This distinction, however, is not always clear-cut, as some indicators—such as health or skills—are objective phenomena that rely on self-reported data (Eurostat, 2021).

The data supporting the Eurostat QoL statistics are drawn from various components of the European Statistical System (ESS). Central among these is the EU Statistics on Income and Living Conditions (EU-SILC), which provides comprehensive data on a wide range of quality of life factors. Other significant sources include the EU Labour Force Survey (EU-LFS) and the European Health Interview Survey (EHIS), along with various administrative records (Eurostat, 2021). Together, these tools provide a multidimensional picture of the quality of life across Europe, emphasizing the role of both objective conditions and subjective perceptions in understanding individual well-being.

Figure 2: Eurostat Quality of Life, the 9 dimensions. Source: (Eurostat, 2021).

2.1.3 OECD Well-being Framework

The OECD collects data on various aspects of well-being through its key report, *How's Life?*, published every two to three years (OECD, 2011, 2013b, 2015, 2017, 2020b). This statistical report provides a comprehensive overview of the well-being of populations in OECD countries, with the latest edition, How's Life? (2020b), marking the fifth since the initiative's inception in 2011. As part of the OECD Better Life Initiative, the report supports the organization's mission to promote "Better Policies for Better Lives" by monitoring quality of life and assessing whether life is improving and if the benefits of progress are shared equitably.

The OECD Well-being Framework focuses on current well-being outcomes and the inequalities within them, capturing the material conditions that shape economic options, quality of life, and social interactions. The Framework also evaluates the systemic resources needed to sustain future well-being within planetary and societal limits.

Current well-being is assessed across 11 dimensions, which include material conditions like Income and Wealth, Housing, and Work and Job Quality, alongside quality-of-life factors such as Health, Knowledge and Skills, Environmental Quality, Subjective Well-being, and Safety. The framework also considers the impact of social connections, civic engagement, and work-life balance, providing insights into both the subjective experiences of individuals and their engagement with society.

To address inequalities, the framework considers three types of inequalities: horizontal inequalities, which look at differences between demographic groups such as age or gender; vertical inequalities, which measure disparities between the top and bottom performers in each well-being dimension, like income; and deprivations, assessing the share of the population falling below essential thresholds in critical areas such as health and skills.

Future well-being is supported by four types of capital: Economic Capital, encompassing financial and man-made assets; Natural Capital, which includes natural resources and ecosystems; Human Capital, referring to the skills and future health of the population; and Social Capital, which involves social norms and institutional arrangements that enhance cooperation. These capitals are conceptualized as public goods, with elements like trust and environmental sustainability impacting well-being on both community and global scales.

In this thesis framework, only the components of Social and Human Capital—such as trust in others and institutions, volunteering, gender equality, obesity, educational attainment, and health determinants—have been considered and included, as they directly reflect well-being outcomes. While Economic and Natural Capital are undeniably important, they fall outside the scope of this work. The primary objective is to develop a tool that assesses vulnerabilities among different population groups by examining disparities in well-being outcomes. Therefore, the focus is on indicators that directly measure population conditions, enabling comparisons across social groups. For instance, rather than analyzing natural resources in terms of stocks and flows, the emphasis is on individuals' access to these resources, as this access has a direct impact on their well-being.

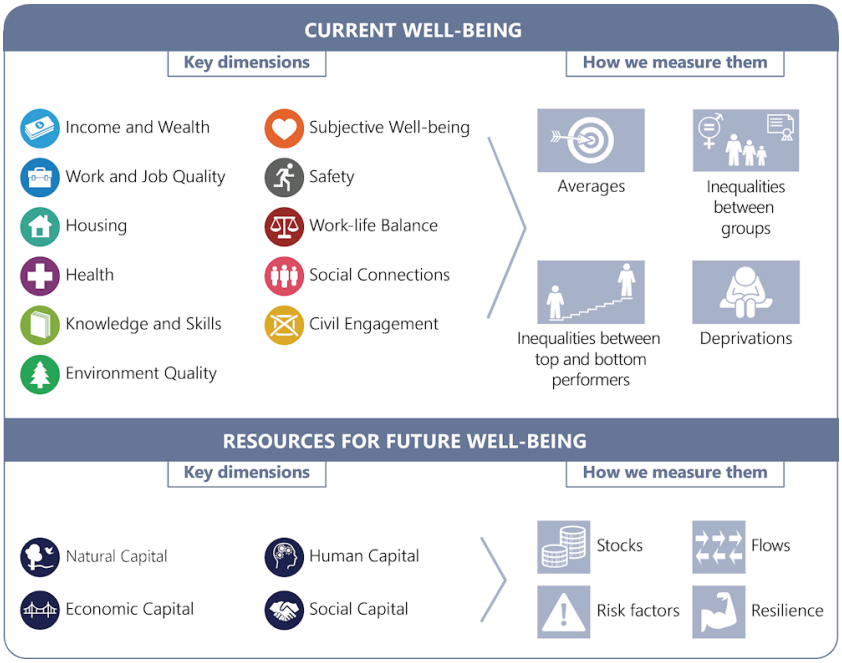

Figure 3: OECD Well-being Framework. Source:(OECD, 2020b).

2.2 Comparative analysis

Since the aim is to build a tool to assess vulnerability to climate policies and monitor their impacts on inequalities, in the european context, the three aspects considered most important and analysed are: how sustainability and well-being are integrated together, approach to the measurement of horizontal inequalities, how the impacts of nature and environmental quality on well-being are measured, data availability and relevance for europe. Table 1 summarizes and compares the main characteristics of the frameworks that will be analysed in the following sections.

Table 1: Comparison of frameworks for multi-dimensional well-being and sustainability. Source: own elaboration.

Framework	Dimensions, constituents or domains	Well-being frame	Nature impacts on well-being	Horizontal inequalities	Source
Eurostat Quality of Life	Material living conditions (income, consumption, material deprivation, housing); health; education; personal activities including work-life balance; political and governance systems; social connections; environment; economic security and subjective well-being.	Objective and subjective indicators of current well-being	Perceived pollution (including noise), access to green spaces	Gaps in labor market condition (employment rate and earnings) by gender and migrant background.	(Eurostat, 2017)
OECD Better Life	Health status; work-life balance; education and skills; social connections; civic engagement and governance; environmental quality; personal security; income and wealth; jobs and earnings; housing; subjective well-being; digital inclusion; environmental sustainability.	Objective and subjective indicators of current and future well-being	Air pollution exposure, access to green spaces	Gaps in well-being outcomes between population groups by gender, age, and education.	(OECD, 2020b)
UN SDG Framework	17 Goals including poverty reduction, health, education, clean water and sanitation, gender equality, affordable and clean energy, decent work and economic growth, reduced inequalities, sustainable cities and communities, climate action, life on land and below water, peace and justice, and partnerships for the goals.	Objective indicators of sustainable development.	Access to natural resources (air, water, food, energy, green spaces), mortality due to pollution, impact of natural disasters.	Gaps in access, opportunities, and outcomes by gender, age, ethnic group, geographical location, disability status, and migrant background.	(UN, 2015)
EU SDG Framework			Mortality from air pollution, perceived noise pollution	Not clearly defined	(Eurostat, 2024c)

2.2.1 Sustainability and well-being integration across frameworks

While there is some overlap between sustainability and well-being in the frameworks analyzed, they are generally treated as separate concepts. In well-being frameworks, the social dimensions of well-being have gained increasing recognition, but the importance of environmental and ecological factors is still emerging. Conversely, sustainability frameworks often treat well-being as a secondary concern, rather than a fully integrated element. What is needed is a transdisciplinary approach that connects the individualistic focus of well-being with the interdependent social and environmental systems of sustainability. This would result in an integrated model of "sustainable well-being," offering the potential for positive outcomes for both human well-being and the natural environment.

The OECD Well-being Framework introduces the concept of sustainability by tracking the resources required to support future generations' well-being. This forward-looking approach marks a key distinction from the Eurostat QoL Framework, which focuses solely on current well-being without considering the needs of future generations. However, neither framework fully integrates the UN SDGs. Their emphasis remains on well-being, leaving sustainable development goals less connected to the well-being assessment.

In contrast, the UN SDG Framework is designed with sustainability at its core, aiming to integrate economic, social, and environmental dimensions to achieve long-term sustainability for both people and the planet. However, while the SDGs address aspects of well-being—such as health and education—there is a notable lack of emphasis on subjective well-being indicators, which measure people's perceptions and experiences, crucial factors that shape overall quality of life. The EU SDG Indicator set is even more reliant on objective indicators, such as employment rates and pollution levels, which contributes to a disconnect between sustainable development goals and a more holistic understanding of human well-being.

2.2.2 Measuring environmental impacts on well-being

The impact of nature on current well-being is measured differently across the frameworks. The Eurostat QoL framework relies only on subjective indicators of environmental quality, and these are the self-reported measures of pollution, noise, and satisfaction with green spaces . While these indicators are valuable for capturing individual perceptions, they do not fully reflect objective environmental conditions or disparities in living environments. For instance, individuals accustomed to living in noisy areas may report lower levels of disturbance, yet the long-term health effects of noise pollution persist, irrespective of their perception. This reliance on subjective reporting can mask the real impact of environmental factors on well-being.

In contrast, the OECD Well-Being Framework employs more objective measures to assess the environment's impact on well-being. It uses indicators on the exposure to air pollution (measured as the population exposed to PM2.5 levels above the WHO threshold) and access to green spaces within a ten-minute walk. These standardized measures provide a clearer understanding of how environmental factors can impact well-being and how different populations are affected. However, this framework does not capture the subjective experiences and perceptions of people living in these environments, which are crucial in shaping people's well-being.

Thus, both the Eurostat and OECD frameworks fail to balance subjective and objective measures of environmental conditions, and the range of indicators they use is relatively narrow. They do not assess other crucial aspects of how the natural environment affects well-being, such as access to water, food, energy, or the broader impacts of climate change, including the rising frequency and intensity of natural disasters and the growing threat of food insecurity.

On the other hand, the Global SDGs indicator framework includes a broader set of indicators related to environmental health, such as mortality rates attributed to air pollution and unsafe water, sanitation, and hygiene (WASH) services. It also measures access to essential resources like clean water, nutritious food, clean energy, and green spaces. Moreover, it tracks the number of deaths and people affected by natural disasters, which reflects the direct impacts of climate change. However, when it comes to health, the focus of the SDGs tends to be on extreme outcomes (e.g., mortality), rather than the everyday experiences of living in polluted or degraded environments, which are captured more effectively by the Eurostat and OECD frameworks.

2.2.3 Assessing horizontal inequalities and discrimination

While the Eurostat Quality of Life (QoL) framework is the most comprehensive tool for measuring well-being at the European level among the frameworks analyzed, it falls short in addressing horizontal inequalities. Most indicators are disaggregated only by sex or age, with many not disaggregated at all. The graph in Figure 4 highlights this, showing the percentage distribution of indicators across categories such as "By Country of Birth," "By Income," "By Education," "By Age," "By Sex," and "No Disaggregation." Notably, no indicator is disaggregated by other critical characteristics such as citizenship, disability status, ethnicity, sexuality, or religion.

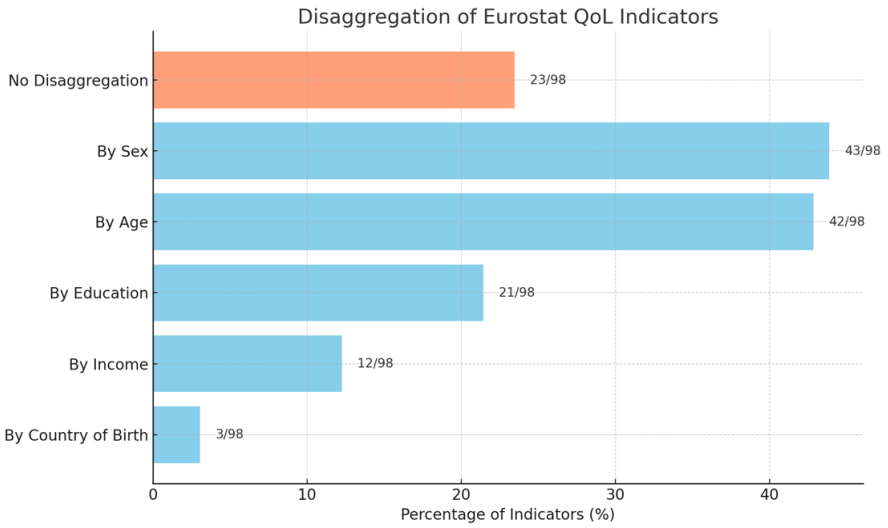

Figure 4: *This graph illustrates the distribution of Eurostat Quality of Life (QoL) indicators by disaggregation. The categories shown include "By Country of Birth," "By Income," "By Education," "By Age," "By Sex," and "No Disaggregation," with each category displaying both the percentage of indicators and the number out of the total. The "No Disaggregation" category, highlighted in a different color, represents the portion of indicators that are not disaggregated by any of the categories considered. Source: own elaboration.*

Additionally, the framework includes a topic titled “Discrimination and Equal Opportunities” under the “Governance and Basic Rights” dimension, but this is narrowly focused on disparities in labor conditions by gender and country of birth. This topic is assessed through indicators such as:

- Gender pay gap in unadjusted form by NACE Rev. 2 activity (earn_gr_gpgr2)
- Gender employment gap (tesem060)
- Employment rates by sex, age, educational attainment level, country of birth, and degree of urbanization (lfst_r_redcobu)

However, this approach provides a limited perspective on horizontal inequalities and discrimination. It primarily addresses gender and migrant status while overlooking the broader range of discrimination that occurs based on characteristics such as skin color, ethnicity, religion, beliefs, gender identity, and sexuality. Across the European Union, many individuals face discrimination and hatred because of these factors, and the current framework fails to capture the full scope of these inequalities.

By focusing predominantly on labor conditions, the framework neglects other crucial dimensions of social rights and well-being, including health, education, access to essential services, living conditions, and political participation. These aspects are critical to ensuring equal opportunities of well-being.

On the other hand, OECD framework uses horizontal inequalities as a measure of the distribution of well-being, across all its dimensions. This approach provides a deeper understanding of how disparities across various dimensions impact well-being. However, it is important to note that the data is only disaggregated by gender, age, and educational attainment. This leaves out ethnic minorities and other marginalized communities who often face discrimination and environmental injustices.

Acknowledging the importance of high-quality disaggregated data to achieve the "Leave No One Behind" principle, the UN SDGs prioritize the development of such data, advocating for disaggregation by income, sex, age, race, ethnicity, migratory status, disability, and geographic location. However, many countries and regions, including Europe, still face challenges in providing sufficiently disaggregated SDG data, especially regarding structural discrimination based on race, ethnicity, class, or caste (WHO, 2024). In the case of the EU SDG framework, many indicators are not sufficiently disaggregated, and those that are often focus on sex, age, or citizenship.

2.2.4 Concluding remarks on framework integration

In conclusion, between the two well-being frameworks, the Eurostat QoL Framework stands out as the most comprehensive tool for assessing well-being in the European Union. Its ad-hoc surveys provide standardized data across a broad range of quality-of-life indicators, making it a valuable resource for understanding various dimensions of well-being. By contrast, the OECD Well-being Framework offers a more limited selection of indicators, largely due to the challenges of obtaining high-quality, comparable data across all OECD countries. Additionally, the OECD framework includes fewer subjective indicators, which are crucial for capturing people's perceptions and feelings—key elements that significantly shape quality of life.

Despite its limitations, the OECD Well-being Framework remains a valuable tool, offering important guidelines and indicators not covered by Eurostat. However, both frameworks fall short when it comes to fully integrating the SDGs and addressing the interconnection between human well-being and environmental conditions. To bridge this gap, the framework developed in this thesis will enhance these existing frameworks by incorporating considerations and indicators from the Global SDG Framework. This will link well-being measures directly to the SDGs, and adopt a broader perspective on the relationship between people and the environment by drawing on both the UN SDG framework and other relevant literature.

The EU SDG Indicator set, while more tailored to the European context, does not include many important indicators that are found in the UN SDG Framework. For this reason, it was necessary to consider both frameworks in the development of the new framework. Additionally, from the analysis carried out, many of these indicators resulted to focus predominantly on objective phenomena, neglecting subjective evaluations of well-being. This gap results in a failure to fully integrate well-being into sustainability measures. Furthermore, the lack of sufficient disaggregation in many EU SDG indicators impairs the ability to effectively assess horizontal inequalities. As a result, well-being and social inequalities are not fully considered in the assessment of EU SDGs, ultimately hindering progress toward achieving these goals.

These limitations are reflected in the EGD, whose policies are informed by these frameworks. As highlighted in the introduction, the EGD has been criticized for primarily framing the green transition around economic and industrial transformation, treating the social dimensions of the environmental crisis as secondary impacts rather than integrating them into a cohesive strategy (Lafortune et al., 2024; REAL DEAL Consortium, 2023). The framework developed in the next chapter aims to overcome this narrow focus, leveraging the strengths of each framework to integrate climate ambition with development goals, and holistically address both environmental sustainability and social inequality.

3 Development of a new framework to assess vulnerabilities

The framework developed in this thesis addresses vulnerability through the lens of equal access to sustainable well-being, consisting of 11 dimensions of well-being. Based on the analysis carried out in the previous chapter, the Eurostat Quality of Life (QoL) framework has been chosen as the starting point, as it is specifically tailored to the European Union, which is the focus of this thesis. Modifications to the Eurostat QoL framework have been informed by the OECD Well-being Framework, the UN Sustainable Development Goals (SDGs), and other relevant literature, all guided by the findings of the analysis. This process defines 11 dimensions of sustainable well-being, along with their respective topics and sub-topics, which form the 105 rows of the matrix.

The integration of the Eurostat QoL and OECD Well-being frameworks with the UN Sustainable Development Goals has the goal of fostering synergies between, climate action, well-being and sustainable development. In this way, climate policies can be evaluated based on the impacts they have on people's prospects of well-being, ensuring the most vulnerable do not suffer disproportionately, and therefore reducing inequalities (SDG 10). At the same, linking every well-being dimension with the SDGs ensures policies can evaluate progress towards other SDGs as well, breaking silos between climate and development agendas. This integrated approach will be defined as a unified concept of sustainable well-being (see Figure 5).

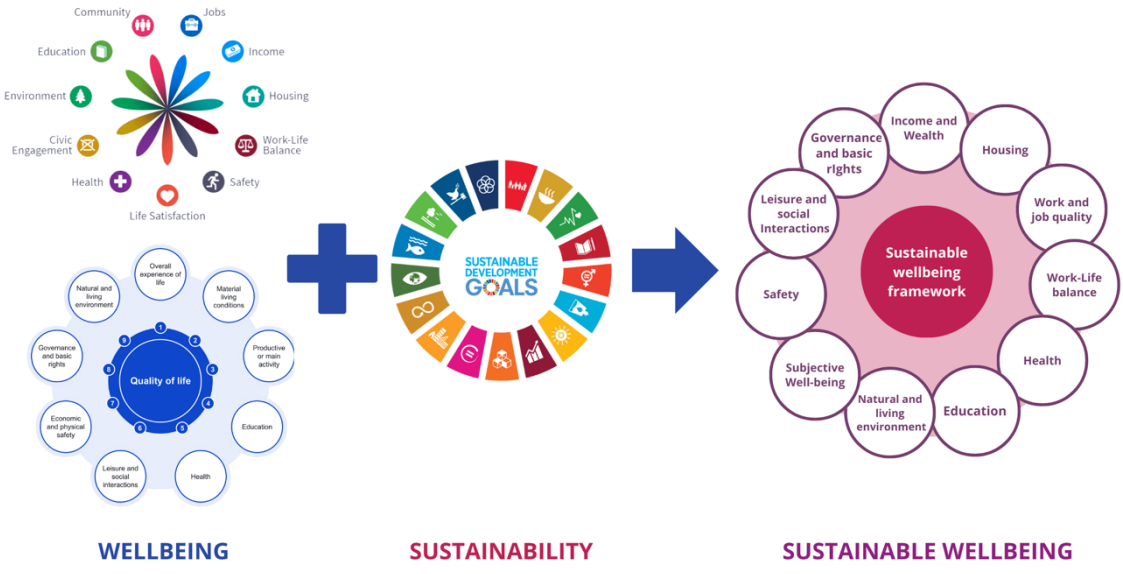

***Figure 5**: **Integration of Well-being and Sustainability Dimensions into the Sustainable Well-being Framework** This figure illustrates the process of combining well-being dimensions, as outlined in the Eurostat and OECD Well-being Frameworks, with sustainability objectives, as defined by the UN Sustainable Development Goals (SDGs). The resulting framework aims to define "sustainable well-being," which considers both individual quality of life and broader sustainability goals. Source: own elaboration*

Indicators, primarily sourced from the Eurostat, UN SDG, and OECD databases, are then placed in the appropriate cells according to available disaggregation, under the columns of “gender,” “age,” and “migration status.” These categories are further subdivided into: “women/men,” “youth/elderly,” and “citizenship/country of birth.” In cases where no disaggregation is available for a particular indicator, a column labeled “no disaggregation available” has been added, resulting in a total of seven columns. If no indicator is available for a specific topic and disaggregation, the corresponding cell is marked with “GAP.” These gaps highlight the absence of important indicators, signaling areas where further development is necessary. A simplified version of this matrix structure is displayed in Table 2.

This detailed disaggregation provides a comprehensive evaluation of well-being, allowing for a more equitable approach to assessing the impacts of climate policies. By listing indicators disaggregated by population subgroups, the framework enables comparisons of well-being outcomes between specific demographic groups and the general population. This helps identify inequalities and vulnerabilities, which can inform the design of climate policies that address these disparities and support vulnerable groups. It ensures that all members of society have an equitable opportunity to achieve positive outcomes and benefit from climate interventions.

Once a policy is implemented, this framework also allows for tracking progress, evaluating how specific demographic groups are performing in relation to both the Sustainable Development Goals (SDGs) and well-being. This enables policymakers to assess whether gaps are narrowing, ensuring that no one is left behind.

Table 2: Simplified Overview of the Developed Framework. *This table presents the key dimensions of the framework, without detailing specific topics and subtopics. Each dimension will be fully elaborated in the following sub-chapters, ending with a table for each dimension. These tables will provide a breakdown of the relevant topics, subtopics, and correspondent indicators, with disaggregation by gender, age, and migration status.*

Dimension	Gender		Age		Migration status	
	women	Men	Youth	Elderly	Citizenship	Country of birth
Income and Wealth						
Housing						
Work and Job Quality						
Work-Life Balance						
Health						
Education						
Natural and Living Environment						
Safety						
Leisure and social Interactions						
Governance and Civic Engagement						
Subjective Well-being						

3.1 A view to equal opportunities to sustainable well-being: the 11 dimensions

The subchapters of Chapter 3.2 explore the 11 dimensions essential for assessing vulnerability and ensuring equal opportunities for sustainable well-being. Each subchapter begins with an introduction explaining the dimension's relevance to well-being and sustainable development. It highlights how the dimension influences quality of life and equal opportunities and addresses any modifications made to existing frameworks like Eurostat's Quality of Life or the OECD Well-being framework. After the introduction, the chapter dives into the topics and subtopics defining the dimension, explaining each indicator and the rationale behind their selection. Each subchapter concludes by identifying gaps in data or indicators needed to track well-being and sustainability, especially in the context of the green transition, emphasizing where more data is necessary to ensure that no vulnerable group is overlooked in green mitigation policies.

3.1.1 Income and wealth

In the Eurostat Quality of Life framework, the first dimension, **Material Living Conditions**, is divided into three main topics, each with its own subtopics, as shown in Table 3 below:

Table 3: Eurostat Quality of Life "Material living conditions". Source: (Eurostat, 2021)

Dimension	Topic	Subtopic
Material living conditions	Income	
	Consumption	Constrained consumption
		Consumption (including non-market consumption and government provided services)
	Material conditions	Material deprivation
		Housing conditions

While this structure is comprehensive, it does not give enough focus to some critical areas like **Housing** and **Poverty**. For instance, housing is only treated as a subtopic under material conditions, and without further breaking it down into the many aspects that influence housing-related vulnerability (OECD, 2024c) To address this limitation, I have opted to adopt the categorization used in the OECD Well-being Framework, which separates the domain into two distinct categories: 'Income and Wealth' and 'Housing' (OECD, 2020b). This modification enables a more detailed assessment of both dimensions, integrating crucial indicators for sustainable development and well-being, such as food poverty and energy poverty. The revised structure, along with an in-depth explanation of these changes, will be presented in this chapter and the following section on Housing. Table 4 the revised "income and wealth" domain, first domain of this thesis' framework.

