EXPLORING THE WAYS FOR INTEGRATING THE GREEN BOND WITH DECOUPLING PROJECTS THROUGH MONITORING AND EVALUATION: THE CARBON EMISSION ATLAS AND EXPERT SYSTEM (KAUS)

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

ŞEVVAL ÇAVUŞOĞLU

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
CITY PLANNING IN CITY AND REGIONAL PLANNING

APRIL 2022

Approval of the thesis:

EXPLORING THE WAYS FOR INTEGRATING THE GREEN BOND WITH DECOUPLING PROJECTS THROUGH MONITORING AND EVALUATION: THE CARBON EMISSION ATLAS AND EXPERT SYSTEM (KAUS)

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ABSTRACT

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Master of Science, City Planning in City and Regional Planning
Supervisor : Prof. Dr. Anlı Ataöv Demirkan

April 2022, 156 pages

More research in recent years has highlighted that the climate crisis is a consequence of the immense release of carbon emissions due to human activities. The negative side of the climate crisis is that it has led to severe environmental problems around the globe, which has negatively affected urban settings. Environmental-sensitive planning approaches can help reduce carbon emissions. One effective way to do that is reducing the energy use in cities and gaining the human behavior to become carbon-neutral. On a global scale, international agreements drawing a framework for carbon emissions, such as the Green Deal, reveal the need to look at the situation both environmentally and economically. Therefore, the main aim should be to achieve sustainable green growth by decoupling economic pressure on the environment. There are development projects with the decoupling aim. These projects need funds or grants to be implemented and disseminated. Since state supports are not sufficient throughout the world, private investments should be expanded by creating a market value for these projects. In this respect, green bonds, a green finance instrument, can be a catalyst for this market. Therefore, how these

projects and green bonds can be integrated should be sought. Both of these concepts, green bond and decoupling projects, need monitoring and evaluation, so they can combine to work together via M&E tools.

The primary purpose of this study is to investigate how the green finance module can be integrated into the monitoring and evaluation systems, including decoupling projects in the planning process. In this context, The Carbon Emission Atlas and Expert System (KAUS) in the GAP Region, conducted by the METU Built Environment and Design Application and Research Center (YTM-MATPUM), has been examined. Also, it has been discussed how green bond can be integrated into this monitoring and evaluation process and what the problems are against this integration.

Keywords: Carbon Emission, Decoupling, Green Finance, Green Bond, Monitoring and Evaluation

ÖZ

YEŞİL TAHVİL VE AYRIKLAŞTIRMA PROJELERİNİN İZLEME VE DEĞERLENDİRME İLE BÜTÜNLEŞTİRME YOLLARININ ARANMASI : KARBON EMİSYON ATLASI VE UZMAN SİSTEMİ (KAUS)

Çavuşoğlu, Şevval
Yüksek Lisans, Şehir Planlama, Şehir ve Bölge Planlama
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Nisan 2022, 156 Sayfa

Son yıllarda yapılan araştırmalarda iklim krizinin, insan faaliyetlerinden kaynaklanan karbon emisyonlarının bir sonucu olduğu vurgulanmaktadır. İklim krizi dünya çapında kentsel ortamları olumsuz etkileyen ciddi çevre sorunlarına yol açmaktadır. Çevreye duyarlı planlama yaklaşımları, karbon emisyonlarının azaltılmasına yardımcı olabilir. Bunu yapmanın etkili bir yolu, şehirlerdeki enerji kullanımını azaltmak ve insan davranışını yönlendirerek karbon nötrlüğü sağlamaktır. Küresel ölçekte, Yeşil Mutabakat (Green Deal) gibi karbon emisyonları için bir çerçeve çizen uluslararası anlaşmalar, duruma hem çevresel hem de ekonomik açıdan bakma ihtiyacını ortaya koymaktadır. Bu nedenle temel amaç, ayrıklaştırma (Decoupling) yani ekonomik büyümeyi sağlarken çevre üzerindeki baskıyı kaldırarak sürdürülebilir yeşil büyümeyi sağlamak olmalıdır. Ayrıklaştırma amaçlı kalkınma projelerinin uygulanması ve yayılması için fonlara veya hibelere ihtiyaç duyulmaktadır. Bu mali destek için dünya genelinde devlet destekleri yeterli olmadığı için bu projelere piyasa değeri yaratılarak özel yatırımların yaygınlaştırılması gerekmektedir. Bu açıdan, yeşil finans bu piyasa için bir katalizör görevi görebilir. Dolayısıyla bu projeler ile yeşil finansmanın nasıl entegre edilebileceği araştırılmalıdır. Yeşil tahvil ve ayrıklaştırma projeleri konseptlerinin

her ikisi de izleme ve değerlendirmeye ihtiyaç duyar. Dolayısıyla izleme ve değerlendirme araçları aracılığıyla birlikte çalışmak üzere bir araya gelebilirler.