Table 4: Income and Wealth. Source: Own elaboration.

Dimension	Topic	Subtopic
Income and wealth	Income	Mean and median Income
		Income distribution and inequality
	Poverty	At-risk-of-poverty
		Food Poverty
	Material conditions	Severe material and social deprivation
		Difficulties with making ends meet

3.1.1.1 Income

The first topic, **Income**, is an important one as it has an impact on most of the other indicators in the framework. The first sub-topic, **Mean and median income**, is measured using data from the EU-SILC and ECHP surveys. This indicator captures the mean and median equivalised disposable income, defined as the total income of a household, after taxes and other deductions, available for spending or saving, divided by the number of household members converted into equivalent adults. Household members are equalised by weighting each according to their age, using the so-called modified OECD equivalence scale (Eurostat, 2017). Median household income, representing the middle income level, provides a more stable estimate free from distortions caused by high income outliers and better reflects the standard of living for the typical household. Thus, looking at median income creates more focus on inclusive growth that generates wider benefits (Eurostat, 2017).

While median disposable income is a useful indicator for analysing the purchasing power of an average citizen -thereby reflecting their overall material living standards- it is the distribution of income and wealth that determines by which extent individuals have equal access to the goods and services produced within a national economy. Beyond the mere allocation of resources, or the distribution of income across different societal groups, individuals often hold subjective perceptions of inequality, viewing them through the lens of 'social fairness.' This relative perspective, where individuals assess their circumstances in comparison to their peers, is also important in a quality of life framework.

The second sub-topic, **Inequality of income distribution,** captures this relative perspective. It is measured through the income quintile share ratio, often referred to as the 'S80/S20 ratio' is calculated as the ratio of total income received by the 20 % of the population with the highest income (the top quintile) to that received by the 20 % of the population with the lowest income (the bottom quintile) (Eurostat, 2022). This metric is a valuable complement to the at-risk-of-poverty indicator as it offers insights into the relative incomes of the poorest versus the richest households. Additionally, the S80/S20 ratio is particularly relevant in this context as it is less sensitive to changes at the tails of the distribution than other common measures of income inequality such as the Gini coefficient or the P90/P10 ratio (Eurostat, 2017).

The other main change in this thesis' framework is the omission of the topic of **Consumption** which is the second topic within the "Material Living Conditions" dimension in Eurostat's Quality of Life (QoL) framework. This, like income, can serve as a criterion for defining economic vulnerability (Eurostat, 2023a). Vulnerability can be assessed through consumption expenditures (Atkinson et al., 2017) rather than household disposable income. Since consumption expenditures tend to fluctuate less over time compared to income, they may provide a more stable indicator (Eurostat, 2023a). However, the proportion of individuals with low expenditures often mirrors those below the income-based at-risk-of-poverty threshold (Eurostat, 2023a).

Additionally, the indicator used to assess low expenditure is based on experimental statistics (Eurostat, 2024d), and exploring economic vulnerability in depth goes beyond the scope of this thesis. Therefore, this framework omits the topic of consumption. Future work on the experimental income, consumption, and wealth (ICW) dataset could enhance the understanding of multi-dimensional economic vulnerability (Eurostat, 2023a), potentially refining the framework.

3.1.1.2 Poverty

In this thesis, the second topic under *Income and Wealth* shifts focus to **Poverty,** instead of consumption. While Eurostat's Quality of Life (QoL) framework includes poverty under the broader topic of income, this thesis treats it as a distinct topic. This allows for a more detailed examination of specific issues like food poverty, a critical concern, especially in the context of climate change. Although food poverty is not explicitly covered in the Eurostat QoL or OECD frameworks, it is recognized as a subdomain of "Economic Security and Equality" in the Social Determinants of Health (SDOH) framework (World Health Organization (WHO), 2024). Moreover, it is addressed through Sustainable Development Goal (SDG) 2, aimed at eliminating hunger and malnutrition, ensuring access to safe, nutritious, and sufficient food for all (UN, 2022). Including it here is crucial, as hunger and malnutrition can severely affect overall well-being and hinder sustainable development by reducing productivity and increasing susceptibility to diseases (UN, 2022).

While poverty is a concept widely understood intuitively, its statistical measurement presents significant complexities, particularly when related to quality of life assessments. It can be defined as the practical difficulty of satisfying basic needs and achieving a decent living standard. However, poverty is inherently multi-dimensional and relative, influenced by factors such as income distribution, consumption patterns, and wealth (Eurostat, 2022). The challenge in measuring poverty lies not only in its ambiguous definition but also in the methodological approaches used. Poverty can be quantified in absolute terms, based on a predefined set of basic needs, or in relative terms, reflecting average conditions that vary across economies (Eurostat, 2022).

Within the EU, policymakers predominantly use a relative income-based approach, adjusted for social transfers, to highlight the link between poverty and social exclusion. This approach defines the risk of poverty as a persistent condition in which individuals cannot afford to fully participate in the society in which they live. Specifically, a person is considered at risk of poverty if their income is below 60% of the national median equivalised disposable income.

The first sub-topic, **at-risk-of-poverty**, includes three indicators— two sourced from Eurostat's Quality of Life framework and a third introduced in this thesis:

1. *At-Risk-of-Poverty Rate by Poverty Threshold***:** This indicator, derived from the EU-SILC and ECHP surveys, measures the percentage of individuals whose income falls below 60% of the national median equivalized disposable income. Since this threshold is directly tied to the median income, its monetary value varies not only between countries but also over time (Eurostat, 2022).
2. *At-Risk-of-Poverty Rate Anchored at a Fixed Moment in Time***:** This indicator, from EU-SILC surveys, measures the percentage of individuals at risk of poverty, anchored to a fixed reference year (T) and adjusted for inflation (Eurostat, 2017). Adjustment is based on the annual harmonized indices of consumer prices (HICPs). It provides a more stable view of poverty trends over time, mitigating the impact of fluctuations in median income.
3. *In-Work At-Risk-of-Poverty Rate:* Employment is often regarded as the best protection against poverty, but having a job does not always guarantee an escape from poverty. To capture this dynamic, the *In-Work At-Risk-of-Poverty Rate* measures the share of employed individuals who still live below the poverty threshold. This indicator, introduced in this thesis, is based on the EU-SILC survey and part of Eurostat indicators for tracking progress towards SDG 1 (ending poverty in all its forms) and SDG 8 (promoting decent work and economic growth). Monitoring this indicator is essential for the European Commission's strategy of building "An Economy that Works for People," ensuring that employment effectively translates into improved living standards and reduced poverty (European Commission, n.d.-a).

Food poverty, as mentioned before, is an increasingly urgent issue as climate change continues to impact food security and access. Key drivers of food insecurity and malnutrition—such as conflict, climate variability and extremes, and economic downturns—are escalating in frequency and intensity. These factors are further exacerbated by persistent underlying issues such as lack of access to affordable, nutritious food, unhealthy food environments, and entrenched inequality (FAO, 2023).

Two indicators, the *2.1.1 Prevalence of Undernourishment (PoU)* and the *2.1.2 Prevalence of moderate or severe food insecurity in the population*, are being used to monitor the progress toward achieving SDG2 and therefore eradicate food poverty (Food and Agriculture Organization of the United Nations (FAO), n.d.).

The first one, *Prevalence of Undernourishment (PoU),* provides an estimate of the proportion of people regularly failing to meet minimum energy requirements and therefore experiencing hunger. This indicator is based on official country data concerning food supply, food consumption, and dietary energy needs, adjusted for demographic factors like age, sex, and physical activity levels.

The second one measures Food insecurity through the *Food Insecurity Experience Scale (FIES),* see Figure 6. This estimates the proportion of the population experiencing moderate or severe difficulties in accessing sufficient food over the course of a year. A person is considered food insecure when they lack regular access to safe, sufficient, and nutritious food for normal growth, development, and a healthy, active life. Moderate food insecurity occurs when individuals are uncertain about their ability to obtain food and, at times, have been forced to reduce the quality or quantity of their food due to financial or resource constraints. Severe food insecurity means that people have likely run out of food, experienced hunger, or, in extreme cases, gone days without eating, putting their health at serious risk.

Figure 6: Food insecurity based on the FIES. Source: (FAO, n.d.)

In an EU context tracking development in obesity, an important malnutrition problem, becomes highly relevant. This nutrition-related health issue affected almost 15 % of the adult population in the EU in 2022 (Eurostat, 2024e). Obesity is also a significant contributor to other diet-related non-communicable diseases, including cancer, cardiovascular diseases, and diabetes. While the causes of obesity vary, the condition is generally linked to diets that are high in calories, fats (particularly trans and saturated fats), salt, and sugar, but low in essential nutrients like fruits, vegetables, whole grains, legumes, and nuts. Additionally, excessive consumption of red and processed meat, low physical activity, and socio-genetic factors further contribute to the problem. The contexts, such as the food environment, in which lifestyle choices are made, are important determinants of health behaviours and obesity (Eurostat, 2024e). Obesity rates are measured using the Body Mass Index (BMI), calculated by dividing an individual's weight in kilograms by the square of their height in meters. Adults with a BMI of 30 or higher are classified as obese. The pre-obese category includes those with a BMI between 25 and 29.9, while the overweight category encompasses both pre-obese and obese individuals (BMI of 25 or greater) (Eurostat, 2024e). This data is collected through the European Health Interview Survey (EHIS) and the EU Statistics on Income and Living Conditions (EU-SILC).

Together, hunger, food insecurity and malnutrition paint a comprehensive picture of food poverty, highlighting both immediate physical suffering and the broader uncertainty millions of people face in maintaining adequate and nutritious diets.

3.1.1.3 Material conditions

Material deprivation offers a complementary perspective to relative monetary poverty by focusing on objective and absolute criteria that measure economic strain. It refers to the enforced inability to afford a set of basic material standards that most people consider necessary for an adequate quality of life. Examples of material deprivation include the inability to cover unexpected financial expenses, take a one-week annual holiday, or keep up with mortgage or rent payments, utility bills, and loan repayments. It also encompasses being unable to afford regular meals with meat, fish, or a protein equivalent every other day, own a car for personal use, provide adequate heating, or replace worn-out furniture. On an individual level, material deprivation may involve not having an internet connection, being unable to replace old clothes, lacking two pairs of properly fitting shoes (including all-weather shoes), or being unable to spend a small amount on personal needs each week. It also includes being unable to participate in leisure activities, such as socializing with friends or family over a meal or drink at least once a month. The *severe material and social deprivation rate* indicator *r*epresents the proportion of the population unable to afford at least four of these basic necessities, offering a broader and more comprehensive understanding of poverty that extends beyond income alone (Eurostat, 2022).

Eurostat has incorporated the EU-SILC indicator *inability to make ends meet* as a subjective measure of poverty and social exclusion. This self-reported metric offers valuable insights into individuals' perceived financial strain, providing a personal perspective on economic hardship. However, the current disaggregation of this indicator is limited to household composition. To enhance its utility, further disaggregation by household characteristics such as location, income, sex, age, migration status, and the education level of the household head would be highly desirable. These additional breakdowns would allow for a better understanding of poverty and social exclusion across different demographic groups.

Table 5: Income and Wealth. Note: All indicators in this dimension that are categorized by migrant status target the population aged 18 and over. Source: own elaboration.

Dimension	Topic	Sub-Topic	No disaggregation available	Sex		Age		Migration status		Source
				Women	Men	Youth	Elderly	Citizenship	Country of Birth	
Income and Wealth	Income	Mean and median Income		Mean and median income by age and sex - EU-SILC and ECHP surveys (ilc_di03)		Mean and median income by age and sex - EU-SILC and ECHP surveys (ilc_di03)		Mean and median income by group of citizenship (ilc_di15)	Mean and median income by group of country of birth (ilc_di16)	(Eurostat, 2024b).
		Income distribution inequality		Income quintile share ratio S80/S20 for disposable income by sex and age group - EU-SILC survey (ilc_di11)		Income quintile share ratio S80/S20 for disposable income by sex and age group - EU-SILC survey (ilc_di11)		GAP	GAP	(Eurostat, 2024b).
	Poverty	At-risk-of-poverty		At-risk-of-poverty rate by poverty threshold, age and sex - EU-SILC and ECHP surveys (ilc_li02)		At-risk-of-poverty rate by poverty threshold, age and sex - EU-SILC and ECHP surveys (ilc_li02)		Persons at risk of poverty or social exclusion by group of citizenship (ilc_peps05n)	Persons at risk of poverty or social exclusion by group of country of birth (ilc_peps06n)	(Eurostat, 2024b).
				At-risk-of-poverty rate anchored at a fixed moment in time (2008) by age and sex - EU-SILC survey (ilc_li22b)		At-risk-of-poverty rate anchored at a fixed moment in time (2008) by age and sex - EU-SILC survey (ilc_li22b)		GAP	GAP	(Eurostat, 2024b).
				In-work at-risk-of-poverty rate by age and sex - EU-SILC survey (ilc_iw01)		In-work at-risk-of-poverty rate by age and sex - EU-SILC survey (ilc_iw01)		In-work at-risk-of-poverty rate by group of citizenship (ilc_iw15)	In-work at-risk-of-poverty rate by group of country of birth (ilc_iw16)	(Eurostat, 2024b).
		Food poverty	SDG 2.1.1: Prevalence of undernourishment	GAP		GAP		GAP	GAP	(United Nations, 2024).
				2.1.2: Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)		GAP		GAP	GAP	(United Nations, 2024).
			Obesity rate by body mass index (BMI) (sdg_02_10)	GAP		GAP		GAP	GAP	(Eurostat, 2024b).
	Material deprivation	Severe material and social deprivation		Severe material deprivation rate by age and sex (ilc_mddd11)		Severe material deprivation rate by age and sex (ilc_mddd11)		Severe material deprivation rate by group of citizenship (ilc_mddd15)	Severe material deprivation rate by group of country of birth (ilc_mddd16)	(Eurostat, 2024b).
		Difficulties making ends meet	Inability to make ends meet - EU-SILC survey (ilc_mdes09)	GAP		GAP		GAP	GAP	(Eurostat, 2024b).

3.1.2 Housing

This chapter delves into the second dimension of the framework: housing. Housing is a fundamental aspect of well-being, as most people would agree that having access to affordable, decent-quality housing in a safe environment is a basic human need. A dwelling should provide more than just shelter; it must offer adequate space for living, eating, and sleeping, as well as privacy for both households and individual members (Eurostat, 2023b). Ideally, a comprehensive set of measures for housing conditions would assess both the quality and affordability of housing (OECD, 2020b).

In the context of this thesis, the Housing dimension is primarily based on Eurostat's article, *Living Conditions in Europe – Housing* (Eurostat, 2023) and on the guidelines of the final report, with the addition of one extra subtopic: Housing Deprivation. Although not explicitly covered in the Eurostat article, this subtopic is represented by indicators from Eurostat's Quality of Life (QoL) database, specifically under housing conditions. The primary data source for these indicators is the EU Statistics on Income and Living Conditions (EU-SILC) (Eurostat, n.d.-b).

Table 6: Housing. Source: own elaboration

Dimension	Topic	Subtopic
Housing	Housing conditions	Dwelling size
		Housing deprivation
	Housing affordability	Housing cost burden
		Energy Poverty

3.1.2.1 Housing conditions

The first topic within this dimension concerns **housing conditions**. Several objective factors are used to evaluate housing conditions in the EU, including the size of the dwelling, structural problems within homes, and access to basic sanitary facilities. These aspects are grouped into two key sub-topics in this framework.

The first sub-topic, **Dwelling Size**, is assessed using the overcrowding rate indicator, which measures the percentage of the population living in dwellings that do not have enough rooms based on household size, family composition, and the ages of its members (Eurostat, 2023b). The overcrowding indicator provides insight into housing conditions by examining dwelling size from two key perspectives. Firstly, from a strict health standpoint, adequate living space is essential for preventing health issues, as highlighted by the WHO (2018). Secondly, in terms of well-being, the lack of privacy plays a critical role, with research indicating that overcrowding can cause significant stress, particularly for vulnerable groups such as children and women (Evans, 2003). The data for this indicator is sourced from the EU-SILC survey.

Housing deprivation, second sub-topic, reflects the inadequate living conditions experienced by households due to poor amenities. This is measured, as defined by Eurostat, by assessing the presence of one or more of the following conditions: a leaking roof, lack of a bath/shower or indoor toilet, or a dwelling considered too dark. To capture the various dimensions of housing deprivation, I have selected four specific indicators from the EU-SILC survey:

1. *Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor*.
2. *Total population having neither a bath, nor a shower in their dwelling.*
3. *Total population not having indoor flushing toilet for the sole use of their household.*
4. *Total population considering their dwelling as too dark.*

An alternative to the second and third indicators is the combined EU Sustainable Development Goals (SDG) indicator: *Population having neither a bath, nor a shower, nor indoor flushing toilet in their household.* This indicator is similar to the global SDG indicator 6.2.1, which measures the "Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water." It serves as a benchmark for monitoring progress towards SDG 6, which is a priority under the European Green Deal and the European Commission's strategy for 'An Economy that Works for People.' SDG 6 aims to ensure universal access to safe and affordable drinking water, sanitation, and hygiene, and to eliminate open defecation. It also emphasizes improving water quality, water-use efficiency, and promoting sustainable water management practices (UN, 2022). The availability of basic household facilities —such as a bath, shower, and indoor toilet— is essential for healthy living conditions and overall well-being. Their absence is considered housing deprivation and impacts not only personal health but also the environment by contributing to unsanitary practices such as open defecation (Eurostat, 2023c).

While the SDG indicator provides a general overview, I chose to use the separate EU-SILC indicators because they offer more detailed data. They are disaggregated by factors such as age, sex, poverty status, and type of household, allowing for an analysis of horizontal inequalities among different groups. This approach aligns with the framework's structure—enabling the matrix to be accurately filled under the appropriate disaggregation dimension columns—and its scope, which aims to facilitate a detailed examination of inequalities among diverse population groups.

3.1.2.2 Housing affordability

The second topic**, Housing affordability,** is assessed through two sub-topics: housing cost overburden and energy poverty.

The **Housing cost overburden rate** measures the percentage of the population living in households where total housing costs (after housing allowances) exceed 40% of disposable income. This metric highlights the strain that housing expenses can place on individuals and families, particularly when their income is insufficient to cover other basic needs (Eurostat, 2023b).

I included **Energy Poverty (EP)** as a topic of the "Housing" dimension to emphasize its critical role in achieving sustainable and equitable living conditions. EP is recognized as a form of material deprivation that significantly impacts quality of life, affecting areas such as mental health, social inclusion, environmental quality, and productivity (Simshauser, 2021; Carfora & Scandurra, 2024). Adequate levels of heating, cooling, and lighting are fundamental to ensuring a decent standard of living and safeguarding public health (European Commission, n.d.).

Energy poverty occurs when a household is forced to reduce its energy consumption to a level that compromises the health and well-being of its members. This condition is strongly associated with low levels of income in combination with high expenditure on energy and poor building efficiency standards (European Commission, 2020a). Due to its private nature and complexity, EP remains a significant challenge across the EU (European Commission, n.d.-b). As a result of rising inflation, energy prices, and the lingering economic effects of the pandemic, households now face growing obstacles to achieving energy security and affordability.

A shift to renewable energy sources offers a potential solution by fostering a more resilient and stable energy landscape, shielding countries from the volatility of traditional energy markets and geopolitical risks (Carfora & Scandurra, 2024). The promotion of renewable energy and the transition to net-zero emissions are recognized as essential policy measures that can create synergies by addressing climate change, driving inclusive economic development, generating jobs, improving public health, and lowering energy costs—particularly benefiting lower- and middle-income groups (Carfora & Scandurra, 2024; UN, 2024).

Based on these considerations, it is evident that effectively addressing energy poverty requires evaluating access to affordable, reliable, and sustainable energy, as emphasized by Sustainable Development Goal 7 (SDG 7). To provide a comprehensive assessment of energy poverty, I have selected three key indicators:

- The EU-SILC survey indicator, "inability to keep the home adequately warm," which is widely used to monitor energy affordability across the EU.
- SDG 7.1.1: Proportion of the population with access to electricity.
- SDG 7.1.2: Proportion of the population with primary reliance on clean fuels and technology.

The latter two indicators from SDG 7.1 provide a broader perspective on access to clean and reliable energy, complementing the EU-SILC indicator on energy affordability.

Addressing energy poverty and the access to affordable, reliable, and sustainable energy not only supports the transition to clean and sustainable energy sources but also ensures that vulnerable populations are not left behind in the energy transition. Developing more refined indicators of energy poverty, disaggregated by demographic groups, is essential to ensure policies are designed to reduce, rather than exacerbate, burdens on vulnerable populations.

Table 7: Housing. Source: own elaboration.

Dimension	Topic	Sub-Topic	No disaggregation available	Gender		Age		Migration status		Source
				women	men	youth	elderly	citizenship	country of birth	
Housing	Housing conditions	Overcrowding		Overcrowding rate by age, sex and poverty status - total population - EU-SILC survey (ilc_lvho05a)		Overcrowding rate by age, sex and poverty status - total population - EU-SILC survey (ilc_lvho05a)		Overcrowding rate by age, sex and group of citizenship (total population aged 18 and over) (ilc_lvho15)	Overcrowding rate by age, sex and group of country of birth (total population aged 18 and over) (ilc_lvho16)	(Eurostat, 2024b).
		Housing Deprivation		Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor - EU-SILC survey		Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor - EU-SILC survey		GAP	GAP	(Eurostat, 2024b).
				Total population having neither a bath, nor a shower in their dwelling - EU-SILC survey (ilc_mdho02)		Total population having neither a bath, nor a shower in their dwelling - EU-SILC survey (ilc_mdho02)		GAP	GAP	(Eurostat, 2024b).
				Total population not having indoor flushing toilet for the sole use of their household - EU-SILC survey (ilc_mdho03)		Total population not having indoor flushing toilet for the sole use of their household - EU-SILC survey (ilc_mdho03)		GAP	GAP	(Eurostat, 2024b).
				Total population considering their dwelling as too dark - EU-SILC survey (ilc_mdho04)		Total population considering their dwelling as too dark - EU-SILC survey (ilc_mdho04)		GAP	GAP	(Eurostat, 2024b).
	Housing affordability	Housing cost burden		Housing cost overburden rate by age, sex and poverty status - EU-SILC survey (ilc_lvho07a)		Housing cost overburden rate by age, sex and poverty status - EU-SILC survey (ilc_lvho07a)		Housing cost overburden rate by age, sex and group of citizenship (total population aged 18 and over) (ilc_lvho25)	Housing cost overburden rate by age, sex and group of country of birth (total population aged 18 and over) (ilc_lvho26)	(Eurostat, 2024b).
	Energy Poverty	Energy affordability		Inability to keep home adequately warm by level of disability (activity limitation), sex and age (hlth_dhc140)		Inability to keep home adequately warm by level of disability (activity limitation), sex and age (hlth_dhc140)		GAP	GAP	(Eurostat, 2024b).
		Access to clean and reliable energy	SDG 7.1.1: Proportion of population with access to electricity	GAP	GAP	GAP	GAP	GAP	GAP	(United Nations, 2024a).
			SDG 7.1.2: Proportion of population with primary reliance on clean fuels and technology	GAP	GAP	GAP	GAP	GAP	GAP	(United Nations, 2024a)

3.1.3 Work and Job Quality

The second dimension of the Eurostat Quality of Life (QoL) framework, "Productive or Other Main Activity," is a critical area of focus that examines how employment and related activities impact individuals' overall well-being. In this thesis, the framework for this dimension has been divided into two distinct areas: “Work and Job Quality” and “Work-Life Balance,” aligning with the approach used in the OECD Well-being framework. These areas are explored with a specific emphasis on Sustainable Development Goals (SDGs) 8 (Decent Work and Economic Growth) and 5 (Gender Equality).

This dimension is assessed through three key sub-dimensions: the quantity of employment, the quality of employment, and other main activities, including inactivity and unpaid work. Indicators for these areas primarily derive from sources such as the EU Labour Force Survey (EU-LFS), the Structure of Earnings Survey, and various administrative data.

Table 8: Eurostat Quality of Life “Productive or other main activity”. Source: (Eurostat, 2021)

Dimension	Topic	Subtopic
Productive or other main activity	Quantity of employment	Employment and unemployment
		Underemployment (quantity)
		Underemployment (quality)
	Quality of employment	Income and benefits from employment
		Health and safety at work
		Work/life balance
		Temporary work
		Assessment of the quality of employment
	Other main activity	

Recognizing the complementarity of employment quantity and quality is essential for understanding labor market dynamics and their impact on well-being. Improvements in employment quantity primarily benefit the unemployed and underemployed, while enhancements in employment quality impact those already in jobs (Eurostat, n.d.-d). Stiglitz et al. (2008) emphasizes that unemployment has far-reaching effects beyond mere income loss. Unemployed individuals often face psychological and social consequences, including diminished life satisfaction, increased stress, and reduced joy, highlighting the substantial non-pecuniary costs of unemployment. The European Employment Strategy (EES) reflects this holistic approach, advocating for the creation of "more and better jobs." This strategy recognizes that increasing employment alone is not enough, jobs must also provide security, fair pay, and decent working conditions to improve overall well-being (European Commission, 1997). Balancing employment quantity with quality is therefore vital for sustainable development and societal well-being.

3.1.3.1 Quantity of employment

The **quantity of employment** topic focuses on the extent of employment and job availability. It encompasses key indicators such as the employment rate, unemployment rate, long-term unemployment, all of which are derived from the Labour Force Survey (EU-LFS). As the long-term unemployment indicator had no age disaggregation, I have introduced the *Youth long-term unemployment rate* indicator under the correspondent disaggregation column.

Involuntary temporary work and involuntary part-time employment are on the border between quantity and quality of employment.

An indicator on *involuntary part-time employment*, from EU-LFS, serves as a proxy for **underemployment**, where individuals work fewer hours than they are willing or able to, reflecting an incomplete utilization of labour potential. (Eurostat, n.d.-d).

3.1.3.2 Quality of employment

Apart from mere access to employment (i.e. the quantitative aspect), the quality of paid work is especially important, since it relates to personal dignity. The **Quality of employment** is measured by several aspects within a framework developed by a joint UNECE/Eurostat/OECD Task Force (UNECE, 2010). This framework includes several critical sub-topics such as income and benefits, health and safety at work, temporary work, and under-employment (quality) all of which directly influence an individual's job satisfaction and overall well-being.

Income and benefits is measured by an indicator on the percentage of low-wage earners from the Structure of Earnings Survey (SES). A low-wage earner is defined as an employee (excluding apprentices) earning two-thirds or less of the national median gross hourly earnings. Since median earnings represent the middle point in a population's wage distribution, this indicator helps capture wage disparities and the prevalence of low-paying jobs.

Secondly, the sub-topic of **Health and safety at work** is considered. The corrispondent Eurostat dataset includes 4 indicators on health and safety at work that have been chosen from the EU-LFS ad hoc modules devoted to this topic: 1) accidents at work, 2) work-related health problems, and exposure to factors that can adversely affect either 3) mental well-being or 4) physical well-being. This are grouped under the dataset *Health and safety at work (qol_act_qlh),* to synthetize and not overcrowd.

Table 10 of the framework the dataset had been reported and not the indicators in it one by one. These sub-topic aligns also with SDG 8.8 “Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment”.

The next sub-topic covers indicators related to **Temporary work**, which provide information into employment security. This, in turn, directly impacts the economic security and quality of life for employees. Temporary work arrangements particularly affect young people, who often face difficulties in achieving stability early in their professional careers. These conditions can also influence important life decisions, such as when to start a family. There are various reasons for holding temporary jobs, such as education or training, probationary periods, or personal preference. However, it is crucial to differentiate between voluntary and involuntary temporary employment. The latter refers to individuals who hold temporary contracts because they are unable to secure permanent positions. To capture this distinction, the indicator *Temporary employees, disaggregated by main reason* is used. As the data does not provide disaggregation by citizenship or country of birth, I introduced the indicator *Temporary employees as a percentage of total employees* to fill this gap. Both indicators are based on data from the EU Labour Force Survey (EU-LFS).

Additionally, this topic examines *over-qualification***,** under the topic of **underqualification (quality)**, to assess if individuals are employed in roles that align with their skills and qualifications. The importance of the indicators on over-qualification is twofold — at an individual level and at a societal level. For the individual, working in a job that requires a lower qualification than that resulting from the person’s successful completion of a given level of education can have an important negative impact on self-esteem, job satisfaction and overall quality of life assessment. Working in such a job, in general implies lower income. For the society, high over-qualification rate indicates a suboptimal usage of its stock of human capital, which can hamper social and economic development both in the short and the long term. Currently, this indicator, coming from the EU-LFS ad hoc module 2014, measures the percentage of employed persons who answered yes to the question: Considering your educational level, experience and skills, do you feel over-qualified for your current main job? Here over-qualified means that the qualifications and skills of the person would allow for more demanding tasks to be undertaken than the current job requires.

The sub-topic **Assessment of the quality of employment** complements the information about the quality of employment with more subjective indicators such as job satisfaction and perceived fairness. This includes one indicator on satisfaction with the job from the EU-SILC and two indicators on employees having a good relationship with their supervisor / with their colleagues derived from the European Working Conditions Survey (EWCS), as conducted by Eurofound (Eurofound, n.d.).

A crucial aspect of employment quality introduced in this thesis is the sub-topic **Career advancement**, fundamental for SDG 5 and measured with the indicator on *employed women being in managerial positions* sourced from Quality of Employment (QoE) data series. This sub-topic evaluates opportunities for career progression and fair treatment in the workplace. It addresses the "glass ceiling" phenomenon—artificial and often invisible barriers that impede women's access to top decision-making and managerial positions. This phenomenon is key to address gender equality, also my suggestion would be to develop a similar indicator also for other, often discriminated demographics, as a similar phenomenon could also determine disparities and discrimination faced by youth, individuals with migrant backgrounds and other minorities. Therefore, it is vital to develop indicators that assess career advancement based on factors such as age, citizenship and country of birth, religion and other demographic in addition to sex.

3.1.3.3 Other Main Activities

The third topic, **Other Main Activities**, encompasses indicators related to inactivity and unpaid work. According to the International Labour Organization (ILO), the "inactive population" refers to individuals outside the labour force—neither employed nor unemployed. The subtopic of unpaid work, particularly relevant to SDG 5, is discussed in greater detail in the *Work-Life Balance* section. While Time Use Survey data is the primary source for comparable information on unpaid work, it is collected on a voluntary basis and does not cover all EU Member States.

Additionally, I have included subtopic focused on measuring young people who are not in employment, education, or training (NEET), in alignment with SDG 8.6. This indicator is vital for understanding the vulnerability of youth and for effectively monitoring the challenges they face in accessing the labour market. It measures the share of young people who are NEET, expressed as a percentage of the total youth population within the relevant age group, disaggregated by gender. In many countries, young mothers are disproportionately represented among NEETs, often due to family responsibilities that hinder their participation in the workforce. Therefore, this data is not only critical for tracking progress toward SDG 8.6 but also SDG 5, which focuses on gender equality. It helps to inform policies that target the unique barriers young women face in accessing education and employment opportunities, contributing to more inclusive and equitable solutions.

Table 9: Work and Job Quality.

Dimension	Topic	Subtopic
Work and Job Quality	Quantity of employment	Employment and Unemployment
		Underemployment
	Quality of employment	Income and benefits from employment
		Health and safety at work
		Temporary work
		Assessment of the quality of employment
		Career Advancement
		Over qualification
	Other main activity	Inactive population
		NEET
		Unpaid work

Table 10: Work and Job Quality (Part I). Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			Women	Men	Youth	Elderly	Citizenship	Country of Birth	
Work and Job Quality	Quantity of Employment	Employment and Unemployment	Employment rates by sex, age and educational attainment level (%) (lfsa_ergaed)		Employment rates by sex, age and educational attainment level (%) (lfsa_ergaed)	n.a.	Employment rates by sex, age and citizenship (%) (lfsa_ergan)	Employment rates by sex, age and country of birth (%) (lfsa_ergacob)	(Eurostat, 2024b).
			Unemployment rates by sex, age and educational attainment level (%) (lfsa_urgaed)		Unemployment rates by sex, age and educational attainment level (%) (lfsa_urgaed)	n.a.	Unemployment rates by sex, age and citizenship (lfsa_urgan)	Unemployment rates by sex, age and country of birth (%) (lfsa_urgacob)	(Eurostat, 2024b).
			Long-term unemployment by sex - annual data (une_ltu_a)		Youth long-term unemployment rate (12 months or longer) by sex and age (yth_empl_120)	n.a.	Long-term unemployment (12 months or more) as a percentage of the total unemployment, by sex, age and citizenship (lfsa_upgan)	Long-term unemployment (12 months or more) as a percentage of the total unemployment, by sex, age and country of birth (%) (lfsa_upgacob)	(Eurostat, 2024b).
		Under-employment (quantity)	Involuntary part-time employment as percentage of the total part-time employment, by sex and age (%) (lfsa_eppgai)		Involuntary part-time employment as percentage of the total part-time employment, by sex and age (%) (lfsa_eppgai)	n.a.	GAP	GAP	(Eurostat, 2024b).
	Quality of Employment	Income and Benefits from Employment	Low-wage earners as a proportion of all employees (excluding apprentices) by sex (earn_ses_pub1s)		Low-wage earners as a proportion of all employees (excluding apprentices) by age (earn_ses_pub1a)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Health and Safety at Work	Health and safety at work (qol_act_qlh)		Health and safety at work (qol_act_qlh)	n.a.	GAP	Health and safety at work (mii_hsw_apex)	(Eurostat, 2024b).
		Temporary work	Part-time employment and temporary contracts - annual data (lfsi_pt_a)		Part-time employment and temporary contracts - annual data (lfsi_pt_a);	n.a.	Temporary employees as percentage of the total number of employees, by sex, age and citizenship (%) (lfsa_etpgan)	Temporary employees as percentage of the total number of employees, by sex, age and country of birth (%) (lfsa_etpgacob)	(Eurostat, 2024b).
			Temporary employees by sex, age and main reason (lfsa_etgar)		Temporary employees by sex, age and main reason (lfsa_etgar);	n.a.	GAP	GAP	(Eurostat, 2024b).
		Under-employment (quality)	Self-declared over-qualified employees as percentage of the total employees by sex, age, migration status and educational attainment level (lfso_14loq)		Self-declared over-qualified employees as percentage of the total employees by sex, age, migration status and educational attainment level (lfso_14loq)	n.a.	Self-declared over-qualified employees as percentage of the total employees by sex, age, migration status and educational attainment level (lfso_14loq)	Self-declared over-qualified employees as percentage of the total employees by sex, age, migration status and educational attainment level (lfso_14loq)	(Eurostat, 2024b).

Table 11: Work and Job quality (Part II). Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			Women	Men	Youth	Elderly	Citizenship	Country of Birth	
Work and Job Quality	Quality of Employment	Assessment of the quality of employment	Satisfaction with the job by sex, age and educational attainment (ilc_pw15)		Satisfaction with the job by sex, age and educational attainment (ilc_pw15)	n.a.	GAP	GAP	(Eurostat, 2024b).
			Employees having a good relationship with their supervisor by sex and age (qoe_ewcs_7a2)		Employees having a good relationship with their supervisor by sex and age (qoe_ewcs_7a2)	n.a.	GAP	GAP	(Eurostat, 2024b).
			Employed persons having a good relationship with their colleagues by sex and age (qoe_ewcs_7a1)		Employed persons having a good relationship with their colleagues by sex and age (qoe_ewcs_7a1)	n.a.	GAP	GAP	(Eurostat, 2024b).
			Employed persons discriminated at work during the last 12 months by sex and age (qoe_ewcs_1c3)		Employed persons discriminated at work during the last 12 months by sex and age (qoe_ewcs_1c3)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Career Advancement	Employed women being in managerial positions by age (tqoe1c2);	n.a.	GAP	n.a.	GAP	GAP	(Eurostat, 2024b).
	Other main Activity	Inactive Population	Inactive population as a percentage of the total population, by sex and age (%) (lfsa_ipga)		Inactive population as a percentage of the total population, by sex and age (%) (lfsa_ipga)	n.a.	Inactive population by sex, age and citizenship (1 000) (lfsq_igan)	Inactive population by sex, age and country of birth (1 000) (lfsq_igacob)	(Eurostat, 2024b).
			Young people neither in employment nor in education and training by sex, age and labour status (NEET rates) (edat_lfse_20)		Young people neither in employment nor in education and training by sex, age and labour status (NEET rates) (edat_lfse_20)	n.a.	Young people neither in employment nor in education and training (NEET), by citizenship (sdg_08_20a)	GAP	(Eurostat, 2024b)..
		Unpaid Work	Time spent in total work (paid and unpaid work as main or secondary activity) by sex and by form of work (tus_00work)		Time spent in total work (paid and unpaid work as main or secondary activity) by sex and by form of work (tus_00work)	n.a.	GAP	GAP	(Eurostat, 2024b).

3.1.4 Work-Life Balance

Work-life balance is undeniably a key factor in assessing the quality of employment and is considered a sub-component of employment quality in the Eurostat Quality of Life (QoL) framework. However, this thesis treats work-life balance as a standalone dimension, aligning with the approach adopted by the OECD Well-being framework. The rationale behind this is that work-life balance encompasses an individual's ability to effectively manage and integrate family responsibilities, leisure activities, and both paid and unpaid work. This dimension is critical not only to employment but also to overall well-being, as it reflects the time available to fulfill personal needs (Gröpel & Kuhl, 2009). An inadequate work-life balance has been linked to several adverse outcomes, including reduced job and life satisfaction (Allen, Herst, Bruck, & Sutton, 2000; Kossek & Ozeki, 1998), decreased well-being and overall quality of life (Aryee, 1992; Grant-Vallone & Donaldson, 2001; Noor, 2004; Rice, Frone, & McFarlin, 1992), heightened stress (Burke, 1988), impaired mental health (Beatty, 1996; Grzywacz & Bass, 2003), and increased family conflict (Higgins, Duxbury, & Irving, 1992; Kofodimos, 1990).

Ideally, the scope of this dimension would include aspects such as the quantity of time devoted to leisure and personal care as well as the balance between both paid and unpaid work. Time use that is negatively associated with well-being, such as time spent commuting, also belongs in the scope, as this constrains time available for other activities (OECD, 2020b). This dimension overlaps with aspects of Job Quality (e.g., the proportion of people working long hours) and Leisure and Social Interaction (e.g., time spent in leisure).

3.1.4.1 Working time

A key factor in work-life balance is the time spent at work. Research shows that long working hours can have adverse effects on personal health, safety, and stress levels(Eurostat, n.d.-d). To provide a more complete picture of work-related time, additional indicators beyond weekly hours are considered. One such indicator is the proportion of employed individuals working 49 or more hours per week. This data, sourced from the European Union Labour Force Survey (EU-LFS), focuses on hours worked in the main job, excluding multiple jobs, unpaid labor, and commuting time. Therefore, indicators on commuting time and unpaid work are also relevant.

Unpaid work plays a crucial role in both quality of life and advancing gender equality. Sustainable Development Goal (SDG) target 5.1 highlights the importance of recognizing and valuing unpaid care and domestic work as essential for achieving gender equality (United Nations | Department of Economic and Social Affairs, n.d.). Women often bear a disproportionate share of unpaid labor (OECD, 2020b). As a result, although men may spend more hours in paid employment, this does not necessarily mean women have more leisure time. In the OECD framework, this is assessed through the "Long Unpaid Working Hours" indicator, which measures the share of the working-age population (15-64) engaged in more than 60 hours of total work per week, with at least 30 of those hours devoted to unpaid tasks. This 60-hour threshold is roughly equivalent to managing two full-time jobs, where 30 hours is considered the minimum for full-time employment (OECD, 2020b). The indicator accounts for individuals whose main responsibility is domestic production as well as those experiencing a "double day" of paid employment and unpaid work. Unpaid work includes routine housework such as cleaning, cooking, and shopping for household essentials (e.g., food, clothing, and home-related items), caregiving for both household and non-household members, volunteering, and travel related to household tasks. On the other hand, paid work covers all formal employment as well as commuting time (OECD, 2020b). The information is derived through national Time Use Surveys, looking at the indicators of Time spent in total work (paid and unpaid work as main or secondary activity) (tus_00work).

3.1.4.2 Work and family life

A crucial aspect of work-life balance is the ability to reconcile work with family life, which is why I have dedicated a specific topic to it in this framework. While all factors within this dimension affect family life to some degree, there are certain aspects that are particularly detrimental.

The first is **working during unsocial hours**. This refers to the percentage of employed individuals who regularly work (more than half the time in a month) during evenings, Saturdays, or Sundays (excluding night shifts). Working during unsocial hours can significantly disrupt social and family life. Additionally, night work is especially harmful to health, posing risks beyond just the social implications.

The second aspect is the **flexibility of work schedules**, which plays a vital role in balancing work and private life. Flexible working hours allow individuals to better manage their work and family responsibilities. Flexitime, for instance, is a variable work schedule that contrasts with the traditional 9-to-5 model. Under flexitime, employees are generally required to work during core hours, but beyond that, they have the freedom to choose when they work, provided they meet the required total hours and complete necessary tasks. This flexibility helps employees reconcile their work commitments with family needs more effectively.

An additional element introduced by this thesis is **the impact of childcare on employment**, to capture the work-life balance challenges faced by parents and caregivers. This indicator, derived from the 2018 EU-LFS module on work-family reconciliation, is also particularly significant for highlighting gender disparities in caregiving responsibilities. Women are far more likely than men to reduce their working hours or take career breaks due to caregiving duties. In 2018, data from the EU-28 revealed a gender gap of 3.3 percentage points: 5.9% of women, compared to just 2.5% of men, reduced their working time or interrupted their employment for over a month to care for ill, elderly, or disabled relatives (Eurostat, 2018). This indicator is crucial for tracking progress toward SDG 5 (Gender Equality), as it underscores the disproportionate caregiving responsibilities placed on women and emphasizes their significant impact on employment patterns. It highlights the persistent gender inequalities women face in the workplace, including reduced working hours and career interruptions, which limit their professional growth and economic opportunities.

3.1.4.3 Time off and satisfaction with time use

Time off refers to the total time dedicated to personal care activities—such as sleeping, eating, drinking, and other self-care tasks—as well as leisure activities, including sports, socializing, attending events, watching TV, listening to music, and other forms of recreation. It also includes travel time related to these activities. In the OECD framework, only time spent on primary activities is counted, which can underestimate leisure time, especially when multitasking (e.g., talking on the phone while cooking). To provide a more accurate measure, this framework expands to include time spent on secondary activities. Time Use Surveys are used to collect data for this indicator.

Satisfaction with time use, sourced from the EU-SILC survey, introduces a subjective measure of work-life balance. It captures how individuals feel about the way they allocate their time, offering insights into their perceived balance between work and personal life. This subjective measure complements the objective indicators, helping to understand how well individuals feel they manage their time overall.

Table 12: Work-Life Balance. Source: own elaboration.

Dimension	Topic	Subtopic
Work-Life Balance	Working time	Weekly working hours
		Long working hours
		Long unpaid working hours
		Time spent commuting
	Work and family life	Work on weekends
		Working evenings
		Working night
		Flexibility of working schedule
		Effect of childcare on employment
	Time off	
	Satisfaction with time use	

Table 13: Work-Life Balance. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Work-Life Balance	Working time	Weekly working hours	Average number of usual weekly hours of work in main job, by sex, age, professional status, full-time/part-time and economic activity (from 2008 onwards, NACE Rev. 2) (lfsa_ewhun2)		Average number of usual weekly hours of work in main job, by sex, age, professional status, full-time/part-time and economic activity (from 2008 onwards, NACE Rev. 2) (lfsa_ewhun2)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Long working hours	Long working hours in main job by sex, age, professional status and occupation (lfsa_qoe_3a2)		Long working hours in main job by sex, age, professional status and occupation (lfsa_qoe_3a2)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Long unpaid working hours	Time spent in total work (paid and unpaid work as main or secondary activity) by sex and by form of work (tus_00work)		GAP	n.a.	GAP	GAP	(Eurostat, 2024b).
		Time spent commuting	Mean duration of commuting time one-way between work and home by sex and age (qoe_ewcs_3c3)		Mean duration of commuting time one-way between work and home by sex and age (qoe_ewcs_3c3)	n.a.	GAP	GAP	(Eurostat, 2024b).
	Work and family life	Work on weekends	Employed persons working on Saturdays as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpsat)		Employed persons working on Saturdays as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpsat)	n.a.	GAP	GAP	(Eurostat, 2024b).
			Employed persons working on Sundays as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpsun)		Employed persons working on Sundays as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpsun)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Working evenings	Employed persons working in the evenings as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpeve)		Employed persons working in the evenings as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpeve)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Working night	Employed persons working at nights as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpnig)		Employed persons working at nights as a percentage of the total employment, by sex, age and professional status (%) (lfsa_ewpnig)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Flexibility of working schedule	Employees by flexibility of their working schedule and educational attainment level (1 000) (lfso_10fvaredu)		Employees by flexibility of their working schedule and educational attainment level (1 000) (lfso_10fvaredu)	n.a.	GAP	GAP	(Eurostat, 2024b).
		Childcare	Population by effects of childcare on employment and educational attainment level (lfso_18stwked)		Population by effects of childcare on employment and educational attainment level (lfso_18stwked)	n.a.	Population by effects of childcare on employment and citizenship (lfso_18stwknat)	Population by effects of childcare on employment and country of birth (lfso_18stwkcb)	(Eurostat, 2024b).
	Time off		Time spent, participation time and participation rate in the main activity by sex and age group (tus_00age)		Time spent, participation time and participation rate in the main activity by sex and age group (tus_00age)	n.a.	GAP	GAP	(Eurostat, 2024b).
			Time spent, participation time and participation rate in the secondary activity by sex and age group (tus_00age2)		Time spent, participation time and participation rate in the secondary activity by sex and age group (tus_00age2)	n.a.	GAP	GAP	(Eurostat, 2024b).
	Satisfaction with time use		Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)		Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)	n.a.	GAP	GAP	(Eurostat, 2024b).

3.1.5 Health

Health is a fundamental aspect of citizens' quality of life and it can also be convisdered as a form of human capital. Poor health not only impacts individual well-being but also hinders societal progress. Long and healthy lives are a near-universal goal and serve as a widely accepted measure of societal well-being. For this reason, they are integrated into key quality of life indices, such as the United Nations' *Human Development Index (United Nations Development Program (UNDP), n.d.)*.

In the European Union, the health dimension of quality of life is assessed through three key sub-dimensions: health outcomes, health drivers and access to healthcare.

Table 14: Eurostat Quality of Life "Health". Source: (Eurostat, 2021).

Dimension	Topic	Subtopic
Health	Outcomes	Life expectancy
		Morbidity and health status
	Drivers: healthy and unhealthy behaviors	
	Access to healthcare	

The Health dimension in this thesis aligns with Eurostat's framework, with one notable addition: the inclusion of **Sexual and Reproductive Healthcare** under the broader category of "Access to Healthcare" (see section 3.1.5.3.

Table 15). The rationale behind this choice is further elaborated in section 3.1.5.3.

Table 15: Health. Source: own elaboration.