Bu çalışmanın temel amacı, ayrıklaştırma (Decoupling) hedefli projeleri içeren izleme ve değerlendirme sistemlerine planlama sürecinde yeşil finans modülünün nasıl entegre olabileceğini araştırmaktadır. Bu kapsamda, ODTÜ-Yapılı Çevre ve Tasarım Uygulama ve Araştırma Merkezi (YTM-MATPUM) tarafından yürütülmüş GAP Bölgesi'nde Karbon Salım Atlası ve Uzman Sistemi Projesi incelenmiştir. Bu doğrultuda bu sisteme yeşil finans entegrasyonunun nasıl sağlanabileceği ve bu entegrasyonun önündeki sorunların neler olduğu tartışılmıştır.

Anahtar Kelimeler: Karbon Emisyonu, Ayrıklaştırma (Decoupling), Yeşil Finans, Yeşil Tahvil, İzleme ve Değerlendirme

To my future

ACKNOWLEDGMENTS

I would like to thank the following people, without whom I would not have made it through my master's degree.

First, I would like to thank my supervisor, Prof. Dr. Anlı Ataöv Demirkan, for her support, positive attitude, recommendations, contributions, and motivation throughout this study.

Besides, I owe sincere thankfulness to Prof. Dr. M. Melih Pınarcıoğlu. I deeply appreciate him for constantly expanding my vision with his guidance and mind-opening speeches.

I would also like to thank the examining committee member Prof. Dr. Bülent Yeşilata for his willing collaboration in offering a valuable interdisciplinary view.

I could not have completed this study without the support of my besties, Bihter Kızılca, Simge Reyhan, Övünç Ertunç, and Esra Gürel, who provided exciting discussions as well as happy distractions to rest my mind outside of my research. I know that they are always open to support in any matter.

Also, I would like to thank STEP Team Elif Ç., Elif A., Büşra, Deniz, and Ece for always motivating me to finish this thesis. I have never cast doubt on that the days when we will achieve our goals are soon.

I thank my little sister Ceren for her friendship and emotional support during this process. I sincerely appreciate Yiğit for his never-ending patience and assistance despite the lack of subject familiarity.

Finally, I would like to thank my father, who is more impatient than me to see this thesis completed, and my mother for her good wishes, prayer, and energy. I should have to say that the presence of my dear family, Ayşe, Özkan, Aykut, Deniz, Ömer, Sinan, and Yusuf Ali, gave me strength during this process.

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ESG	Environment-Social-Governance
GAP	The Southeastern Anatolia Project
GAP RDA	The Southeastern Anatolia Project Regional Development Administration
GBP	Green Bond Principles
GEF	The Global Environment Facility
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
KAUS	Carbon Emission Atlas and Expert System
METU RICBED	Middle East Technical University- Research and Implementation Center for Built Environment and Design
M&E	Monitoring and Evaluation
SRI	Socially Responsible Investment
TUIK	Turkish Statistical Institute
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER 1

INTRODUCTION

1.1 Problem Definition

Research studies emphasize that the main driving force of climate change is the greenhouse effect. Human activities increase the concentrations of some of these greenhouse gases in the atmosphere, especially carbon dioxide (CO2), methane gas, nitrous oxide, and fluorinated gases. Cities also create significant carbon footprint due to poor planning and development of settlement (European Commission, 2022). Various negotiations, agreements, and targets are concerned about this situation on a global scale. Green Deal is one of the issues that has drawn much attention in recent years. Turkish Government has also included this in its agenda with an aim at staying below 2 degrees Celsius until the end of the 21st century in order to act as part of the Green Deal and to combat the climate crisis (T.R. Ministry of Commerce, 2021). In line with this purpose, climate mitigation for developed countries and climate adaptation in developing countries come to the fore. Mitigation deals with reducing carbon levels, while adaptation focuses on dealing with potentially problematic issues. Under mitigation, two main methods shape the approach: the use of energy-efficient vehicles and a behavior change to reduce carbon levels (Grafakos et al., 2019). Therefore, the problem is framed around carbon emissions, and all activities address that.

Economic growth leads to activities that increase carbon emissions, leading to climate change (Rifkin,2019). However, climate change creates ecological and economic impacts. Carbon taxes and other environmental policies reduce emissions, but this process creates a loop of activities that support economic growth leading to

an increase of emissions (Rifkin,2019). Sustainable development approach can be one of an umbrella solution to this system.