Dimension	Topic	Subtopic
Health	Outcomes	
	Drivers: healthy and unhealthy behaviors	
	Access to healthcare	Medical care
		Sexual and reproductive healthcare

3.1.5.1 Health outcomes

Indicators in the **Health Outcomes** category include data on life expectancy (the expected remaining years a person can live from birth or a specific age) and data on morbidity and health status. The latter includes indicators on healthy life years, self-perceived health, self-reported activity limitations due to health issues, and self-reported current depressive symptoms. These metrics are often broken down by sex, age, education level, and income quintile, to highlight disparities within the population. The data for these indicators comes from the European Statistics of Income and Living Conditions (EU-SILC) survey, while infant mortality and life expectancy figures are derived from population statistics based on administrative records. Healthy life years are calculated using both life expectancy data and information on activity limitations collected through EU-SILC(Eurostat, n.d.-a).

3.1.5.2 Health Drivers

The **Health Drivers** topic focuses on behaviors that influence health, both positively and negatively. Indicators include body mass index (BMI), smoking prevalence, alcohol consumption, frequency of physical activity, and fruit and vegetable consumption. These indicators are calculated using data from the European Health Interview Survey (EHIS), which provides harmonized data on health status, lifestyle (health determinants), and healthcare usage across EU member states(Eurostat, n.d.-a).

3.1.5.3 Access to Healthcare

Access to Healthcare is assessed by measuring self-reported unmet medical needs, which may arise due to financial, geographical, or other barriers. This data is broken down by sex, age, educational level, and income quintile to reveal inequalities in access to healthcare services. Data on unmet medical needs is also collected through the EU-SILC survey(Eurostat, n.d.-a).

By using both objective health measures (e.g., life expectancy) and subjective assessments (e.g., self-reported health and access to healthcare), this framework offers a comprehensive understanding of health in Europe. It accounts for the complexity of population health by considering both outcomes and the factors that drive them. Additionally, lifestyle-related risk factors, such as smoking and other hazardous behaviours, are included because of their potential long-term impact on health and, by extension, on the overall well-being of European societies.

For this reason, the *Health* dimension in this thesis framework aligns with Eurostat's framework, with one key addition: the inclusion of **Sexual and Reproductive Healthcare** under the broader category of "Access to Healthcare." Quality sexual and reproductive healthcare, including family planning services, is crucial for sustainable development due to its strong links to gender equality, women's well-being, intergenerational health impacts, and its influence on equitable economic development and environmental sustainability (Starrs et al., 2018).

Access to these services, including family planning, has a vital role in reducing maternal and child morbidity and mortality, preventing unintended pregnancies, and decreasing unsafe abortions (Field et al., 2014). It also plays a vital role in empowering women and girls by enhancing their autonomy in decisions regarding consensual sexual relations, contraceptive use, and access to reproductive healthcare services, all of which are essential for the full realization of their reproductive rights (Starrs et al., 2018).

Beyond the direct benefits to health, well-being, and gender equality, access to sexual and reproductive healthcare services also carries significant environmental implications. The Intergovernmental Panel on Climate Change (IPCC) has highlighted the role of population growth in exacerbating climate change(IPCC, 2014; Dodson et al., 2020). In its mitigation report aimed at limiting global warming to 1.5 °C, the IPCC reported that reducing population growth can lower overall carbon demand, contributing to climate change mitigation (IPCC, 2018; O'Neill et al., 2012). Additionally, the adaptation report identified modern family planning as a key adaptation measure that not only improves health but also curbs emissions by slowing population growth (IPCC, 2014; Patterson et al., 2021).

Growing evidence further suggest that family planning enhances community resilience, enabling populations to better cope with and adapt to the inevitable impacts of global warming (Hardee et al., 2018; Patterson et al., 2019, 2021).

In sum, ensuring access to sexual and reproductive health services is an effective way to foster inclusive, equitable economic development, improve health outcomes across generations, and contribute to climate change mitigation, adaptation, and resilience. Therefore, these services must be accessible and affordable to all individuals, regardless of age, marital status, socioeconomic background, race, ethnicity, sexual orientation, or gender identity (Starrs et al., 2018).

However, discussions around population often evoke a troubling history of racist, classist, and coercive practices. To prevent perpetuating these harmful dynamics, it is crucial to emphasize that decisions regarding whether, when, with whom, and how many children to have should be left entirely to individuals. Upholding human rights and ensuring full bodily autonomy must always be the primary focus, with gender equality as a fundamental objective. Therefore, the environmental benefits of accessible reproductive health services should be recognized as positive outcomes that stem from empowering individuals with agency and choice, rather than as the main motivation for providing these services.

The indicators in this subtopic are derived from Sustainable Development Goals (SDGs) 3 and 5. Specifically, target 3.7.1 aims to ensure universal access to sexual and reproductive healthcare services by 2030, including family planning, information, education, and the integration of reproductive health into national policies and programs (UNDESA, n.d.). Target 5.6 focuses on ensuring universal access to sexual and reproductive health and reproductive rights, as agreed in key international frameworks such as the Programme of Action from the International Conference on Population and Development and the Beijing Platform for Action (United Nations | Department of Economic and Social Affairs, n.d.).

Table 16: Health. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Health	Outcomes		Health status (qol_hlt_st)		Health status (qol_hlt_st)		Health status (mii_hlth_state)	Health status (mii_hlth_state)	(Eurostat, 2024b)
	Drivers		Determinants of health (qol_hlt_dh)		Determinants of health (qol_hlt_dh)		Health determinants (mii_hlth_det)	Health determinants (mii_hlth_det)	(Eurostat, 2024b).
	Access to healthcare	Medical care	Self-reported unmet needs for medical examination by sex, age, main reason declared and educational attainment level (hlth_silc_14)		Access to healthcare (qol_hlt_ca)		Health care (mii_hlth_care)	Health care (mii_hlth_care)	(Eurostat, 2024b)
		Sexual and reproductive healthcare	Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods (SDG 3.7.1)	n.a.	GAP	n.a.	GAP	GAP	(United Nations, 2024).
			Adolescent birth rate (aged 10-14 years; aged 15-19 years) per 1,000 women in that age group (SDG 3.2.1)	n.a.	Adolescent birth rate (aged 10-14 years; aged 15-19 years) per 1,000 women in that age group	n.a.	GAP	GAP	(United Nations, 2024).
			Proportion of women aged 15-49 who make their own informed decisions regarding sexual relations, contraceptive use and reproductive health care (SDG 5.6.1)	n.a.	GAP	n.a.	GAP	GAP	(United Nations, 2024).

3.1.6 Education

Investing in education not only benefits individuals and societies but also has a transformative impact on global sustainability and well-being.

A long tradition of economic research emphasizes the critical role of education in providing the skills and competencies necessary for economic production (Hanushek et al., 2007; Hicks, 1987). However, education enhances overall quality of life, independent of its impact on earnings and productivity (Edgerton et al., 2012; Michalos, 2017; Powdthavee et al., 2015). Numerous studies suggest that the non-monetary benefits of education are at least as significant as the monetary. What researchers in this area have found is that education empowers individuals by equipping them with essential cognitive, social, and emotional skills, leading to better decision-making in areas such as health, marriage, and parenting (Oreopoulos & Salvanes, 2011; Powdthavee et al., 2015). For instance, those with higher levels of education tend to have better mental and physical health outcomes on average ones (Lleras-Muney, 2005; Powdthavee, 2010; Silles, 2009). Additionally, more educated individuals are less likely to experience unemployment, and when they do, they tend to find new employment more quickly (Kettunen, 1997; Mincer, 1991). Education also promotes civic and political engagement, interpersonal trust, and tolerance (Borgonovi & Miyamoto, 2010). All these factors contribute to greater life satisfaction (Edgerton et al., 2012; Michalos, 2017; Ross & Van Willigen, 1997)

These individual benefits extend to society as a whole. Education is widely recognized as the most crucial form of human capital, playing a fundamental role in advancing sustainable development and supporting democratic societies. It serves as a powerful tool for building peaceful, inclusive, and equitable communities. At the EU level, education is increasingly viewed as essential for promoting the Union's core values and fostering a shared sense of belonging among its citizens (Chiarello, 2012).

Moreover, education is at the heart of Sustainable Development Goal 4 (SDG 4), which advocates for inclusive and equitable quality education and lifelong learning opportunities for all. It is seen as a prerequisite for achieving many other SDGs (Eurostat, n.d.-e). Inclusive and equitable education promotes gender equality, diversity, and tolerance, laying the foundation for a more just and sustainable society (Lauder et al., 2006; Lutfiyya & Bartlett, 2020; UNESCO, 2011). For example, time spent in school and early education is positively associated with the successful integration of students from migrant backgrounds (Schneeweis, 2011). Additionally, when education levels rise for girls and young women, awareness and use of contraception typically increase, along with greater political, social, and economic empowerment (Stromquist, 2003; Walker et al., 2019). This not only enables women to achieve economic independence—an essential factor in escaping difficult situations such as domestic violence—but also often leads to a decline in fertility rates, supporting more sustainable population growth (Patterson et al., 2021). These trends have profound implications for global population dynamics and, consequently, for planetary health, as discussed in chapter 3.1.5.

SDG 4.7 specifically emphasizes that education should equip learners with the knowledge and skills needed to promote sustainable development, including education for sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship, and an appreciation of cultural diversity and culture's contribution to sustainable development. This includes integrating an environmental perspective into education, providing students with insights that enable them not only to prevent harmful environmental impacts but also to develop informed opinions on major global environmental issues (Cars & West, 2015; Kopnina & Meijers, 2014; UNESCO, 2011). Education, particularly around science, technology, engineering, mathematics, climate solutions, and sustainable consumption can help to strengthen communities' capacity to support the growth of jobs centred on low-carbon technology and mitigate future emissions (Kwauk & Casey, 2021).

Clearly, education plays a crucial role in enhancing quality of life and supporting sustainable development. To assess the impact of education on quality of life, a broad range of educational indicators are used. The relevance of each indicator depends on a country's stage of development and the specific goals of the evaluation. In the European Union and therefore in Eurostat QoL the indicators used are categorized as is shown in Table 17 and better explained further in this chapter.

Table 17: Eurostat Quality of Life "Education". Source: (Eurostat, 2021).

Dimension	Topic	Subtopic
Education	Competences and skills	Educational attainment
		Self-reported skills
		Assessed skills
	Lifelong learning	
	Opportunities for education	

3.1.6.1 Competences and Skills

The first topic, **Competences and Skills**, focuses on the skills possessed by individuals. Assessing these skills, especially 'soft' skills acquired through social interactions or informal learning outside traditional educational systems, is complex. To achieve a complete understanding, Eurostat's Quality of Life (QoL) framework follows the guidelines of the Eurostat report "Statistical Approaches to the Measurement of Skills" and employs three different approaches:

- **Indirect Measures:** These use formal qualifications as proxies for a certain level of skills. Data is collected from the EU Labour Force Survey (EU-LFS) on the level, field, and orientation of educational attainment (Eurostat, 2016).
- **Self-Reported Measures:** Individuals provide subjective assessments of their skills on digital competencies and foreign language proficiency (Eurostat, 2016).

- **Direct Measures:** These involve direct assessments of skills, such as test scores, which, despite their limitations in scope, are generally more accurate in reflecting people's actual skill levels compared to indirect measures (Eurostat, 2016).

These three approaches are employed to comprehensively assess the impact of education on quality of life, reflected in the following subtopics: **Educational Attainment, Self-Reported Skills, and Cognitive Skills**. This relationship is visually represented in Figure 2, which illustrates how each approach connects to specific sub-topics and their corresponding indicators.

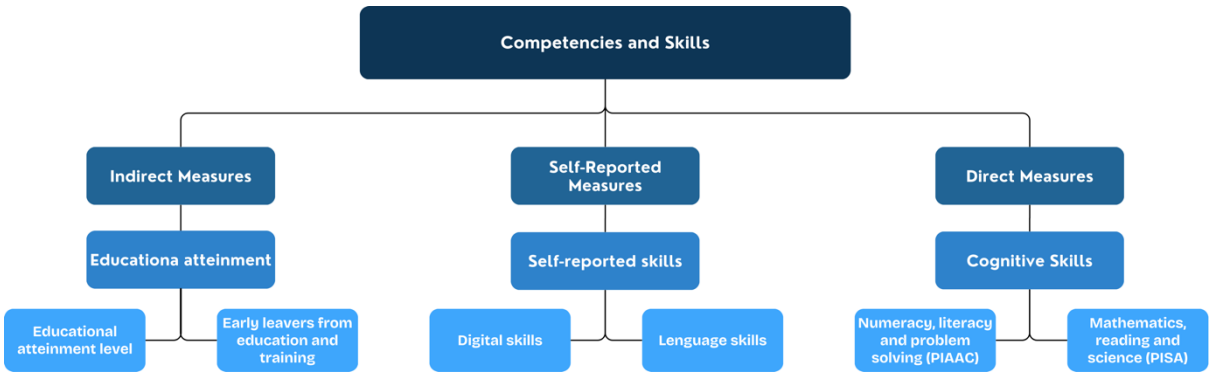

Figure 7: Competencies and Skills *– The figure illustrates the three approaches used to assess individual skills. Each approach is linked to corresponding sub-topics: Educational Attainment, Self-Reported Skills, and Cognitive Skills, and then to their respective indicators.*

The first sub-topic, **Educational attainment**, is an indirect measure of skills, represented by two key indicators sourced from the EU Labour Force Survey:

- *Educational Attainment Level*: This refers to the highest International Standard Classification of Education (ISCED) level successfully completed by an individual, validated by a recognized qualification.
- *Early Leavers from Education and Training*: This measures the proportion of individuals aged 18 to 24 who have attained at most lower secondary education (ISCED 2011 levels 0-2) and have not participated in any education or training in the four weeks preceding the survey.

Higher levels of educational attainment are generally associated with better job prospects and higher income, which positively impact quality of life. Individuals with tertiary education are more likely to secure stable employment, as unemployment rates decrease with higher education levels. Conversely, early school leavers face increased risks of social exclusion, poverty, and reduced civic engagement, as education significantly enhances people’s understanding of the world and their perceived ability to influence it.

Self-reported skills assess the ability to use a computer and the command of a foreign language, that are among the most important competencies in modern economies, not only for the job market but also to take advantage of education, information and cultural opportunities in our increasingly digital and globalised societies.

- **Digital skills** are crucial for sustainable development, driving progress in areas like climate action, education, and poverty reduction. Since digital solutions can directly impact 70% of the 169 SDG targets, enhancing these skills accelerates progress toward the SDGs. Additionally, assessing digital skills across different demographics serves as a key indicator of inclusive digital transformation (ITU & UNDP, 2023). Digital skills indicators are composite measures based on specific activities related to internet or software use, performed by individuals aged 16-74 in four key areas: information, communication, problem-solving, and software skills. It is assumed that individuals who have engaged in certain activities possess the corresponding digital skills, making these indicators a useful proxy for assessing digital competencies. Data on self-reported digital skills are collected through surveys on information and communication technology (ICT) usage in households.
- **Language skills** have become increasingly important in most EU Member States, not only for effective communication but also to facilitate mobility for leisure, study, and work. The EU promotes multilingualism with the goal of enabling all citizens to speak two languages in addition to their mother tongue. Data on self-reported foreign language skills are gathered through the Adult Education Survey (AES) and the EU Labour Force Survey (EU-LFS) module on the labor market situation of migrants and their immediate descendants.

3.1.6.2 Assessed Skills

Although the sub-topic "assessed skills" is included in Eurostat's Quality of Life framework, no corresponding indicators are present in the dataset. Therefore, for the sub-topic of **Assessed Cognitive Skills**, this framework follows the guidelines of Eurostat's report *"Statistical Approaches to the Measurement of Skills"* and the OECD's Well-Being Framework by using direct measurements of skills based on studies conducted by the Organisation for Economic Co-operation and Development (OECD):

- **Programme for the International Assessment of Adult Competencies (PIAAC)**: The primary product of PIAAC is the Survey of Adult Skills, which measures adults' proficiency in literacy, numeracy, and problem-solving in technology-rich environments. Proficiency in each domain is viewed as a continuum of ability, involving the mastery of increasingly complex information-processing tasks. The results are presented on a 500-point scale, with proficiency levels defined by specific score ranges corresponding to the difficulty of tasks within those ranges. The target population for this survey includes adults aged 16-65.

- **Programme for International Student Assessment (PISA)**: PISA assesses the extent to which 15-year-old students, nearing the end of their compulsory education, have acquired basic knowledge and skills necessary for effective participation in modern societies. The skills measured are reading, science, and mathematics. Data are disaggregated by gender, age, and migrant background, with further distinctions between 'first-generation immigrant students' (born abroad) and 'second-generation immigrant students' (native-born with parents born abroad).

These assessments provide valuable insights into the cognitive skills of both adults and students. I have included these measurements in the framework as they could serve as important indicators of potential discrimination in school systems. For instance, results from PISA 2018 show that, in the EU, the risk of underperformance for young people from disadvantaged socio-economic backgrounds is nearly six times higher than for those from more advantaged backgrounds. However, even after accounting for socio-economic background and gender, pupils with a migrant background still perform worse than their non-migrant peers (European Commission, 2019b). Similarly, results from PISA 2022, illustrated in Figure 2, show that the most common pattern of underachievement in mathematics reveals a significant gap between students born abroad and those with a non-migrant background (European Commission, 2024d).

This suggests that students with a migrant background may face additional barriers, potentially due to discrimination in the education system, which can limit their future opportunities both personally and professionally.

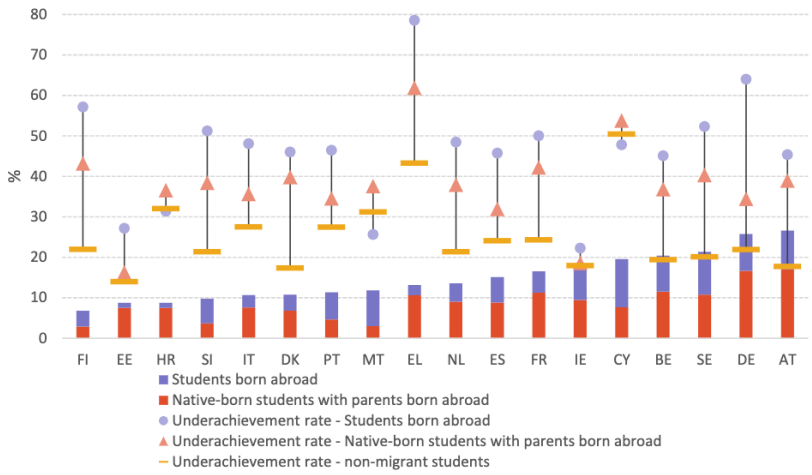

Figure 8: Share of students with a migrant background and underachievement rate in mathematics by migrant background (2022). Notes: Only countries where more than 5% of students have a migrant background are included in the figure. Caution is required when interpreting 2022 data for Denmark, Ireland and the Netherlands because one or more PISA sampling standards were not met (see OECD, 2023 Annexes A2 and A4). Countries are shown in ascending order according to the share of students with a migrant background. Source: figure from European Commission, 2024 with data from OECD, 2023 (Tables I.B1.7.1 and I.B1.7.17).

3.1.6.3 Lifelong learning

The second topic covers **Lifelong learning,** which includes all learning activities undertaken throughout life, beyond the typical age of formal schooling, for personal or professional development. Eurostat's lifelong learning statistics target individuals aged 25 to 64 living in private households, and the indicator measures the percentage of people who reported receiving education or training in the four weeks prior to the survey(Eurostat, 2017). This data is collected through the EU Labour Force Survey (LFS).

Continuous participation in learning activities allows individuals to enhance their knowledge, skills, and competencies, which can be beneficial for career advancement and personal growth. It is important to note that lifelong learning statistics cover both formal and non-formal guided education and training but do not include self-learning activities(Eurostat, 2017). For instance, attending evening or language courses at universities or other institutions, and participating in computer skills courses, are considered lifelong learning. However, activities such as reading a history book or visiting a science museum, while aligned with the concept of lifelong learning, are not included in this statistical measure.

3.1.6.4 Opportunities for Education

The third topic in this dimension focuses on measuring **Opportunities for Education**, with participation in early childhood education serving as a key indicator. This is because early childhood education and care (ECEC) play a crucial role in children's development and well-being. A growing body of research shows that ECEC significantly enhances children's language, cognitive, social, and emotional skills while fostering self-regulation and confidence, which are essential for a smooth transition into primary school (OECD, 2020a, 2021b, 2024a; Shuey & Kankaraš, 2018; Yoshikaw et al., 2016). Moreover, the progress children make in their early years has a lasting impact on their educational attainment, academic performance, well-being, and future earnings (García et al., 2020; Heckman et al., 2019).

Beyond individual benefits, well-designed and high-quality ECEC programs help reduce social inequalities by promoting equitable opportunities among children in the longer term (Duncan et al., 2023; OECD, 2024b). As a result, they can help reduce disparities in academic performance across socio-economic classes and genders, and strengthen social cohesion among children (UNICEF, 2019). Families and society also benefit from ECEC in both the short and long term, through the increased participation of parents, especially women, in the labour market (OECD, 2021b).

For these reasons, the selected indicator for this topic is the participation rate of children aged 3 and above in ISCED level 0 educational programs. This indicator measures the proportion of children between the ages of three and the start of compulsory primary education who participate in early childhood education. The data is sourced from the UIS/OECD/Eurostat (UOE) questionnaires on education statistics, which serve as the primary database for educational data.

The chosen indicator aligns with the guidelines of the Eurostat expert group on Quality of Life indicators (2017). However, it differs from the "Participation/enrolment in education (ISCED 0-4)" indicator used in the Eurostat QoL dataset. The reason of this choice lays in the fact that the indicator used in the dataset is was of the UOE data collection up to 2012. The indicator chosen in this thesis is an updated indicator provides a more current representation of early childhood participation.

Table 18: Education. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Education	Competences and skills	Educational attainment	Population by educational attainment level, sex and age (%) - main indicators (edat_lfse_03)		Population by educational attainment level, sex and age (%) - main indicators (edat_lfse_03)		Population by educational attainment level, sex, age and citizenship (%) (edat_lfs_9911)	Population by educational attainment level, sex, age and country of birth (%) (edat_lfs_9912)	(Eurostat, 2024b).
			Early leavers from education and training by sex and labour status (edat_lfse_14)		Early leavers from education and training by sex and labour status (edat_lfse_14)	n.a.	Early leavers from education and training by sex and country of birth (edat_lfse_02)	Early leavers from education and training by sex and country of birth (edat_lfse_02)	(Eurostat, 2024b).
		Lenguage skills	Number of foreign languages known (self-reported) by sex (edat_aes_l21)		Number of foreign languages known (self-reported) by sex (edat_aes_l21)	GAP	Foreign-born population by level of current skills in the main host country language, sex, age, citizenship and labour status (lfso_21lang03)	Foreign-born population by level of current skills in the main host country language, sex, age, country of birth and educational attainment level (lfso_21lang02)	(Eurostat, 2024b).
		Digital skills	Individuals' level of digital skills (until 2019) (isoc_sk_dskl_i)		Individuals' level of digital skills by sex and age (eq_dskl07)		Individuals' level of digital skills by country of citizenship (eq_dskl09)	Individuals' level of digital skills by country of birth (eq_dskl08)	(Eurostat, 2024b).
		Cognitive skills	PIAAC mean scores in numeracy, literacy and problem solving (presented separately)		PIAAC mean scores in numeracy, literacy and problem solving (presented separately)		PIAAC mean scores in numeracy, literacy and problem solving (presented separately)		(OECD, 2024d)
			PISA mean scores in mathematics, reading and science (presented separately)		PISA mean scores in mathematics, reading and science (presented separately)		PISA mean scores in mathematics, reading and science (presented separately)		(OECD, 2024d)
	Lifelong learning		Participation rate in education and training (last 4 weeks) by sex, age and educational attainment level (trng_lfs_02)		Participation rate in education and training (last 4 weeks) by sex, age and educational attainment level (trng_lfs_02)	n.a.	Participation rate in education and training (last 4 weeks) by sex, age and citizenship (trng_lfs_12)	Participation rate in education and training (last 4 weeks) by sex, age and country of birth (trng_lfs_13)	(Eurostat, 2024b).
	Opportunities for education		Participation in early childhood education by sex (children aged 3 and over) (sdg_04_31)		Participation in early childhood education by sex (children aged 3 and over) (sdg_04_31)	n.a.	GAP	GAP	(Eurostat, 2024b).

3.1.7 Natural and living environment

This dimension examines the influence of the natural and living environment on human well-being. Eurostat (2017) defines the living environment as the surrounding area of one's residence, encompassing access to essential services (such as shops and public transport), recreational facilities (like cinemas, museums, and theatres), and the broader landscape and built environment. The living environment is crucial for people's well-being, inclusion, and sustainability, as it affects both material and non-material aspects of life. It influences economic well-being by shaping people's access to jobs and other opportunities and plays a role in non-economic aspects, such as health, safety, environmental quality, and social connections (OECD, 2020b, 2023a; WHO Regional Office for Europe, 2016).

Environmental conditions directly affect health through factors like air, water, and soil quality, which depend on the presence and concentration of hazardous substances (EEA, 2022). These conditions also indirectly impact health through issues like climate change, biodiversity loss, and natural disasters. Each of these challenges influences the health of ecosystems, with cascading effects on human life (IPBES, 2018). The aesthetic value of the natural environment also holds importance, influencing persona(Balestra & Dottori, 2012)live (Balestra & Dottori, 2012). Access to environmental services, such as clean water and recreational areas, is critical. For instance, proximity to green spaces has been linked to numerous health benefits, including psychological relaxation, stress reduction, increased physical activity, and protection from pollution, excessive heat, and noise (Remme et al., 2021; WHO Regional Office for Europe, 2016).

Measuring the impacts of environmental conditions on well-being is complex due to the varying timescales of these effects and the diversity of individual characteristics, such as location and activity patterns. Moreover, the depth of these relationships is often underestimated because of limitations in scientific understanding and gaps in systematic studies. In recent decades, significant progress has been made in monitoring environmental conditions, thanks to improvements in data collection and the regular tracking of environmental indicators. These advancements have enriched our understanding of the impacts on morbidity and mortality, labor productivity, and the economic costs of issues such as climate change, biodiversity shifts, and natural disasters. Additionally, they have strengthened the right to environmental information. A wide array of environmental indicators now helps to assess the human pressure on the environment and responses from governments, businesses, and households in addressing environmental degradation.

Despite this progress, existing indicators from a quality of life perspective remain insufficient. For example, emissions indicators often focus on aggregate pollutant quantities without considering the proportion of the population exposed to hazardous levels. As suggested by Eurostat (2017), indicators should also capture the number of premature deaths caused by exposure to air pollution, the number of people lacking access to water services and natural environments, and those exposed to dangerous levels of noise and pollution. Moreover, subjective measures, such as people's personal assessments of the environmental conditions in their neighborhoods, are needed. As environmental conditions affect individuals differently, these indicators should include diverse classification criteria to reflect this variability.

Currently, the Eurostat (2021) framework provides a limited view of the 'natural and living environment' dimension. As illustrated in Table 19, this dimension is categorized into three key topics: Pollution, Access to green and recreational spaces, and Landscape and built environment. However, the Eurostat database includes data for only two of these topics—Pollution and Landscape and built environment. Additionally, only three subjective indicators are available:

- Pollution, grime, or environmental problems: population exposed to these issues.
- Noise from neighbors or streets: population reporting disturbances.
- Life satisfaction by domain, including satisfaction with the living environment and recreational green areas.

Unfortunately, the data for green spaces and living environments is outdated, with the latest figures from 2013, rendering it insufficient for up-to-date analysis.

Table 19: Eurostat Quality of Life "Natural and living environment". Source: (Eurostat, 2021).

Dimension	Topic
Natural and living environment	Pollution (including noise)
	Access to green and recreational spaces
	Landscape and built environment

Even the OECD Well-being Framework (2020b) provides a limited view of environmental quality, reporting only two indicators:

- Exposure to air pollution: This measures the share of the population exposed to PM2.5 concentrations above the WHO threshold level of 10 micrograms per cubic meter.
- Access to green space: This tracks the share of the urban population with access to recreational green spaces within a 10-minute walking distance.

To offer a more comprehensive perspective, this chapter aims to expand on the natural and living environment's potential impact on sustainable well-being. The proposed framework categorizes the environment in accordance with the guidelines from the Eurostat Quality of Life Indicators final report (2017) and the OECD Well-being framework (2020b) but also draws from the EEA Zero Pollution Monitoring Assessment (2022c) and the OECD report *Built Environment through a Well-being Lens (2023a).*

The categorization presented in Table 20 shows the broader analysis of environmental impacts on well-being proposed in this thesis. Note that *access to green and recreational spaces* has been placed as a sub-topic under the *landscape and built environment* category. This is consistent with the UN definition (UN, 2021b) and the OECD (2023a) framework, where green spaces are regarded as public spaces integral to the built environment, rather than a standalone topic as seen in the Eurostat framework.

By integrating these insights, the chapter provides a richer, multidimensional approach to understanding the interaction between the living environment and human well-being, aligning with broader sustainability and well-being goals.

Table 20: Natural and living environment. Source: own elaboration.

Dimension	Topic	Sub-topic
Natural and living environment	Environmental quality	Air pollution
		Noise pollution
		Soil pollution
		Access to safe drinking water
		Perceived environmental issues
	Built environment	Transport
		Access to green and recreational spaces

3.1.7.1 Environmental quality

The first topic addresses environmental quality and examines the effects of hazardous chemicals and pollution in the air, water, soil, and noise. This issue is closely aligned with SDG 3.9, which aims to reduce the number of deaths and illnesses caused by hazardous chemicals and pollution in the environment. Additionally, it supports the goals of the Zero Pollution Action Plan, which envisions reducing pollution to levels no longer harmful to human health and ecosystems by 2050.

Pollution is deeply linked to health and quality of life. Reducing pollution protects society's most vulnerable groups—such as children, the elderly, and low-income communities—while also improving the overall well-being of all individuals. Currently, over 10% of premature deaths annually in the EU-27 are linked to environmental pollution. A recent European Environment Agency (EEA) report highlights that pollution from air, hazardous chemicals, radon, UV radiation, and second-hand smoke contributes to over one-tenth of the total cancer burden in Europe (EEA, 2023). Additionally, the full impact of pollution on health may be underestimated, as we currently only measure the effects of a limited number of pollutants and health outcomes.

As mentioned earlier, Eurostat (2017) suggests that environmental indicators from a quality-of-life perspective should capture several key aspects: the number of premature deaths caused by exposure to air pollution, the number of people lacking access to water services and natural environments, and those exposed to dangerous levels of noise and pollution. Additionally, the report emphasizes the importance of capturing people's personal assessments of their environmental conditions. Therefore, the sub-topics in this chapter are structured as follows:

- Air Pollution: This section assesses both exposure to air pollution and its associated mortality rates.
- Noise Pollution: Here, the focus is on exposure to dangerous noise levels and related health outcomes.
- Soil Pollution: While proposed as a potential sub-topic, currently no indicators exist to assess soil pollution.
- Access to Safe Drinking Water: This section addresses the critical issue of ensuring access to clean and safe water.
- Perceived Environmental Issues: This topic complements objective data by incorporating subjective perceptions of environmental quality.

Access to natural environments will be discussed in the subsequent topic titled "Landscape and Built Environment."

Additionally, to assess the impacts of pollution on people's vulnerability and quality of life, two key aspects have been considered based on EEA (2018b) guidelines:

1. **Exposure to Pollution**: Understanding the levels and types of pollutants individuals are exposed to is essential to identify at-risk populations. This also allow to assess disparities, as pollution exposure often varies between regions and social groups. For example, lower socio-economic groups often face greater exposure due to living conditions near industrial sites or busy roads (EEA, 2018b).
2. **Health Outcomes**: Measuring also the health impacts of pollution is particularly important. Vulnerabile groups, such as children and older adults, are more sensitive to pollution and therefore experience more severe health consequences from the same levels of exposure (EEA, 2018b).

3.1.7.2 Air pollution

The first sub-topic addresses air quality, highlighting air pollution as the most significant environmental health threat in Europe. In 2021, exposure to fine particulate matter (PM2.5) and nitrogen dioxide (NO2) exceeding World Health Organization (WHO) recommendations resulted in an estimated 253,000 and 52,000 premature deaths, respectively. More than 70% of EU citizens live in urban areas, where high population density and industrial activities contribute to elevated pollution levels. Pollutants such as particulate matter (PM), ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), and benzo[α]pyrene (BaP) are linked to severe health conditions, including respiratory and cardiovascular diseases, as well as cancer (see Figure 5). Both short- and long-term exposure to these pollutants pose significant health risks.

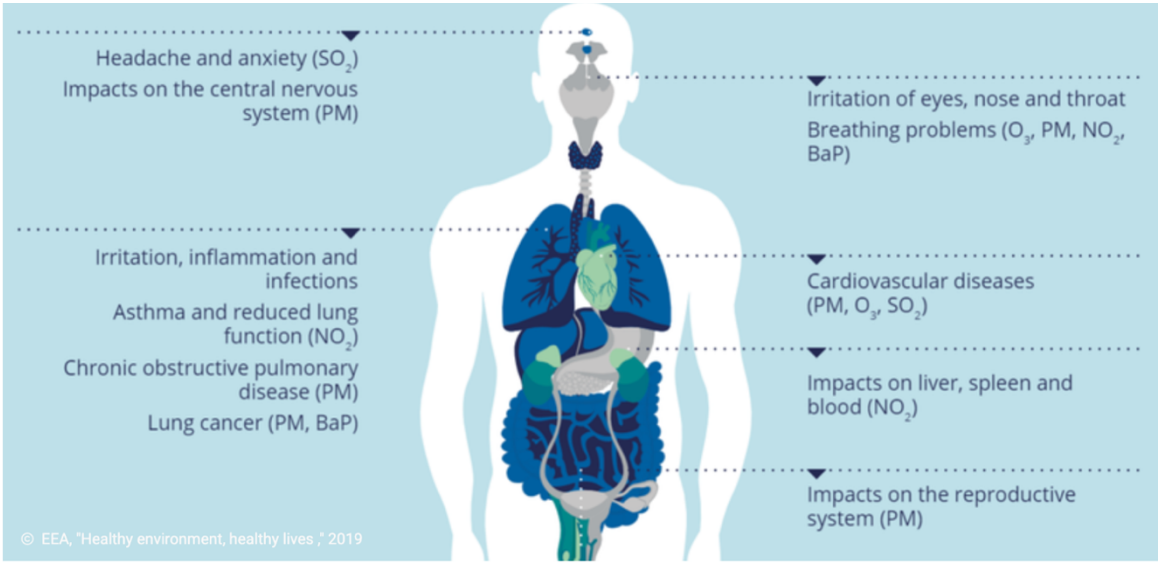

Figure 9: Health impacts of air pollution*. Note: Particulate matter with a diameter of 2.5 µm or less (PM2.5), particulate matter with a diameter of 10 µm or less (PM10), ozone (O3), nitrogen dioxide (NO2), benzo[a]pyrene (BaP) and sulphur dioxide (SO2). Source: (EEA, 2023)*

In addition to its health impacts, air pollution harms ecosystems by degrading air, water, and soil quality and negatively affecting biodiversity. The economic consequences include increased healthcare costs, reduced life expectancy, and lost productivity due to sick leave across various sectors. To tackle these challenges, the EU Ambient Air Quality Directives aim to protect human health, vegetation, and ecosystems by setting limits and target values for key pollutants.

To effectively monitor the impact of air pollution on people's quality of life, it is essential to track both exposure to pollutants and the associated health effects (EEA, 2018a). The first indicator, from the European Environment Agency (EEA) database, is the "*Share of the EU urban population exposed to air pollutant concentrations above EU standards and WHO guidelines*." This indicator shows the fraction of the EU-27 population potentially exposed to ambient concentrations of six key pollutants—PM2.5, PM10, O3, NO2, SO2, and BaP—that exceed either EU limits or the stricter 2021 WHO air quality guideline levels. As illustrated in Figure 6, using WHO guidelines is crucial, as these updated limits are based on the latest scientific evidence and are more stringent than current EU standards. In line with this, the European Green Deal has proposed revising EU air quality standards to better align with these updated WHO guidelines.

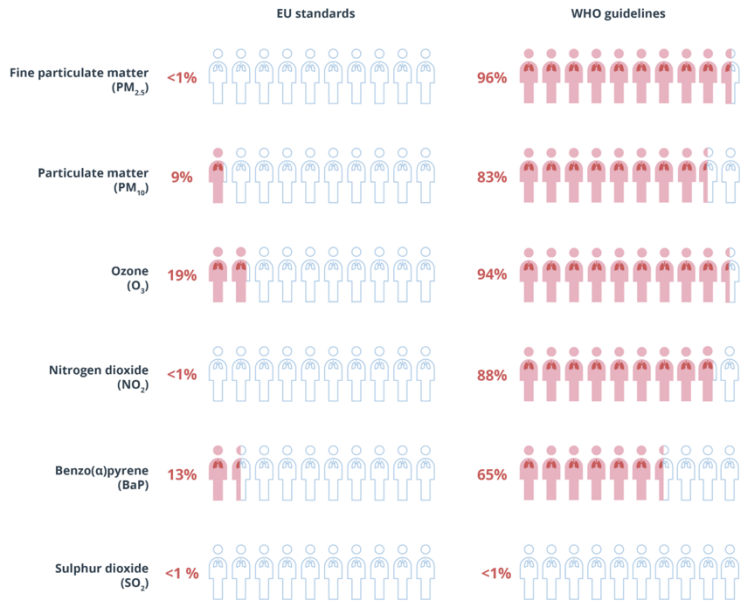

Figure 10: Share of the EU urban population exposed to air pollutant concentrations above certain EU standards and WHO guidelines in 2022. *Notes: Exposure above EU standards: the EU urban population is exposed to PM2.5 annual concentrations above 25µg/m3; PM10 daily concentrations above 50µg/m^3 for more than 35 days per year; O_3 maximum daily 8-hour mean concentrations above 120µg/m^3 for more than 25 days per year; NO_2 annual concentrations above 40µg/m^3; Benzo[a]pyrene (BaP) annual concentrations above 1ng/m^3; and sulphur dioxide (SO_2) daily concentrations above 125µg/m^3 for more than three days per year. Source: (EEA, 2024).*

The second indicator is the EEA's "*Health impacts of air pollution*" indicator, which estimates years of life lost (YLL) and the number of premature deaths due to PM2.5 exposure. Premature deaths refer to deaths occurring before reaching the expected life expectancy, and they are considered preventable if the root causes—such as air pollution—are addressed. The YLL metric quantifies the potential years of life lost due to premature deaths, with greater weight given to deaths at younger ages (EEA, 2018b). This indicator is part of the EU Sustainable Development Goals (SDG) dataset and is used to monitor progress toward achieving SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities).

However, disaggregating these indicators to measure horizontal inequalities—such as differences between men and women, age groups, and educational backgrounds—in relation to air pollution remains a challenge. Nonetheless, regional (subnational) data on air pollution exposure is available and reveals stark inequalities. There is strong evidence linking lower socio-economic status to increased exposure to air pollution. In many parts of Europe, people from lower-income backgrounds are more likely to live near busy roads or industrial zones, where pollution levels are higher. Additionally, the most deprived individuals in society often have poorer health and less access to quality healthcare, exacerbating their vulnerability to air pollution's harmful effects (EEA, 2018c, 2023b, 2024). Regions with lower GDP per capita, particularly in Eastern and South-eastern Europe, tend to have higher levels of PM2.5. This is largely due to the widespread use of low-quality solid fuels (e.g., coal and wood) for domestic heating in inefficient ovens. Consequently, these regions experience higher population exposure to PM2.5, which translates into greater numbers of premature deaths attributable to air pollution (EEA, 2022).

In addition to these socio-economic disparities, air pollution affects different groups in varying ways. Older adults, children, and individuals with pre-existing health conditions are more vulnerable to the health impacts of air pollution (EEA, 2023). Children and adolescents are especially at risk, as their bodies, organs, and immune systems are still developing. Exposure to air pollution during childhood has a negative effect on neural development and cognitive capacities. This can affect performance at school and later in life, leading to lower productivity and quality of life (UNICEF, 2017). Addressing these disparities requires a comprehensive approach that integrates stricter air quality standards with policies that reduce exposure in the most affected communities and prioritize vulnerable groups.

3.1.7.3 Access to safe drinking water

Polluting water bodies with chemicals, nutrients, or bacteria poses serious risks to health and well-being. While access to clean drinking water in Europe is generally high, according to the WHO/UNICEF Water and Sanitation Hygiene (WASH) database, notable disparities persist among specific ethnic and vulnerable groups. For instance, the Roma, the largest ethnic minority in the EU, face significant barriers, with many living in settlements without access to tap water (ERRC, 2017; FRA, 2016). Additionally, migrants and asylum seekers in both formal and informal refugee camps experience limited access to clean drinking water, as highlighted by the United Nations High Commission for Refugees (UNHCR, 2020).

The indicator used to assess access to clean water is SDG Indicator 6.1.1, which measures the *proportion of population using safely managed drinking water services*. A safely managed drinking water service is defined as an improved water source that is located on premises, available when needed, and free from faecal (E.coli or thermotolerant coliforms) and priority chemical contamination (from arsenic and fluoride) (EEA, 2022b). Ensuring access to safe and clean water is critical for preventing waterborne diseases and promoting overall environmental health.

This indicator is used to track progress towards Sustainable Development Goal 6 (SDG 6), which seeks to ensure the availability and sustainable management of water and sanitation for all (UN, 2022). Specifically,w hile Target 6.1 focuses on universal access to safe drinking water, Target 6.2 emphasizes sanitation and hygiene. Access to sanitation and hygiene has been covered in the *Housing* chapter.

Furthermore, the EU 2020 revised Drinking Water Directive emphasizes improving access (EP & Council, 2020)er for all (EP & Council, 2020). The impact assessment that supported the revision of the directive estimated that, without further action, more than 100 million EU citizens could face long-term health risks from polluted drinking water by 2030. The level of risk varies across Member States, with the populations most at risk ranging from 13%-14% in Cyprus and Slovenia to 29%-31% in Belgium, Finland, Latvia, Malta, and Romania (EC, 2018).

3.1.7.4 Soil pollution

Human exposure to soil pollution is estimated to contribute to more than 500,000 premature deaths globally each year (Landrigan et al., 2018). Many of these deaths occur within vulnerable groups, such as children and the elderly, who are disproportionately affected by long-term exposure to contaminated soils. Furthermore, this estimate only accounts for a limited range of pollutants; the full impact of soil contamination on health and well-being is likely even greater.

Soil pollutants can harm various organs and systems, including the lungs, skin, gut, liver, and kidneys, depending on the chemicals involved. They may also affect the immune, reproductive, nervous, and cardiovascular systems. Poorer households are often more affected by soil pollution, as they are more likely to live near industrial sites or in areas with contaminated soils (Morrens et al., 2012; Levasseur et al., 2021). Emerging contaminants such as per- and polyfluoroalkyl substances (PFAS), phthalates, and flame retardants have been associated with significant health risks (Maddela et al., 2022).

Hotspots for human exposure to soil pollution include contaminated industrial sites, certain agricultural and urban soils, and areas that have previously experienced flooding. In Europe, many contaminated sites remain unregistered, uncharacterized, unmonitored, and unremediated, continuing to pose significant risks to human health.

Currently, there is no widely accepted indicator for soil quality that directly links soil pollution to health outcomes. This absence is due to the complexity of establishing a direct relationship between exposure to soil contaminants and specific diseases (Filippelli et al., 2020). Soil pollution tends to have long-term impacts, and several factors influence the extent of health risks associated with exposure, including:

- Type and concentration of contaminants: Humans are often exposed to multiple contaminants over time. The specific combinations of pollutants, which can have synergistic, antagonistic, or additive effects, vary throughout life.
- Routes of exposure: People may be exposed to contaminants through inhalation, ingestion, or dermal absorption, often occurring simultaneously.
- Source media of exposure: Soil contaminants can reach humans via soil, dust, air, water, or food, either separately or in combination.
- Individual vulnerabilities and community-specific factors: Those with pre-existing illnesses, as well as vulnerable individuals such as fetuses, neonates, and children, are more sensitive to the effects of soil pollution. Certain communities face higher risks due to socio-economic status and proximity to pollution sources.

Developing an appropriate indicator for soil quality is critical to assessing quality of life and addressing environmental justice. Ethnic minorities and socio-economically disadvantaged populations are often more likely to live near contaminated sites, such as landfills and industrial areas, where the health risks are higher. A comprehensive soil quality indicator could help identify at-risk populations, monitor pollution levels, and inform policies to mitigate the health impacts of soil contamination.

3.1.7.5 Noise pollution

The fourth sub-topic of the Pollution category addresses noise pollution, which significantly impacts both physical and mental health. While transport-related noise levels are generally too low to cause direct hearing damage, long-term exposure to noise above certain thresholds can lead to a variety of non-auditory health effects, such as annoyance, sleep disturbances, and adverse effects on the cardiovascular and metabolic systems, as well as cognitive impairment in children (WHO Regional Office for Europe, 2018). In response, the European Commission's Zero-Pollution Ambition aims to reduce the number of people chronically disturbed by transport noise by 30% by 2030, compared to 2017 (European Commission, 2021e).

To assess noise pollution, two main indicators are used, based on data reported by EU Member States in accordance with the Environmental Noise Directive (END, 2002/49/EC), which is the primary EU instrument for identifying noise pollution levels and initiating necessary actions at both the national and EU levels (European Commission, 2002). The data collected covers the population exposed to noise above END thresholds—specifically, noise levels of 55 dB or higher during the day-evening-night period (Lden) and 50 dB or higher at night (Lnight)—from the following noise sources:

- Roads with more than 3 million vehicle passages per year,
- Railways with more than 30,000 train passages per year,
- Airports with more than 50,000 aircraft movements per year,
- And all roads, railways, airports, and industries located in urban areas with more than 100,000 inhabitants.

The first indicator provides an overview of the estimated number of people exposed to environmental noise above these thresholds in both urban and non-urban areas.

The second indicator estimates the number of people highly annoyed and highly sleep disturbed by noise from road, rail, and air traffic. These outcomes are some of the most prevalent effects of noise pollution. Exposure-response functions for high annoyance and sleep disturbance, outlined in the WHO Environmental Noise Guidelines for the European Region (2018), are used to calculate these estimates. However, these estimates are calculated based on the adult population (age 17+), as the exposure-response functions used in these models are drawn from adult data and are not applicable to children.

It is important to note that the END thresholds (55 dB Lden and 50 dB Lnight) are higher than the WHO-recommended levels, meaning that more people may be exposed to harmful noise levels than what is reported using these thresholds.

The reporting under the END began in 2005, with Member States required to submit noise exposure data every 5 years (in 2007, 2012, 2017, and 2022). However, since countries use various methods to calculate noise maps, the comparability of data across countries and years can be limited, meaning that trends should be interpreted with caution (EEA, 2024b).

To complement the objective indicators on noise pollution, a third indicator provides a subjective measure of noise pollution. This indicator, part of Eurostat's Quality of Life dataset, is based on self-reported noise disturbance collected through the EU-SILC survey. It captures individuals' perceptions and experiences of noise in their immediate surroundings, adding a personal perspective to the overall assessment of noise pollution (Eurostat, 2017).

This indicator is also included in the EU SDG dataset to track progress towards SDG 11.2, which focuses on improving access to safe, affordable, and sustainable transport while minimizing environmental impacts like noise pollution, especially in urban areas. Including subjective data on noise pollution helps to evaluate its impact on quality of life, as it reflects not just exposure but how people feel and react to noise in their environments (UN, 2022).

3.1.7.6 Perceived environmental issues

This sub-topic provides an overall subjective measure of pollution and environmental quality by collecting personal assessments and perceptions of environmental conditions in people's neighborhoods. Such personal insights are essential to complement objective data, offering a fuller picture of how local environmental factors influence well-being (Eurostat, 2017).