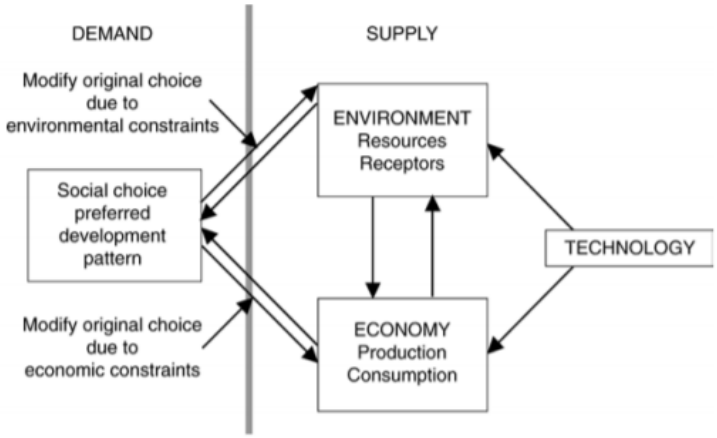

Figure 1. 1. Sustainable Development and its Indicators (Briassoulis, 2001)

Sustainability is often presented as a concept on balance between the developments of three pillars: an economic pillar, an environmental pillar, and a social pillar (Nordic Council, 2006). Briassoulis (2001) proposes a more specific model to that through a sustainability chart highlighting the relationship between the environment and the economy. He defines the sustainability relationship through demand and supply. Accordingly, economic production and consumption rely on social choices in the demand part, and environmental resources are used in reference to such choices. Furthermore, sustainable development based on the relationship between economy and environment may change in different socio-cultural and political contexts. Technology is also an essential factor in providing goods and services for the realization and management of these processes (Briassoulis, 2001).

One necessary component of reaching the sustainable development path is the decoupling process (Drastichová, 2014). The term of decoupling refers to "breaking the link between environmental bads and economic goods" (OECD, 2002). However, in practice, due to the established capacities of separately trained experts in the social, economic and environmental fields, it becomes impossible to integrate the key interconnected issues in sustainability assessment effectively. The processes of

communities to identify and prioritize issues with a bottom-up approach are often concerned with critical goals of safe livelihoods, safety, health and attractive communities, new opportunities and options, and impact on decisions. Thus, the three pillars of the sustainability model align poorly with these concerns that are widely expressed by citizens, the intended beneficiaries of strategic and project-level initiatives (Gibson, 2006). This calls for a catalyst that is concerned with public issues while reinforcing such integration.

Recent work in this issue (Menon, 2021) highlights green finance and asserts that it can play the role of catalyzing the transition to a sustainable future. Green finance can enable radical changes across industries transitioning to a sustainable low-carbon future through funding activities. It can channel capital into environmentally friendly projects and technologies. Public support is not always adequate in the realization of the decoupling implementations; therefore, support from the green finance market may be needed. For example, according to the OECD data, an estimated US$7 trillion must be invested each year till 2030 to converge climate and development objectives (Menon, 2021). At this point, however, the term "green" should be clearly defined, and relevant instruments should be discussed. This thesis asserts that it is particularly salient that the term green should be elaborated within the framework of green finance to understand how projects can benefit from green finance.

In this respect, green bonds can be considered as one of such financing options, which operate as bond revenues to fund projects with an aim to support climate crisis solutions such as sustainable, low-carbon and resilient cities. To understand how green bonds can contribute to the operationalization of balancing between the environmental impacts and economic benefits, the monitoring and evaluation processes of green projects should also be examined. Some software/digital tools such as expert tools recently used in planning can support the monitoring and evaluation of the decoupling process and its integration with financial instruments (Jacobson, 2018).

In this direction, this thesis is built upon the assumption that green bonds with a monitoring and evaluation model can support efficient and effective carbon emission-reducing projects. These models can include the decision-making, monitoring and evaluation stages of the financing process of decoupling projects and can assist in the financial, social and environmental examination of projects. In this context, this thesis is designed around how this integration can be possible starting from developing a framework for the monitoring and evaluation of decoupling projects in the planning of carbon-neutral cities.

1.2 Aim and Justification of the Study

Taking this as a point of departure, the thesis values monitoring and evaluation (M&E) as an important component of urban planning from the development of strategic goals to the determination of their intended results. The M&E system can, in fact, provide the platform to generate the database including urban parameters that create carbon emissions, to allow their follow-up through their value inputs, and to extract the areas of improvement. Moreover, the information produced by M&E can be used to strengthen projects, programs and investment activities by developing strategies and revealing clues for future strategic planning initiatives. At the same time, M&E can constitute the ground for the cities that plan their future to become carbon-neutral places. At this point, priorities can be determined first, necessary basic data can be collected and appropriate mechanisms can be put into use (The Cities Alliance, 2005). Integrated monitoring and evaluation tools can support planning processes that concern carbon neutral transition in cities. When standards and measures are uncertain and rely on traditional measures of economic activities, there are very limited indicators needed to analyze how progress can be made. Therefore, the monitoring and evaluation process is important to prevent inconsistent relationships in the transtition to carbon neutral economy (OECD, 2015).