The primary indicator used for this measure is based on self-reported exposure to pollution, grime, or other environmental issues, gathered through the EU-SILC survey. This survey captures people's experiences and feelings about their immediate environment, providing valuable insights into environmental quality. It is particularly important in reflecting local environmental conditions that may not be captured through traditional objective measures, especially in communities facing environmental injustices.

This indicator is especially relevant for marginalized social groups, who are often pushed to live in degraded or unhealthy areas. Populations from lower socio-economic backgrounds, ethnic minorities—such as Roma communities—and migrants are typically more exposed to environmental hazards (EEA, 2024). Unfortunately, there is no disaggregation of the data by factors like socio-economic status or ethnicity, making it difficult to fully understand how these groups are disproportionately affected by environmental problems. Addressing this gap is crucial to better targeting policies aimed at reducing environmental inequalities and promoting environmental justice.

3.1.7.7 Landscape and built environment

The built environment plays a significant role in shaping nearly every aspect of our lives, as highlighted in the OECD (2023a) report, *"Built Environment through a Well-being Lens."* Recognizing its importance, the European Commission committed in 2020 to introduce a sustainable built environment strategy, stating that the built environment "encompasses everything people live in and around, including housing, transport infrastructure, service networks, and public spaces" (European Commission, 2023).

In line with this definition and OECD (2023a) approach, the built environment is divided into two sub-topics: transport and access to green and recreational spaces. These are components of the built environment key to people well-being and environmental sustainability. The Housing dimension has already been discussed in chapter 3.1.2, while essential service networks such as energy and water supply are addressed in the Housing affordability and Access to safe drinking water chapters respectively.

These topics align with Sustainable Development Goal (SDG) 11, which aims to "make cities and human settlements inclusive, safe, resilient, and sustainable." Specifically, SDG 11.2 focuses on ensuring access to safe, affordable, and sustainable transport systems for all, while SDG 11.7 emphasizes providing universal access to safe, inclusive, and accessible green spaces, particularly in urban areas (UN, 2022).

3.1.7.8 Transport

Transport plays a crucial role in connecting people to jobs, education, and social activities, making it essential for both individual and collective well-being. Effective transport systems create numerous opportunities, but when poorly planned, they can worsen inequalities, increase social exclusion, and negatively impact health and safety through traffic accidents and air pollution. Moreover, transport is a significant contributor to climate change, emitting large amounts of greenhouse gases (GHG) and causing habitat loss (OECD, 2019). The European Green Deal's goal of cutting transport-related emissions by 90% by 2050, advancing cleaner, sustainable mobility options like electric public transport (European Commission, 2021d).

A well-designed renewable energy-powered public transport system, such as electric buses and trains, provides a cost-effective alternative to private vehicles, helping to reduce both transportation expenses and emissions (Welle et al., 2023). This solution becomes even more critical given the global energy crisis and rising fossil fuel prices, which have significantly increased transport costs. Low-income households and rural communities are disproportionately affected, as they already allocate a larger portion of their income to transport fuels, heightening the risk of transport poverty (Ari et al., 2022; Kiss, 2022; OECD, 2021c).

Additionally, as the EU pushes toward net-zero emissions, addressing these transport challenges becomes even more urgent. Policies such as the EU Emissions Trading System (ETS) and the Energy Taxation Directive (ETD) implement carbon pricing mechanisms to reduce emissions (European Commission, 2021a, 2021c). However, these measures risk disproportionately affecting vulnerable populations who rely on fossil fuel-powered vehicles and lack access to affordable public transport or clean energy alternatives.

Many underserved communities face transport inequalities, including poor infrastructure, unreliable public services, and limited vehicle ownership. These barriers restrict access to essential services, particularly in low-income neighborhoods, where transport options are scarce, roads are poorly maintained, and connections to jobs are unreliable (OECD, 2018a, 2018b) Furthermore, women are disproportionately impacted by inadequate and unsafe transport infrastructure, which negatively affects their economic opportunities and well-being compared to men (OECD, 2021a).

In this context, it is critical to track and ensure the accessibility and affordability of transport systems for all. SDG indicator 11.2.1, selected for this framework, measures the convenience of access to public transport. Public transport is considered convenient if stops are located within 500 meters for low-capacity systems (e.g., buses) and 1 km for high-capacity systems (e.g., metro, rail). The indicator also emphasizes that transport must be accessible to all, including those with physical and visual impairments, and must offer frequent service in safe and comfortable environments (UN, 2021a).

While these data are helpful for assessing accessibility, there is a need for internationally comparable data on other crucial aspects, such as affordability, comfort, safety, sustainability, and inclusiveness. Smart mobility systems, which leverage information and communication technologies (ICT) to enhance transport convenience, can help address these gaps (OECD, 2023a). By generating real-time data on travel conditions, user preferences, and service quality, these systems enable the development of new indicators that assess safety, comfort, and accessibility for all population segments.

3.1.7.9 Access to green and recreational spaces

Urban green and blue spaces, such as parks, urban forests, tree-lined streets, riverbanks, and coastlines, provide significant benefits to local communities. These spaces not only improve air quality, reduce noise pollution, and enhance biodiversity but also help regulate urban temperatures by offering shaded and cooler areas, particularly during hot periods (Romanello et al., 2021; Zulian et al., 2024). They are valuable for physical exercise, social interaction, and mental relaxation, offering critical health benefits such as reducing mortality, lowering the incidence of chronic diseases, improving mental health, and reducing obesity (EEA, 2020).

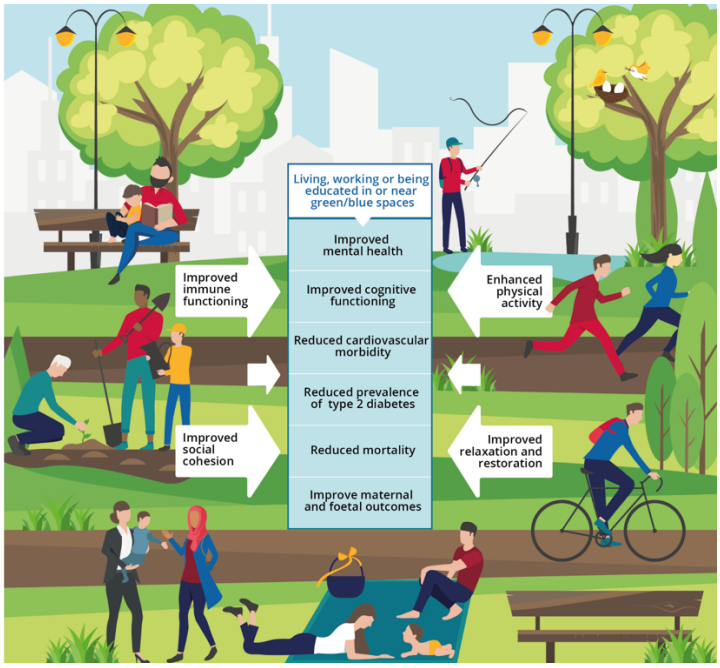

Figure 11: Health and well-being benefits of urban green space. Source:(EEA, 2020).

Beyond these health benefits, urban green spaces are increasingly recognized in international frameworks and European policies as key contributors to sustainability and well-being. The United Nations' Sustainable Development Goal 11.7 promotes universal access to safe, inclusive, and accessible green spaces (UN, 2015). Similarly, the EU's 2030 Biodiversity Strategy encourages bringing nature back into cities by creating biodiverse and accessible green infrastructure (EC, 2020). The role of nature-based solutions for climate resilience has also been recognized in the EU Strategy on Adaptation to Climate Change (EC, 2021a), with an earlier Green Infrastructure Strategy emphasizing the potential of green spaces to reduce social isolation and strengthen communities (EC, 2013). Cities that have signed the Green City Accord, a European Commission initiative, pledge to enhance urban biodiversity by increasing both the quantity and quality of green spaces (EC, 2021b).

Urban green spaces are especially beneficial for vulnerable groups. For children, access to green areas supports their physical and mental development, while the elderly experience improved physical health and social well-being. In cities like Berlin, London, and Sheffield, urban green spaces have been found to foster social inclusion, providing spaces where migrants and asylum seekers can connect with others (Rishbeth et al., 2019).

However, access to green spaces is often unequal within cities. Neighborhoods with lower socio-economic status or a higher proportion of immigrants and ethnic minorities tend to have less access to high-quality green and blue spaces than more affluent areas (de Sousa Silva et al., 2018; EEA, 2022). Vulnerable groups, such as children with disabilities or the elderly, may not use green spaces due to a lack of essential facilities like seating, toilets, and drinking fountains (Artmann et al., 2017; Lynch et al., 2020). Gender also plays a significant role in access, with studies from Sweden showing that while women value green spaces more than men, they often feel less safe in certain areas, which reduces their usage (Fredman et al., n.d.; Ode Sang et al., 2020).

Despite the recognition of these challenges, there is limited guidance on ensuring equal access to high-quality green spaces for different socio-economic and demographic groups. Recently, the '3-30-300 rule' has been proposed, advocating that everyone should be able to see at least three trees from their home, every neighborhood should have 30% tree cover, and there should be a green area of 1 hectare within 300 meters (Konijnendijk, 2021).

To monitor access to green spaces, the OECD (2020b) framework utilizes the indicator "Percentage of the urban population with access to recreational green space within 10 minutes walking distance from their home," sourced from geospatial data in the OECD How's Life? Well-Being database. Unfortunately, data for this indicator is currently unavailable, which limits its utility for tracking the proximity of green spaces in urban areas. Furthermore, while this indicator provides valuable insights into proximity, it does not assess the quality, accessibility, or usability of these spaces for different demographic groups.

In addition to proximity, an indicator from Eurostat—*satisfaction with green and recreational places*—could complement the proximity measure by providing a subjective assessment of people's experiences with green spaces, serving as a proxy for the quality and usability of such areas. However, the available data for this Eurostat indicator is also limited, with data only recorded for the year 2013. Both indicators are included in the framework, but to make them fully operational, they would require more recent data.

Table 21: Natural and living environment. Source: own elaboration.

Dimension	Topic	Sub-Topic	No disaggregation available	Gender		Age		Migration status		Source
				women	men	youth	elderly	citizenship	country of birth	
Natural and Living Environment	Environmental quality	Air quality	Share of the EU urban population exposed to air pollutant concentrations above EU standards and WHO guidelines	GAP		GAP	GAP	GAP	GAP	(EEA, 2024a).
			Health impacts of air pollution (hlth_cd_iap)	GAP		GAP	GAP	GAP	GAP	(Eurostat, 2024b).
		Access to safe drinkable water	Population using safely managed drinking-water services (%)	GAP		GAP	GAP	GAP	GAP	(United Nations, 2024).
		Soil pollution	GAP							
		Noise pollution	Estimated number of people exposed to unhealthy noise levels, based on END thresholds (millions)(%)	GAP		GAP	GAP	GAP	GAP	(EEA, 2024a).
			Estimated number of people highly annoyed and highly sleep disturbed by noise from road, rail and air traffic based on END thresholds (millions)	GAP		GAP	GAP	GAP	GAP	(EEA, 2024a).
				Noise from neighbours or from the street by level of disability (activity limitation), sex and age (hlth_dhc110)		Noise from neighbours or from the street by level of disability (activity limitation), sex and age (hlth_dhc110)	GAP	GAP	GAP	(Eurostat, 2024b).
		Perceived environmental issues		Pollution, grime or other environmental problems by level of disability (activity limitation), sex and age (hlth_dhc120)		Pollution, grime or other environmental problems by level of disability (activity limitation), sex and age (hlth_dhc120)	GAP	GAP	GAP	(Eurostat, 2024b).
	Built environment	Access to green and recreational spaces	Share of the urban population with access to recreational green space within 10 minutes' walking distance	GAP		GAP	GAP	GAP	GAP	(OECD, 2024d).
				Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)		Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)	GAP	GAP	GAP	(Eurostat, 2024b).
		Transport		SDG 11.2.1: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities		SDG 11.2.1: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities	GAP	GAP	GAP	(United Nations, 2024)

3.1.8 Safety

This dimension focuses on safety, defined as freedom from harm, whether that harm arises from crime, conflict, violence, terrorism, accidents, or natural disasters. This interpretation aligns with the OECD (2020b) *Safety* dimension but differs from the Eurostat framework by excluding economic security.

Table 22: Eurostat Quality of Life "Economic and physical safety". Source:(Eurostat, 2021)

Dimension	Topic	Sub-topic
Economic and physical safety	Economic security and vulnerability	Wealth (assets)
		Debt
		Income insecurity (including job)
	Physical and personal security	Crime
		Perception of physical safety

As outlined by OECD (2020b), safety indicators should capture a variety of crimes and offenses experienced by individuals. These include property crimes (e.g., car theft, burglary), contact crimes (e.g., assault, mugging, domestic violence), and non-conventional crimes (e.g., hate crimes, emotional abuse, corruption, money-laundering, terrorism). Other threats that jeopardize people's safety include traffic accidents, natural disasters, and conflicts such as wars. However, the inconsistency in data sources and approaches across different countries' criminal legislation makes it challenging to create a consistent and internationally comparable definition for various criminal acts.

The OECD (2020b) framework proposes three main indicators: homicide rates, feelings of safety at night, and road death rates. These indicators are considered in the framework, but the analysis has been expanded. This thesis' framework includes additional topics such as gender-based violence against women, aligning with SDG 5, and natural disaster risk, which aligns with SDG 1, SDG 11, and SDG 13.

Table 22 outlines the revised categories in the framework, reflecting an approach that emphasizes both personal safety and sustainable development.

Table 23: Safety. Source: own elaboration.

Dimension	Topic
Safety	Crime
	Perception of physical safety
	Gender-based violence
	Disasters
	Road deaths

3.1.8.1 Crime

According to the OECD (2020b), an ideal set of indicators for measuring crime should extend beyond homicides to include non-conventional crimes such as hate crimes, emotional abuse, corruption, money laundering, and terrorism. These types of crimes often disproportionately affect vulnerable communities and are crucial for capturing the full scope of threats to personal safety. In this framework, crime is measured using the same indicator employed in the Eurostat Quality of Life framework: "Police-recorded offences by offence category." This indicator reports on 21 distinct crime categories, classified according to the International Classification of Crime for Statistical Purposes (ICCS). By offering a broader classification, it provides a more comprehensive overview of criminal activity than the OECD (2020b)'s narrower focus on homicides, which represent only a small fraction of total crime (Eurostat, 2017). The inclusion of various offense categories enhances the ability to assess the prevalence and diversity of criminal acts, offering a more complete understanding of crime's impact on society. However, it is important to note that hate crimes are not included in this classification, despite their significance in tracking violence driven by discrimination and hostility towards specific groups.

As stated in an ideal set of indicators for measuring crime should also include, other than homicides, non-conventional crimes such as hate crimes, emotional abuse, corruption, money-laundering, and terrorism. These forms of crime often have a profound impact on vulnerable communities and are critical to capturing the full scope of threats to personal safety. Therefore, Crime is measured in this framework using the same indicator employed in the Eurostat Quality of Life framework: "Police-recorded offences by offence category". This indicator reports 21 distinct categories of crimes, classified according to the International Classification of Crime for Statistical Purposes (ICCS). This broader classification provides a more comprehensive view of crime compared to the OECD's focus on homicides, as homicides represent only a small portion of the total spectrum of crimes (Eurostat, 2017). By including a wider range of offenses, this indicator better captures the prevalence and variety of criminal activity, offering a more complete picture of crime's impact on society. However, hate crime is not included and this is instead important for tracking violence based on discrimination and hate towards specific groups.

3.1.8.2 Feelings of safety

While actual crime rates are important, the perception of safety plays a critical role in subjective well-being. People's feelings of physical insecurity often affect their quality of life more than actual threats. For instance, homicides account for only a small percentage of deaths, yet the emotional impact on communities is profound, affecting not just the victims' loved ones but also others in the area who begin to feel insecure. As a result, the subjective perception of crime magnifies the social impact of crime far beyond its physical effects (Eurostat, 2017).

Thus, it is important to include subjective indicators of safety, such as:

- *Perception of crime, violence, or vandalism in the area*: This is a subjective indicator sourced from the EU-SILC survey, which assesses whether respondents feel that crime, violence, or vandalism is a problem for their household. It is equivalent to the indicator used in the EU SDG dataset for assessing progress on SDG 16.1, but with different disaggregation.
- *Feeling safe at night*: This indicator, sourced from the OECD Current Well-Being Database, is based on a Gallup World Poll survey question: "Do you feel safe walking alone at night in the city or area where you live?". The data is based on representative national samples and is also used as a proxy for UN Indicator 16.1.4, which measures the proportion of the population that feels safe walking alone after dark (UN, 2022).

The interaction between the perception of crime and its actual prevalence is complex. For example, people may feel unsafe walking at night in an area despite the actual crime rate being low. Conversely, neighborhoods with a high perception of danger may see behavioral changes—such as people avoiding going out after dark—that lead to a reduction in crime incidents. Thus, measuring both objective crime data and subjective feelings of safety is essential to fully understand how crime affects quality of life (Eurostat, 2017).

3.1.8.3 Gender-based violence against women

Gender-based violence refers to violence directed at a person because of their gender or violence that disproportionately affects individuals of a particular gender (Council of Europe, 2011). According to the EU Gender Equality Strategy 2020-2025, gender-based violence remains one of the most significant challenges facing society today. This violence is rooted in gender inequality, with women and girls—across all ages and backgrounds—being most affected. Violence against women is recognized as a violation of human rights and a form of discrimination. Gender-based violence takes many forms, including:

- Physical violence: This results in injuries, distress, and health problems, and can sometimes lead to death. Forms include beating, strangling, pushing, and the use of weapons. In the EU, 31% of women have experienced physical violence since the age of 15.
- Sexual violence: This involves non-consensual sexual acts, including rape, trafficking, and other acts against a person's sexuality. It is estimated that 5% of women in the EU have been raped since the age of 15.
- Psychological violence: This includes behaviors such as coercion, controlling behavior, and emotional abuse. About 43% of women in the EU have experienced some form of psychological violence from an intimate partner.

This topic is measured using the indicators from the *Gender-based violence against women (GBV)* database, sourced from the EU Survey on Gender-Based Violence Against Women and Other Forms of Interpersonal Violence (EU-GBV). The indicators in the database are grouped into the following categories:

- Violence by intimate partner during lifetime (gbv_ipv)
- Violence by non-partner since the age of 15 (gbv_npv)
- Violence by domestic perpetrator during adulthood (gbv_dv)
- Violence by any perpetrator during adulthood (gbv_any)
- Sexual harassment at work during lifetime (gbv_shw)
- Experiences on stalking (gbv_st)
- Sexual violence experienced in childhood (gbv_ch)
- Awareness of support services (gbv_awr)

The majority of the indicators in the *dataset* are disaggregated by age and country of birth. Therefore, in this framework, the entire database has been categorized under the columns "woman," "age," and "country of birth" to maintain simplicity in reporting. However, it is important to note that not all datasets within the database are disaggregated. For example, the *awareness of support services (gbv_awr)* is not disaggregated by any demographic factors.

3.1.8.4 Natural disasters

Extreme weather events pose significant risks to nature, buildings, infrastructure, and human health. In recent years, Europe has experienced an increase in the frequency and severity of weather and climate-related natural hazards, such as droughts, forest fires, heatwaves, storms, and heavy rainfall. Climate change is expected to further intensify these events, making them more frequent and severe (EEA, 2024a; European Commission, 2019a).

Extreme temperatures particularly affect the health of vulnerable groups, but they also disturb sleep patterns for the general population. The rising heat is leading to the drying up of rivers and lakes, impacting ecosystems and all life that depends on them. At the same time, soils are becoming drier, which increases the risk of wildfires and reduces agricultural productivity, threatening food security (EEA, 2024a).

Conversely, other regions of Europe are witnessing intense downpours, which often lead to flash floods that can damage buildings, infrastructure, and property within minutes. Coastal areas are also at higher risk due to storm surges, which lead to flooding of buildings and agricultural lands. Furthermore, increasing wind speeds are resulting in accidents and severe damage to property, while some parts of the continent experience extreme cold spells, adding to the complexity of the climate crisis (EEA, 2024a).

To monitor and assess these impacts, this section uses SDG Indicator 13.1.1 (also known as 11.5.1 and 1.5.1) to track the number of people who have died, gone missing, or been directly affected by disasters per 100,000 people. In this context, "directly affected" refers to individuals who have suffered injury, illness, or other health impacts, or those who have been evacuated, displaced, relocated, or experienced damage to their livelihoods, economic assets, and physical or social infrastructure(UN, 2023a).

This indicator contributes to monitoring progress towards SDG 1 (No Poverty), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

3.1.8.5 Road deaths

Tracking road safety is crucial not only for ensuring people's well-being but also as a measure of the overall safety and sustainability of transport systems. This complements the "transport" sub-topic of the "natural and living environment" dimension, which primarily focuses on accessibility. By introducing an additional focus on safety, we gain a more comprehensive understanding of how transport systems affect both public health and the environment. Road deaths serve as a key indicator of how well transport policies and infrastructure protect citizens. High numbers of fatalities often reveal systemic weaknesses, such as inadequate infrastructure or poor urban planning that compromises pedestrian and cyclist safety. For instance, the trend in the number of cyclists killed on EU roads is a serious concern: more than 2,000 cyclists were killed in 2022 (European Commission, 2024a).

In the context of climate mitigation strategies, ensuring road safety becomes even more important. Policies aimed at promoting electric vehicles (EVs) and green public transport are focused on reducing emissions but can also introduce new road safety risks. For example, while EVs reduce both noise pollution and greenhouse gas emissions, their quiet operation can present challenges, as vulnerable groups like children, the elderly, and the visually impaired may be less aware of their presence, heightening risks (EEA, 2018; Pardo-Ferreira et al., 2020). These issues highlight the need for policies that balance environmental sustainability with public safety considerations.

Conversely, strategies that reduce reliance on cars and incorporate traffic calming measures can advance both climate go(Balant & Lep, 2020)objectives (Balant & Lep, 2020). This aligns with the EU's Vision Zero strategy, which aims to eliminate road deaths by 2050. This strategy integrates both emission reduction and road safety measures to create a framework that prioritizes sustainable and safe transport systems. Key components of this strategy include reducing vehicle speeds, promoting public transport use, and expanding cycling and walking infrastructure. These measures not only lower traffic fatalities but also reduce emissions, creating safer, greener urban spaces. The EU promotes initiatives such as low-emission zones, 30 km/h zones, and smart mobility solutions to meet these goals (CINEA, 2022; European Commission, 2021b).

In this framework, the two indicators used track the number of persons killed in road accidents by age, sex, and category of persons involved (pedestrians, drivers, passengers), and the persons killed in road accidents by type of vehicle. Disaggregating data on road deaths by road user group, demographics, and type of vehicle is important to identify the most vulnerable. To illustrate, men accounted for three out of four road deaths (77%). Older people, aged 65+, are at greater risk, representing 29% of all road deaths while accounting for only 21% of the population. Similarly, young people aged 18-24 accounted for 12% of road deaths but make up just 7% of the population (European Commission, 2024a).

Additionally, car occupants (drivers and passengers) represented 45% of all fatalities, while pedestrians accounted for 18%, users of powered two-wheelers (motorbikes and mopeds) 19%, and cyclists 10%. The patterns change significantly depending on age. Among those aged 65+, pedestrians represented 29% of fatalities, and cyclists accounted for 17% (European Commission, 2024a). These figures underline the need to adjust transport safety strategies to protect the most vulnerable populations. Figure 8 shows the 2022 collision matrix detailing the main vehicles involved in fatal road crashes.

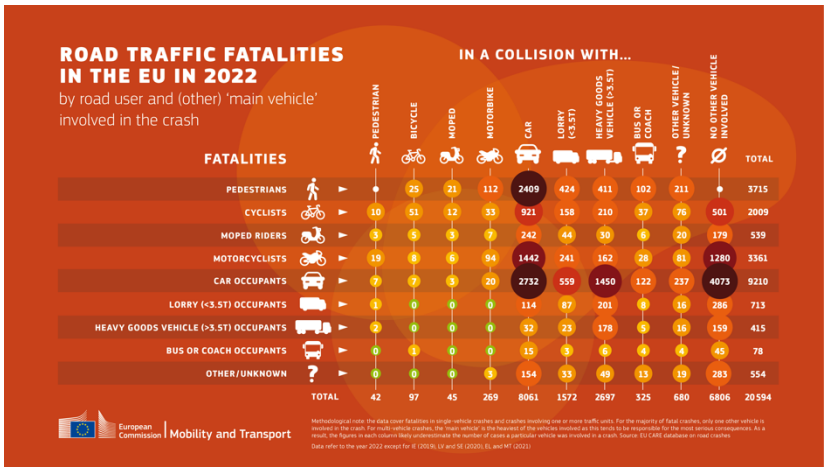

***Figure 12**: 2022 collision matrix showing the road traffic fatalities in the EU in 2022 by road user and (other) 'main vehicle' involved in the crash. Source:(European Commission, 2024a).*

Ultimately, measuring road safety helps ensure that both environmental goals and public health outcomes are aligned. It supports safer, more inclusive urban mobility and contributes to global efforts such as SDG 3.6, which aims to halve road deaths by 2030 (UN, 2015).

Table 24: Safety. Source: own elaboration.

Dimension	Topic	No disaggregation available	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Safety	Crime and violence	Police-recorded offences by offence category (crim_off_cat)	GAP		GAP	GAP	GAP	GAP	(Eurostat, 2024b).
	Perception of physical safety		Crime, violence or vandalism in the area by level of disability (activity limitation), sex and age (hlth_dhc130)		Crime, violence or vandalism in the area by level of disability (activity limitation), sex and age (hlth_dhc130)		GAP	GAP	(Eurostat, 2024b).
			Share of people declaring that they feel safe when walking alone at night in the city or area where they live		Share of people declaring that they feel safe when walking alone at night in the city or area where they live		GAP	GAP	(OECD, 2024d).
	Gender-based violence		Gender based violence against women (gbv)	n.a.	Gender based violence against women (gbv)		GAP	Gender based violence against women (gbv)	(Eurostat, 2024b).
	Road deaths		Persons killed in road accidents by age, sex and category of persons involved (tran_sf_roadus)		Persons killed in road accidents by age, sex and category of persons involved (tran_sf_roadus)		GAP	GAP	(Eurostat, 2024b).
		Persons killed in road accidents by type of vehicle (tran_sf_roadve)	GAP		GAP	GAP	GAP	GAP	(Eurostat, 2024b).
	Disaster	SDG 11.5.1: Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	GAP		GAP	GAP	GAP	GAP	(United Nations, 2024)

3.1.9 Leisure and Social Interactions

Leisure and social interactions are fundamental components of well-being and quality of life. They provide individuals with opportunities to relax, pursue passions, and build meaningful relationships. Engaging in leisure activities and fostering social connections has been consistently linked to higher levels of happiness, reduced stress, and better physical and mental health (Brajša-Žganec et al., 2011; J. Helliwell et al., 2021; OECD, 2020b; Stiglitz et al., 2008). As modern societies place increasing emphasis on work-life balance, understanding the roles that leisure and social interactions play in enhancing well-being is crucial for fostering environments where individuals and communities can thrive.

Table 20 shows the topics and sub-topics of this dimension. These have not been changed in the framework of this thesis.

Table 25: Eurostat Quality of Life "Leisure and social interactions". Source: (Eurostat, 2021).

Dimension	Topic	Sub-topic
Leisure and social interactions	Leisure	Quantity of leisure
		Quality of leisure
		Access to leisure
	Social interactions	Activities with people
		Activities for people
		Supportive relationships
		Social cohesion

3.1.9.1 Leisure

Leisure refers to the discretionary time people spend outside of productive activities, such as paid or unpaid work, that is often pursued for personal enjoyment. Leisure is valued for its intrinsic rewards—engaging in activities simply because they bring joy, relaxation, or personal growth. The economist John Maynard Keynes predicted that economic development would one day allow individuals to work fewer hours, leaving more time for leisure, which he saw as a marker of societal progress. This vision of increased leisure time as a sign of quality of life is reflected in Article 24 of the United Nations Declaration of Human Rights, which affirms the "right to rest and leisure" (UN, 1948).

Several European Union policies aim to enhance the quality of leisure by preserving and promoting access to Europe's cultural heritage. Article 167 of the Treaty on the Functioning of the EU supports cultural preservation in areas like literature, cinema, and art through initiatives like the *Creative Europe Programme* (European Union, 2009). The *Audiovisual Media Services Directive* and the *Creative Europe* framework ensure diverse and accessible cultural content, while Protocol No. 29 of the Treaty supports public service broadcasting. (European Commission, 2024b). Additionally, the *EU Work Plan for Sport (2024-2027)* focuses on promoting integrity, sustainability, and health-enhancing physical activity, while emphasizing inclusivity and the link between physical and mental health (European Commission, 2024c).

The benefits of leisure are particularly evident among vulnerable populations, such as the elderly, people with disabilities, and marginalized communities (Labbé et al., 2019; Lange et al., 2024; Sala et al., 2019). Participating in cultural activities or recreational pursuits has been shown to enhance physical and mental health, promote creativity, and build resilience (Bone et al., 2022; Kumar et al., 2024). It fosters a sense of belonging, connecting individuals to their communities, and improving overall quality of life. In this way, leisure is not only a personal good but also a social one, contributing to stronger, more vibrant communities.

Leisure has both a quantitative and a qualitative dimension. The quantitative aspect refers to the availability of time for leisure activities, while the qualitative dimension pertains to the accessibility, diversity, and enjoyment of those activities (Eurostat, 2017). Recent studies have shown that more leisure time and better access to leisure activities are associated with higher levels of self-reported happiness and life satisfaction (Brajša-Žganec et al., 2011; Newman et al., 2014; Schmiedeberg & Schröder, 2017). People who have the opportunity to engage in leisure pursuits tend to experience lower stress levels, improved mental health, and greater overall well-being.

In the context of measuring leisure as part of quality of life, the Eurostat (2017) report proposes three key components: the quantity of leisure time, the quality of leisure experiences, and access to various leisure activities.

The **quantity of leisure** is assessed through two indicators:

- the *participation in cultural or sports activities within the last 12 months*, broken down by activity type and frequency, which is sourced from the EU-SILC survey.
- *time spent, participation time, and participation rate in leisure activities*, which is sourced from the Time Use Survey (TUS). This serves as a proxy for the discretionary time individuals have for leisure, excluding time dedicated to necessary activities like work, commuting, or household labor.

Regarding the sub-topic of **quality of leisure**, while the Eurostat database includes two indicators on life satisfaction across different domains, none of the domains refer to leisure. Therefore, I have chosen not to reference these indicators here, instead emphasizing the gap in appropriate measures that assess the quality of leisure experiences. This lack of direct focus on leisure highlights the need for more precise and targeted indicators that can better capture the diversity and enjoyment of leisure activities.

The **access to leisure** is measured through an indicator that tracks non-participation in cultural or sports activities over the past 12 months by activity type and reasons. This indicator is particularly important because it provides insight into the percentage of individuals who are unable to participate in leisure activities due to financial constraints or other barriers. By assessing these limitations, the indicator helps shed light on inequalities in access to leisure and the broader impact this has on quality of life.

3.1.9.2 Social interactions

Social interactions encompass both close personal relationships and broader community connections. Personal relationships are often identified as the single strongest determinant of well-being (Diener & Seligman, 2002). People with stronger social ties have been found to enjoy better health outcomes and are more likely to find employment (Scrivens & Smith, 2013; Stiglitz et al., 2008). Moreover, having someone to rely on in times of need has been recognized as a key determinant of quality of life and is featured as a headline indicator in the *United Nations World Happiness Report* (J. F. Helliwell et al., 2023).

The sense of "relatedness" fostered by personal relationships not only contributes to well-being but is also considered a fundamental psychological need. The first two sub-topics within the *Social Interactions* dimension—*activities with people* and *supportive relationships*—align with this concept. These two were adjusted following to OECD (2020b) guidelines, stating that it is important to assess both the quantity (e.g., frequency and time spent with family, friends, and colleagues) and the quality (e.g., satisfaction with interactions, perceived loneliness) of social connections, as well as the emotional and financial support these relationships provide. Measuring both is crucial because spending time with others does not always prevent loneliness or a lack of support (OECD, 2020b).

Activities with people, such as spending time with family or friends, nurture emotional well-being and strengthen connections. These activities are assessed through two indicators in the EU-SILC survey: *frequency of getting together with family or friends* and *frequency of contact with family or friends*. Since these indicators mainly assess the quantity of social interactions, an additional measure for the quality of these interactions — *satisfaction with social interaction* (part of life satisfaction domains) —has been introduced, following the OECD (2020b) guidelines.

Supportive relationships provide essential emotional or practical assistance during difficult times. Having someone to rely on is a significant determinant of quality of life and is a key metric in global happiness reports (J. F. Helliwell et al., 2023). This dimension is assessed through the indicator *Persons having someone to ask for help*, which captures the practical and financial support available to individuals. This form of social support is a key element of social capital—a concept initially coined by Pierre Bourdieu to describe the benefits derived from social networks. Research shows that having a reliable support system is associated with positive econo(Scrivens & Smith, 2013)tcomes (Scrivens & Smith, 2013).To ensure a comprehensive assessment, the *Persons having someone to discuss personal matters* indicator complements the financial and practical aspects by focusing on emotional support.At the community level, social cohesion—the trust, shared values, and cooperation within a society—plays an important role in shaping societal outcomes. Strong social cohesion is linked to improved government performance, reduced crime rates, and overall societal well-being (Stiglitz, Sen, & Fitoussi, 2009; Scrivens & Smith, 2013). Two sub-dimensions related to community interactions are activities for people and social cohesion**.**

Activities for people include both informal and formal voluntary activities. Informal voluntary activities involve acts of kindness and help that are not tied to formal organizations, such as cooking for others, caring for the sick, or helping someone with daily tasks. Formal voluntary activities, on the other hand, are organized through charities, community groups, or other structured organizations. Volunteering is highly valued in many societies for its contribution to the greater good, and it also benefits the individual, contributing to higher subjective well-being (Scrivens & Smith, 2013). These activities are measured through indicators from the EU-SILC survey, such as *Persons not participating in formal/informal voluntary activities or active citizenship* and *Persons participating in formal/informal voluntary activities*.

Social cohesion itself is crucial for both individual and collective well-being. Communities with strong social cohesion foster a sense of belonging, which supports both personal and societal well-being. Trust in others—one of the most commonly used measures of social capital—is strongly correlated with life satisfaction and well-being (Scrivens & Smith, 2013). This EU-SILC trust indicator reflects respondents' general trust in other people, serving as a measure of generalized social trust. Many objective indicators measure social exclusion, particularly in the contexts of material conditions, education, or labor market participation. However, understanding social cohesion requires more than just these objective measures; it also necessitates a subjective assessment of individuals' personal feelings of inclusion or exclusion from society. For this reason, I have included the EU-SILC indicator *Perception of social exclusion* to capture these subjective experiences. This indicator helps assess whether people feel part of society or marginalized, offering a crucial insight into the social cohesion dimension. By combining both objective and subjective measures, policymakers can better understand the full scope of social inclusion and cohesion, ensuring a more comprehensive approach to improving quality of life across communities.

Table 26: Leisure and Social Interactions. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Leisure and social Interactions	Leisure	Quantity of leisure	Persons participating in cultural or sport activities in the last 12 months by sex, age, educational attainment, activity type and frequency (ilc_scp03)		Persons participating in cultural or sport activities in the last 12 months by sex, age, educational attainment, activity type and frequency (ilc_scp03)		GAP	GAP	(Eurostat, 2024b).
			Time spent, participation time and participation rate in the main activity by sex and educational attainment level (tus_00educ)		Time spent, participation time and participation rate in the main activity by sex and educational attainment level (tus_00educ)		GAP	GAP	(Eurostat, 2024b).
		Quality of leisure	GAP						
		Access to leisure	Persons not participating in cultural or sport activities in the last 12 months by sex, age, educational attainment, activity type and reasons (ilc_scp05)		Persons not participating in cultural or sport activities in the last 12 months by sex, age, educational attainment, activity type and reasons (ilc_scp05)		GAP	GAP	(Eurostat, 2024b).
	Social interactions	Activities with people	Persons getting together with family (relatives) or friends by sex, age, educational attainment and frequency (ilc_scp09)		Persons getting together with family (relatives) or friends by sex, age, educational attainment and frequency (ilc_scp09)		GAP	GAP	(Eurostat, 2024b).
			Persons having contacts with family (relatives) or friends by sex, age, educational attainment and frequency (ilc_scp11)		Persons having contacts with family (relatives) or friends by sex, age, educational attainment and frequency (ilc_scp11)		GAP	GAP	(Eurostat, 2024b).
			Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)		Life satisfaction by sex, age, educational attainment and domain (ilc_pw01b)		GAP	GAP	(Eurostat, 2024b).
		Activities for people	Persons participating in formal/informal voluntary activities or active citizenship by sex, age and educational attainment (ilc_scp19)		Persons participating in formal/informal voluntary activities or active citizenship by sex, age and educational attainment (ilc_scp19)		GAP	GAP	(Eurostat, 2024b).
			Persons not participating in formal/informal voluntary activities or active citizenship in the last 12 months by sex, age, educational attainment and reasons (ilc_scp21)		Persons not participating in formal/informal voluntary activities or active citizenship in the last 12 months by sex, age, educational attainment and reasons (ilc_scp21)		GAP	GAP	(Eurostat, 2024b).
		Social support	Persons having someone to ask for help by sex, age and educational attainment (ilc_scp15)		Persons having someone to ask for help by sex, age and educational attainment (ilc_scp15)		GAP	GAP	(Eurostat, 2024b).
			Persons having someone to discuss personal matters by sex, age and educational attainment (ilc_scp17)		Persons having someone to discuss personal matters by sex, age and educational attainment (ilc_scp17)		GAP	GAP	(Eurostat, 2024b).
		Social cohesion	Trust in others by sex, age and educational attainment (ilc_pw03)		Trust in others by sex, age and educational attainment (ilc_pw03)		GAP	GAP	(Eurostat, 2024b).
			Persons feeling left out from society by sex, age and educational attainment (ilc_pw10)		Persons feeling left out from society by sex, age and educational attainment (ilc_pw10)		GAP	GAP	(Eurostat, 2024b).

3.1.10 Governance and basic rights

Governance, political voice, and civic engagement are essential components of both quality of life and the successful implementation of sustainability transitions (Eurostat, 2017; OECD, 2020b; World Economic Forum, 2023). Good governance ensures transparency, accountability, and inclusivity, fostering trust in public institutions—a critical element for the long-term success of sustainability policies. Political voice and active civic engagement provide the means for citizens to influence decisions that directly impact their well-being, ensuring that policies reflect the diverse needs and values of society. This participatory approach strengthens the legitimacy of sustainability efforts, enabling governments to address complex challenges such as climate change, inequality, and environmental degradation in a socially inclusive and equitable way (EEA, 2023).

In Europe, public participation in environmental decision-making is a legal right, established by the **Aarhus Convention** in 1998. However, contemporary discussions of public participation go beyond this fundamental right to highlight its practical benefits. The 8th Environment Action Programme emphasizes the importance of public engagement to close knowledge gaps and stresses that citizens should be involved at all levels of decision-making. This approach aligns with the UN 2030 Agenda for Sustainable Development, which calls for leaving no one behind in sustainability efforts. The European Green Deal further underscores this by declaring that citizens should remain the driving force of the sustainability transition.

Despite these frameworks, public discontent—particularly among those who feel excluded from the political process—has sparked resistance to green policies. Recent declines in trust and rising EU skepticism have hindered progress in key sustainability initiatives, such as the European Green Deal. Systematic differences in how various groups exercise political voice, particularly between citizens and growing numbers of immigrants, exacerbate this discontent (Eurostat, 2017). Marginalized groups often face barriers to meaningful participation, which erodes public trust in institutions (Kumagai & Iorio, 2020; NDI, 2021).

Expanding the scope of public engagement is thus essential, not only to ensure inclusivity but also to foster public acceptance and cooperation with ambitious sustainability goals. By enhancing opportunities for all groups to engage in political processes, trust in institutions can be rebuilt, driving the long-term success of green transitions across Europe.

Based on Eurostat (2017), indicators of political voice and governance are critical tools for assessing the health of democratic systems. These indicators should evaluate the functioning of multiparty democracy and universal suffrage, the level of participation in decision-making at the local level, and the presence of essential freedoms, such as the right to form civil organizations, trade unions, and professional bodies, as well as participation in civic and social activities. Relevant indicators also include constitutional and legal rights that promote civil and criminal justice, equality, inclusion, accountability, and affirmative action, as well as adherence to international human rights covenants.

Additionally, the functioning of the judicial system—its independence, efficiency, and accessibility—is vital to understanding how well these governance structures operate.

These indicators are typically compiled by external bodies and are often based on expert opinion. However, to provide a more comprehensive picture, these should be complemented or even replaced in some cases by citizen surveys. These surveys would capture citizens' perceptions of how well political, legal, and executive institutions are functioning, the challenges they face in accessing them, and the trust they place in these institutions. Surveys also need to reflect inequalities in access across different socioeconomic groups, ensuring that marginalized populations are adequately represented.

Table 23 illustrates how the dimension of *Governance and Basic Rights* is structured by Eurostat (2021), with three key topics: institutions and public serices, discrimination and equal opportunities, and active citizenship. However, the section on **Institutions and Public Services** only includes one indicator on the trust in the political system, legal system, and police, without accounting for trust or satisfaction with other vital public services, such as healthcare and education. This limited scope misses important aspects of public satisfaction that are critical for understanding governance comprehensively. Furthermore, the Discrimination and Equal Opportunities topic, as defined by Eurostat, primarily focuses on labor conditions, specifically employment and earnings, without addressing broader aspects of inequality across all the other dimensions of well-being.

Table 27: Eurostat Quality of Life "Governance and basic rights". Source: (Eurostat, 2021).

Dimension	Topic	Sub-topic
Governance and basic rights	Institutions and public services	Trust and/or satisfaction in institutions
		Trust and/or satisfaction in public services
	Discrimination and equal opportunities	
	Active citizenship	

Table 24, in contrast, shows how these indicators have been modified in the present framework to address these limitations:

- Discrimination and Equal Opportunities: As discussed in chapter 2, this topic is excluded from this framework because it is assessed through differences in well-being outcomes across all dimensions, not just in labor market conditions, as Eurostat does.
- Civic Engagement: This has been added as a new topic following the guidelines from OECD (2020b), while the indicators are sourced mainly from the OECD Survey on Drivers of Trust in Public Institutions OECD (2024f). This inclusion broadens the understanding of citizen's feeling of having political voice and their participatation in the political process.

- Gender Parity in Politics: Another new addition, following OECD (2020b). The indicator chosen is sourced from the Eurostat SDG database and is used to track progress towards SDG 5: Gender Equality.

These modifications aim to provide a more comprehensive view of governance, focusing not only on trust in core institutions but also addressing gaps in civic engagement and gender balance in decision-making, which are essential for inclusive, equitable governance in line with SDG 16: Peace, Justice, and Strong Institutions and SDG 5: Gender Equality.

Table 28: Governance and civic engagement. Source: own elaboration.

Dimension	Topic	Sub-topic
Governance and civic engagement	Institutions and public services	Trust and/or satisfaction in institutions
		Trust and/or satisfaction in public services
	Civic engagement	Confidence in own ability to participate in politics
		Have a say in what the government does
		Active citizenship
		Perception of policy responsiveness to public feedback
	Gender parity in politics	

3.1.10.1 Institutions and public services

Ensuring respect for human rights in constitutions and laws is not enough if there is no effective implementation. A key indicator of the quality of governance is the level of citizens' trust in institutions—particularly the judicial system, political systems, and law enforcement (police). This trust stems from factors such as transparency, access to information, absence of corruption, independence from political interference, and fair treatment without discrimination.

In this context, trust and satisfaction in institutions and public services are critical for evaluating governance quality. A composite indicator, often used to assess this, measures trust in institutions such as the legal system, political system, and police.

- The term 'legal system' refers broadly to the entire framework for interpreting and enforcing laws. This includes evaluating the efficiency and effectiveness of institutions like courts, the fairness of legal procedures, and whether the decisions and sentences reflect public values.
- 'Political system' encompasses all institutions and interest groups—such as political parties and trade unions—and examines their relationships, as well as the political norms and rules governing their operations.
- 'Police' refers to the institution of law enforcement as a whole, evaluating public trust in how the police function and their role in upholding the rule of law.

These factors collectively provide insight into the governance quality and how well the system is perceived to deliver justice, fairness, and security to its citizens.

3.1.10.2 Civic engagement

Civic engagement encompasses whether individuals can and do participate in key civic activities that enable them to influence the society they live in. According to the OECD (2020b), an ideal set of indicators for civic engagement should measure various dimensions: whether individuals have opportunities to engage, whether they feel confident in their skills and resources to do so, whether they act on these opportunities, and whether their participation leads to meaningful changes. Following these guidelines, I have selected four indicators to measure civic engagement more comprehensively.

1. **Confidence in own ability to participate in politics**: This indicator captures individuals' self-assessed ability to engage in political activities. It is measured by the survey question: *"How confident are you in your own ability to participate in politics?"* from the OECD (2024f) Trust Survey. This reflects how empowered individuals feel in navigating political systems and influencing decisions.
2. **Perception of Having a Say in Government**: This indicator focuses on individuals' sense of political influence. It is measured through the question: *"How much would you say the political system in your country allows people like you to have a say in what the government does?"* from the OECD (2024f) Trust Survey. It evaluates whether people feel that their political participation has a tangible impact on government actions.
3. **Active Citizenship**: Defined in the context of the EU-SILC survey, active citizenship includes participation in political parties, local interest groups, public consultations, peaceful protests, signing petitions, attending demonstrations, and communicating with politicians or the media. Notably, voting is excluded from this definition, as it is compulsory in some EU Member States. The measurement here focuses on the *percentage of people engaging in formal/informal voluntary activities or active citizenship*, broken down by sex, age, and educational attainment. This highlights the range of political activities citizens engage in beyond voting.
4. **Perceptions of Policy Responsiveness to Public Feedback**: This indicator from the OECD (2024f) Trust Survey measures how responsive citizens believe their government is to public input. It is based on the share of respondents reporting their perception of the likelihood (on a 0-10 scale) that a national policy would change if a majority of people expressed opposition to it. This perception of government responsiveness is crucial, as a lack of responsiveness can foster political alienation, fueling the belief that the system serves only a select few (OECD, 2022). This indicator is vital for assessing whether citizens feel their participation influences policy-making.

These four indicators collectively offer a comprehensive view of civic engagement, from individuals' perceived political empowerment to actual participation in civic activities,

and their perception of government responsiveness. Each indicator captures a different aspect of engagement, helping evaluate both the opportunities for participation and the effectiveness of civic activities in shaping political outcomes.

Note that all the indicator from OECD (2024f) Trust Survey are disaggregated by age (18-24, 25-34, 35-44, 45-54, 55-64, 65+) and gender (female and male, non-binary group as response option).

3.1.10.3 Gender parity in politics

The Gender Parity in Politics topic, represented by the indicator Seats held by women in national parliaments and governments (sdg_05_50), is part of EU's Sustainable Development Goals (SDG) indicator set. This indicator tracks progress towards SDG 5: Gender Equality, which aims to ensure full and effective participation and equal opportunities for leadership roles for women at all levels of political decision-making(UN, 2015).

SDG 5 is a fundamental goal embedded within the European Commission's priorities, particularly under 'An Economy that Works for People' and 'A New Push for European Democracy'. These initiatives emphasize the need for gender balance in decision-making as an essential aspect of inclusive and effective governance. The EU Gender Equality Strategy further aligns with this goal by prioritizing gender parity in political and leadership roles, recognizing that achieving gender balance is critical for democracy and equitable policymaking (European Commission, 2020b).

By focusing on women's representation in national parliaments and governments, the indicator plays a crucial role in tracking and promoting gender equality within the EU's political systems, contributing to the broader objective of equal leadership opportunities in all spheres of influence.

Table 29: Governance and Civic Engagement. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Governance and Civic Engagement	Institutions and public services		Level of trust by sex, age, educational attainment and domain (ilc_pw03b)		Level of trust by sex, age, educational attainment and domain (ilc_pw03b)		GAP	GAP	(Eurostat, 2024b).
	Civic engagement	Confidence in own ability to participate in politics	Share of population who feel confident in their own ability to participate in politics (%)		Share of population who feel confident in their own ability to participate in politics (%)		GAP	GAP	(OECD, 2024d).
		Have a say in what the government does	Share of population reporting different levels of perceived likelihood that their political system allows people to have a say in what government doesat the government does (%)		Share of population reporting different levels of perceived likelihood that their political system allows people to have a say in what government doesat the government does (%)		GAP	GAP	(OECD, 2024d).
		Active citizenship	Persons participating in formal/informal voluntary activities or active citizenship by sex, age and educational attainment (ilc_scp19)		Persons participating in formal/informal voluntary activities or active citizenship by sex, age and educational attainment (ilc_scp19)		GAP	GAP	(Eurostat, 2024b).
		Perceptions of policy responsiveness to public feedback	Share of respondents reporting different levels of perceived likelihood that a national policy would be changed if a majority of people expressed a view against it (%)		Share of respondents reporting different levels of perceived likelihood that a national policy would be changed if a majority of people expressed a view against it (%)		GAP	GAP	(OECD, 2024d).
	Gender parity in politics		Seats held by women in national parliaments and governments (sdg_05_50)	n.a	GAP	GAP	GAP	GAP	(Eurostat, 2024c).

3.1.11 Subjective Well-being

Subjective well-being refers to individuals' good mental states and how they experience life. This dimension plays a distinct role within the sustainable quality of life framework, providing an assessment of life overall, rather than in a specific domain. The OECD *Guidelines on Measuring Subjective Well-Being* (OECD, 2013a) identify three key elements: life evaluations (such as overall life satisfaction), affect (emotions, feelings, and states), and eudaimonia (a sense of meaning and purpose in life). These three subdimensions are all included in the Eurostat Quality of Life framework (see Table 30) and were first collected through the EU-SILC 2013 ad hoc module on subjective well-being, with partial repetition in the 2018 ad hoc module on material deprivation, well-being, and housing difficulties. Since 2021, the variable 'life satisfaction' has been collected annually in the EU-SILC, while the 'being happy' variable is slated for collection every six years starting in 2022. However, the 'sense of purpose in life' variable has been discontinued (Eurostat, n.d.-c), with no current data available in Eurostat database. Consequently, this chapter focuses on the first two elements—life evaluations and affect (see Table 31).

Table 30: Overall experience of life. Source: (Eurostat, 2021).

Dimension	Topic
Overall experience of life	Life satisfaction
	Affects
	Meaning and purpose

3.1.11.1 Life satisfaction

The first topic, **life satisfaction**, refers to a cognitive assessment of an individual's life as a whole. It represents how respondents evaluate or appraise their life in its entirety, considering all aspects at a particular moment ("these days"). The term "life" encompasses all areas of a person's experience, and the variable captures the respondent's overall opinion or feeling about their level of satisfaction with life. The focus is on how people feel "these days" rather than over a specific longer or shorter time. The goal is to capture a reflective judgment rather than an immediate emotional response (Eurostat, 2017).

The response scale used was from 0 to 10, where 0 means not at all satisfied and 10 completely satisfied. Two versions of the indicator are presented in Table 31:

1. The 'overall life satisfaction' indicator reflects the average score across all respondents.
2. The 'overall life satisfaction by level of satisfaction' indicator shows the proportion of the population reporting low satisfaction (0-5), medium satisfaction (6-8), and high satisfaction (9-10).

3.1.11.2 Affects

Regarding the second topic, measures of **affects**, both positive and negative, are recognized as a crucial sub-dimension of subjective well-being, distinct from evaluative measures like life satisfaction (OECD, 2013a; Stiglitz et al., 2008). Affect refers to the emotions an individual experiences moment by moment, capturing how someone feels at a specific point in time. Negative affects include emotions such as sadness, anxiety, or depression. One conceptual framework suggests that overall well-being can be understood as the cumulative sum of these emotional experiences throughout life (Eurostat, 2017).

In its purest form, affect is measured in real time by asking individuals h(Larson & Csikszentmihalyi, 2014)Larson & Csikszentmihalyi, 2014). This approach has an advantage over evaluative measures like life satisfaction because it requires less cognitive effort from respondents—they are not asked to reflect on multiple aspects of their life or recall past experiences. This makes affect-based measures less susceptible to cognitive biases (Larson & Csikszentmihalyi, 2014). In contrast, the affect measures used in the Quality of Life indicator set involve some recall (spanning the past four weeks), though they still require less reflection than life satisfaction questions, which ask respondents to assess their life. The EU-SILC variables on subjective mental well-being refer to a four-week period, making them a proxy for real-time emotional states.

The first sub-topic, **positive affects**, captures emotions like happiness, joy, and contentment, which are often strongly correlated and can be represented on a single axis of measurement. In the EU-SILC survey, this is measured through the question: “How much of the time over the past four weeks have you been happy?” The indicator reflects the frequency of reported happiness over this period.

From a communication standpoint, focusing on negative affect offers a valuable counterbalance to the emphasis on positive emotions in life experience measures. For policymakers, it can often be more actionable to address deficits, such as a high proportion of a specific sub-population feeling downhearted or depressed, rather than solely examining the proportion of people feeling happy or calm. However, Eurostat currently does not assess negative affect directly.

To address this gap and complement the positive affect measure, I have introduced the *Negative Affect Balance* indicator from the OECD Well-being Framework. This indicator evaluates the proportion of the population reporting more negative than positive emotions on the previous day. Respondents are asked to answer "yes" or "no" to experiencing various emotions, with negative affect items including anger, sadness, and worry, and positive affect items encompassing enjoyment, feeling well-rested, and laughing or smiling. A negative affect balance is recorded when respondents report more negative than positive emotions.

For country-level averages, data are pooled over a three-year period (e.g., 2016-18) to enhance the accuracy of the estimates, and for inequality reporting, data are pooled over a longer period (2010-18). The data is sourced from the Gallup World Poll, which surveys around 1,000 individuals per country annually. The sample is designed to be nationally representative of the population aged 15 and over, including rural areas, with results weighted according to population weights provided by Gallup (OECD, 2020b).

Table 31: Subjective Well-being. Source: own elaboration.

Dimension	Topic	Sub-Topic	Gender		Age		Migration status		Source
			women	men	youth	elderly	citizenship	country of birth	
Subjective Well-being	Life satisfaction		Overall life satisfaction by sex, age and educational attainment (ilc_pw01)		Overall life satisfaction by sex, age and educational attainment (ilc_pw01)		GAP	GAP	(Eurostat, 2024b).
			Overall life satisfaction by level of satisfaction, age and educational attainment (ilc_pw05)		Persons rating their life satisfaction as high, medium or low by sex, age, educational attainment and domain (ilc_pw05b)		GAP	GAP	(Eurostat, 2024b).
	Affects	Positive affects	Persons being happy in the last 4 weeks by sex, age, educational attainment and frequency (ilc_pw08)		Persons being happy in the last 4 weeks by sex, age, educational attainment and frequency (ilc_pw08)		GAP	GAP	(Eurostat, 2024b).
		Negative affect balance	Share of population reporting more negative than positive feelings and states in a typical day		Share of population reporting more negative than positive feelings and states in a typical day		GAP	GAP	(OECD, 2024d)

4 Discussion of results and recommendations

This study aimed to develop a vulnerability assessment framework that evaluates the social impacts of climate policies on well-being, focusing on equal opportunities of well-being. By drawing on established frameworks like Eurostat's Quality of Life, OECD Well-being Framework and UN SDG Framework, this approach provides a structured view of social vulnerability within the context of EU climate initiatives, particularly the European Green Deal. Assessing multiple well-being dimensions allows for a deeper analysis of vulnerability and inequality beyond the economic lens, identifying key "hotspots" of vulnerability—specific well-being dimensions driving vulnerability and the demographic groups most affected in each dimension. This approach not only highlights disparities across demographic groups that may be disproportionately impacted by climate policies but also enhances targeted social policies by linking vulnerabilities directly to specific well-being domains. This enables policymakers to address the social issues most affected by climate policies effectively.

Additionally, the methodology's reliance on a structured set of indicators enables a quantitative analysis of well-being disparities, offering a measurable evaluation of vulnerabilities across social groups. This quantitative approach enhances understanding of these groups' vulnerabilities and enables better monitoring of policy impacts by tracking well-being gaps over time. However, this approach also faces notable limitations. Many indicators in Eurostat and OECD databases, lack any form of disaggregation, and those that are disaggregated generally focus on sex, age, and educational level, with few offering data by migration status. For instance, the results of this thesis reveal limited disaggregated data on migration status across most well-being dimensions, with available indicators largely confined to education, labor conditions, and material conditions. This gap indicates that migrant discrimination and inequality are not fully or comprehensively assessed, as measured data focuses only on select aspects critical for economic integration.

These limited categories of disaggregation overlook key social groups, such as ethnic minorities (e.g., Roma communities), who often bear a disproportionate burden from climate change and environmental discrimination (ERRC, 2017; FRA, 2016). Other marginalized groups, including LGBTQ+ communities and religious minorities, are similarly excluded, which is increasingly at odds with Europe's ongoing commitment to recognizing and protecting the rights of these communities. The lack of comprehensive data disaggregation poses a significant limitation for the framework, as it currently precludes quantitative assessments of vulnerabilities across certain demographic groups. Given the present state of data availability, a qualitative approach may be a more effective method to explore the specific challenges these groups face. However, the framework developed in this thesis provides a foundational layout that can be refined and expanded to incorporate additional disaggregation categories as more comprehensive data becomes available.

Furthermore, the reasoning behind the selection of well-being components and indicators in this framework is firmly grounded within the EU context, particularly in alignment with the European Green Deal. Consequently, this framework is well-suited for regional and local policy applications within the EU, where certain indicators could be replaced with region-specific or local measures. This adaptability to regional and local contexts is also part of the planned future work (see *Conclusion and future work*).

However, the framework's generalizability beyond the EU context may be limited, as differing social, economic, and environmental conditions outside the EU influence patterns of vulnerability. The framework could be adapted for use in other OECD countries, as it aligns with the guidelines of the OECD Well-being Framework and can be adjusted with appropriate considerations. However, applying this framework in developing countries is not recommended without substantial modifications, as differing socio-economic dynamics and environmental conditions would likely influence the outcomes.

Finally, while this framework was initially developed to assess the social impacts of climate policies under the European Green Deal, its multidimensional and integrated structure makes it highly adaptable to other policy areas. By building on well-being and sustainability indicators from established frameworks, it offers a flexible tool for evaluating vulnerabilities beyond climate mitigation. Many of the dimensions, indicators, and disaggregation categories included in this framework are also relevant to policies addressing biodiversity and ecosystem restoration, zero pollution ambition, circular economy and waste policies, sustainable agriculture and food system, green finance, and energy security. These policy areas, like climate mitigation, can generate or amplify social inequalities, making vulnerability assessments essential for ensuring an inclusive and fair transition. Expanding the application of this framework to these domains could enhance policymakers' ability to anticipate and address social risks, further aligning sustainability efforts with the EU's commitment to a just and fair green transition.

4.1 Recommendations

Building on the findings of this study, I strongly recommend enhancing data collection by equity stratifiers. As highlighted in the previous chapter, the lack of comprehensive disaggregated data currently limits our understanding of the needs of marginalized and underrepresented communities, as well as the capacity to develop targeted policy responses. Enhanced disaggregation would allow for a more precise understanding of these communities' unique challenges, enabling policymakers to design equitable policies that genuinely address their needs.

The following sub-sections provide targeted recommendations for the well-being dimensions where improvements are most urgently needed. They highlight the critical need to address data disaggregation gaps and suggest developing new indicators where necessary.

4.1.1 Work and Job Quality

To fully capture the role of employment in driving sustainable development within the well-being framework, I recommend developing specific indicators to assess Green Jobs and incorporating them into relevant employment topics. Green Jobs, as defined by the International Labour Organization (ILO), are those that contribute to preserving or restoring environmental quality, while brown jobs are associated with activities that harm environmental sustainability (International Labour Office (ILO), 2018). Disaggregating employment data into green and brown jobs would provide valuable insights into how labor markets are transitioning toward sustainability and the extent to which economic activities support or undermine environmental goals.

Further disaggregating this data by gender, age, and other key demographics would also help to identify how different groups, particularly vulnerable populations such as women and young people, are represented in these sectors. This would enable policymakers to address existing inequalities, ensuring that the benefits of the green transition are distributed equitably and inclusively. Additionally, it would help safeguard workers at risk of losing jobs due to declining industries that negatively impact the environment, facilitating their transition into more sustainable roles.

This approach aligns with SDG 8.5, which champions decent work for all, and supports the European Green Deal's objective of ensuring a fair and inclusive shift towards a green economy (European Commission, 2019).

4.1.2 Education

To better assess the transformative potential of education in the quality-of-life framework, I recommend developing specific indicators to assess Education for Sustainable Development (ESD) and including them in both the Competencies and Skills and Lifelong Learning topics. Defined by UNESCO, ESD emerged from the United Nations Decade of Education for Sustainable Development (2005-2014) and aims to equip individuals with the knowledge, skills, and values needed to promote sustainable development (UNESCO, 2012). It encompasses education on sustainable lifestyles, human rights, gender equality, global citizenship, and the interconnectedness of ecological, social, and economic systems. These indicators should measure the extent to which education systems empower learners to make informed decisions and take responsible actions for sustainability, as well as the opportunities provided for continuous learning related to these principles.

This approach aligns with SDG 4.7 and the Council of the European Union's Recommendation on learning for the green transition and sustainable development, which calls on Member States to integrate ESD into all aspects of education and training (The Council of the European Union, 2022; UN, 2022). Including ESD indicators in the quality-of-life framework would provide a more comprehensive understanding of how education contributes to building sustainable, inclusive, and resilient societies, ensuring that the framework reflects the essential role of education in promoting both individual and collective well-being.

4.1.3 Natural and living environment

One of the key findings in the "Natural and Living Environment" dimension is the lack of universally accepted indicators that connect soil contamination with population exposure and health outcomes, especially mortality. This gap arises from the complex interactions between pollutants and human health. However, it is well-documented that vulnerable populations are often at greater risk, frequently residing near contaminated or industrial sites due to socio-economic pressures (ERRC, 2017; FRA, 2016). Therefore, gathering data on soil pollution exposure, particularly by tracking proximity to such sites, is fundamental for environmental justice considerations. This approach would allow for a nuanced understanding of exposure patterns within vulnerable communities, enabling policymakers to identify environmental injustices and prioritize remediation and protective interventions accordingly.

In terms of green spaces the current indicators—the OECD (2020b) indicator *Percentage of the urban population with access to recreational green space within 10 minutes walking distance from their home*, and Eurostat's indicator *satisfaction with green and recreational places* —have been incorporated into the framework. However, both database have no updated data available for these indicators, to make them fully operational, they require more recent data. Additionally, I would recommend to develop new indicators that better assess the quality and usability of green spaces. This is essential to track equal access to well-being and environmental sustainability in urban areas, ensuring that all groups—particularly vulnerable populations with special needs—benefit from these spaces.

4.1.4 Safety

Regarding the crime topic, it is crucial to note that no data on hate crimes currently exists in Eurostat. Including this data is essential for addressing fundamental rights and ensuring well-being. This aligns with the recommendations of the European Union Agency for Fundamental Rights (FRA), which advocates for EU Member States to systematically collect and publish detailed anonymized data on hate crimes. The data should be disaggregated by various bias motivations, such as racism, xenophobia, or religious intolerance, and other relevant characteristics of the incidents. The dissemination and communication of this data to the general public is also vital to promote transparency and raise awareness (FRA, 2018).

Many individuals across the EU continue to experience abuse based on their perceived or real origins, beliefs, life choices, or physical appearance (FRA, 2018). Addressing this data gap on hate crimes is essential for the EU to uphold its commitment to combating discrimination and protecting individuals from targeted abuse, as mandated by the Charter of Fundamental Rights of the European Union (European Union, 2012). This step is critical to fostering inclusivity and ensuring that hate crime victims are recognized, supported, and that perpetrators are held accountable.

Additionally, the rise of cybercrime and online privacy breaches associated with the digital transformation has introduced new forms of criminal activity that must be tracked. The OECD Policy Framework on Digital Security (2022) highlights the increasing prevalence of crimes such as consumer fraud and cyber-attacks. Online violence, particularly against women, is also a growing concern. In the EU, 1 in 10 women has reported experiencing cyber harassment since the age of 15. In the EU, 1 in 10 women has reported experiencing cyber harassment since the age of 15. Online violence encompasses a wide range of illegal or harmful behaviors, including illegal threats, stalking, incitement to violence, and sharing of private images or videos without consent. These actions can occur both in connection with real-life violence or be limited to the online environment, but in either case, they severely impact women's safety and well-being (European Commission, 2020b).

With regard to the natural disaster topic, while the current indicator tracks the number of people who have died, gone missing, or been directly affected by disasters, the data is not disaggregated by demographics or by the type of disaster. For a more comprehensive understanding of the risks associated with different types of extreme events and which segments of the population are most vulnerable, such disaggregation is necessary. Some countries, like Germany, have already begun to provide disaster data disaggregated by type in their SDG databases . This type of data can help policymakers better target disaster preparedness efforts and support systems for the most at-risk populations.

4.1.5 Leisure and Social Interactions

As shown in Table 26, no indicator is currently available that disaggregates data on leisure and social interactions by migration status. However, given the crucial role these factors play in the well-being and integration of migrants, I would strongly recommend including this data in future analyses. Research indicates that social networks, developed through regular social interactions and community involvement, significantly contribute to the integration process and improve the life satisfaction of migrants.

Leisure spaces provide informal yet essential settings where migrants can engage with host communities, helping to break down barriers, form meaningful social ties, and promote long-term integration and social cohesion (Adedeji & Bullinger, 2019). These interactions not only reduce feelings of isolation but also enhance a migrant's sense of belonging.

Furthermore, the International Organization for Migration (IOM) emphasizes the importance of social and cultural activities in fostering mutual respect and inclusion. These activities encourage interaction between migrants and host communities, helping to build peaceful, cohesive societies and breaking down discriminatory perceptions (IOM, 2021). This underscores the importance of leisure and social interactions in advancing SDG 10: Reduced Inequalities, which emphasizes promoting social, economic, and political inclusion for all, regardless of migration status (UN, 2022).

Furthermore, disaggregated data on leisure and social interactions could help efforts aligned with SDG 11: Sustainable Cities and Communities by informing the design of urban spaces that enhance migrant participation in leisure activities. These spaces would facilitate networking with host communities, fostering integration and social cohesion.

4.1.6 Governance and Civic Engagement

Many of the indicators used in this governance dimension are currently only disaggregated by age and gender, with no detailed information available on individuals with a migrant background or other marginalized groups, such as LGBTQI+ communities, who are often excluded from decision-making processes and feel underrepresented. Disaggregating the indicators by these demographic factors could provide valuable insights into the participation gaps and representation challenges these groups face. For instance, even the indicator on women in parliament, while important for gender equality, could be adapted to measure the representation of ethnic minorities and other marginalized groups, such as migrants and LGBTQI+ individuals, in legislative bodies.

5 Conclusion and future work

This thesis acknowledges three key gaps in current EU climate policy approaches that limit the integration of just transition principles and hinder synergies between the climate and sustainable development agendas. First, there is an urgent need to address the unequal impacts of climate policies on social vulnerability, as climate policies may disproportionately affect specific groups, reinforcing existing inequalities or creating new ones. Second, it is essential to strengthen the connections between environmental and social crises; current approaches often treat social dimensions as secondary, limiting the effectiveness of transition efforts. Finally, existing policies, such as the European Green Deal, adopt a narrow view of inequality and social justice by focusing predominantly on economic disparities, overlooking inequalities in opportunities across all aspects of well-being.

In response to these gaps, this thesis has developed a Vulnerability Framework that provides a structured approach to assessing the distributional impacts of climate mitigation policies on various social groups. The framework has achieved its primary objective by enabling both ex-ante and ex-post evaluations of policy impacts on equal opportunities for sustainable well-being, thereby supporting a more equitable climate policy approach. Through an 11-dimensional matrix of well-being indicators disaggregated by sex, age, and migration status, the framework offers policymakers a practical tool to evaluate social vulnerabilities and ensure that climate policies promote, rather than compromise, social equity.

The decision to incorporate well-being dimensions into the matrix, rather than focusing solely on traditional vulnerability metrics like exposure, sensitivity, and adaptive capacity, enables a more straightforward assessment of policy fairness. Justice considerations become especially pertinent when vulnerability impacts fundamental opportunities for well-being, rather than merely affecting personal consumption preferences. Additionally, social policies aimed at reducing vulnerability to climate policies are likely to be more effective when these vulnerabilities are directly linked to specific social policy domains, such as the defined well-being dimensions in this framework.

This Vulnerability Framework also opens several avenues for future work to enhance its applicability and effectiveness in supporting equitable climate policies. Expanding demographic stratifiers—such as ethnicity, disability, and educational attainment—would improve the framework's capacity to capture a broader range of inequalities, although this can only be fully realized when more disaggregated data become available for European countries. Furthermore, the framework could be expanded to assess vertical inequalities by incorporating income quintiles, allowing for a detailed understanding of disparities between different socioeconomic groups. Such enhancements would provide a more inclusive approach to climate policy that respects the diverse experiences and needs of all social groups.

Another promising avenue for future work is adapting the framework for sub-national applications, aligning with the "Green Deal Going Local" initiative, by the European Committee of the Regions (2020). Cities and regions, which are on the front lines of climate impacts and solutions, could benefit from a localized version of this framework.

For regional and local adaptation, several resources provide valuable indicators. The OECD Regional Well-being dataset, also part of OECD's Better Life Initiative, offers internationally comparable indicators for assessing well-being in regions and cities (OECD, 2024e). Eurostat's database includes many indicators at various NUTS regional levels, as well as data from the Urban Audit and Large City Audit projects, which assess quality of life across European cities Click or tap here to enter text.(Eurostat, 2024b). Additionally, the European Handbook for SDG Voluntary Local Reviews presents a set of 72 indicators designed for local governments to monitor SDG progress (EC, 2016). Combined with localized administrative data, these resources would enable identification of corresponding indicators at regional and local levels, supporting a more tailored approach to just transition.

Additionally, future work will include practical applications of the framework to demonstrate how it can be used to assess specific policies, providing real-world examples of its utility. These applications will likely take place at the local level to illustrate the framework's adaptability to diverse local contexts. By showing how the framework can be applied to assess particular policies, this work would offer concrete guidance on its practical use.

Together, these future enhancements would strengthen the framework's role as a key tool in shaping climate policies that protect vulnerable populations and support sustainable, inclusive development across the EU.

In conclusion, this thesis has successfully addressed its objectives by developing a practical and adaptable approach to assessing social vulnerabilities within EU climate policies. By advancing the understanding and application of just transition principles, this work contributes to a future in which Europe's climate policies are not only effective in mitigating environmental harm but are also foundational in fostering fair, sustainable well-being for all. This research underscores the importance of a balanced approach where environmental sustainability and social equity are mutually reinforcing, supporting the EU's ambition for an inclusive transition that truly leaves no one behind.

6 Abbreviation List

EC: European Commission

EEA: European Environment Agency

EGD: European Green Deal

ETS: Emissions Trading System

EU: European Union

EU-SILC: EU Statistics on Income and Living Conditions

MDG: Millennium Development Goals

NEET: Not in Employment, Education, or Training

OECD: Organisation for Economic Co-operation and Development

PISA: Programme for International Student Assessment

SDG: Sustainable Development Goals

UN: United Nations

WHO: World Health Organization

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