Carbon Emission Atlas and Expert System (KAUS) can monitor and evaluate decoupling projects that can foster the achievement neutral carbon emission in cities. KAUS is a carbon emission calculation tool developed for the Southeast Anatolia Project (GAP) region by METU-Research and Implementation Center for Built Environment and Design (METU-RICBED). The purpose of its use is to monitor and evaluate the impact of proposed actions such as conducting thermal storage and disseminating solar panels use in terms of emissions (METU RICBED, 2020). These actions aim at decoupling the economic pressure from environmental resources. They ultimately suggest to foster the transition to a carbon neutral economy in the agriculture, construction, industry, transport and waste sectors. Although the purpose is to monitor and evaluate decoupling projects, KAUS lacks the Green Bond, a green finance instrument. Thus, this research explores how KAUS and the Green Bond can be integrated.

The research initially developed as a case study on the contribution of monitoring and evaluation tools to planning, and the green bond has become a focus on the basis of the information gathered from the field. Consequently, the inquiry was carried out as a two-stage study.

The primary aim of the research is to develop a general framework for green finance; to understand the green bond financial instrument and its complementaries; to reveal the need for its integration into the planning process; to discuss how it can be integrated into the decoupling projects' monitoring and evaluation process as a systematic way.

Within the scope of this research, the problem questions are formulated as follow:

RQ 1: What are the obstacles that prevent the application of monitoring and evaluation tools like KAUS in planning processes?

RQ 2: How do the Green Bond (a green finance instrument) and KAUS (a monitoring and evaluation tool) can support each other in planning processes?

RQ1 is answered with group meeting notes with decision-makers, while RQ2 is discussed with interview notes with finance specialists.

Answering these questions will be beneficial in three main areas.

Firstly, it is thought that answering these questions can increase the funding opportunity by observing the effects of the projects that need private-sector funds that cannot be carried out only with public funds when they are realized. If green finance tools for urban projects with decoupling objectives can be drawn, it will be convincing for implementing and disseminating these projects. This framework with practical aspects related to the literature will support the scientific approach and expand the planning literature with green finance, a relatively new topic for the world agenda.

Secondly, the planners or project managers need a monitoring and evaluation tool for control, supervision, and management in project process. Still, there is a problem that these tools cannot work with one hundred percent realism because of some internal (technical) and external (use) factors. This study which discusses whether these problems can be overcome with green finance integration will contribute to developing technological tools and algorithms and support the discussion of new planning approaches.

Finally, from the perspective of green finance actors, a project that is well audited and evaluated with many indicators will have a lower risk, so the rate of funding and investment will be higher for both investors and issuers. For this reason, low-carbon city projects that can be integrated with green finance through monitoring and evaluation systems will be preferred, and the investment process's observability will increase.

1.3 Methodology of the Study

The inquiry presented in this thesis adopts an explorative research approach with an aim at determining how the integration of decoupling projects with green finance can be achieved with the help of a monitoring and evaluation tool and identifying the obstacles to this integration. As the monitoring and evaluation tool, the inquiry uses the Carbon Emission Expert System (KAUS), developed by METU YTM-MATPUM (RICBED) for the purpose of providing Carbon Neutral Economy in the GAP Region, particularly in Şanlıurfa. This system was developed with an action research perspective with an aim at changing the behavior of decision-makers and enhancing the adaptation of this KAUS. I was also involved in the design process of this monitoring and evaluation system. This thesis presents the part that investigated the green finance integration with this tool.

In this regard, two research questions were answered: (1) *What are the obstacles that prevent the application of monitoring and evaluation tools like KAUS in planning processes?*; (2) *How do the Green Bond (a green finance instrument) and KAUS (a monitoring and evaluation tool) can support each other in planning processes?*

To this end, the inquiry was conducted in two phases (Figure 1.2). In the first step, the KAUS was examined in detail. Moreover, the challenges that the decision-makers encounter in integrating decoupling projects with this tool were identified. The outcomes of the first phase, referring to the need for the consideration of green finance in effective project management led to the construction of the second phase. This section presents the methodological framework with a closer look at the used monitoring and evaluation tool, the participant composition, data collection and analysis techniques applied.

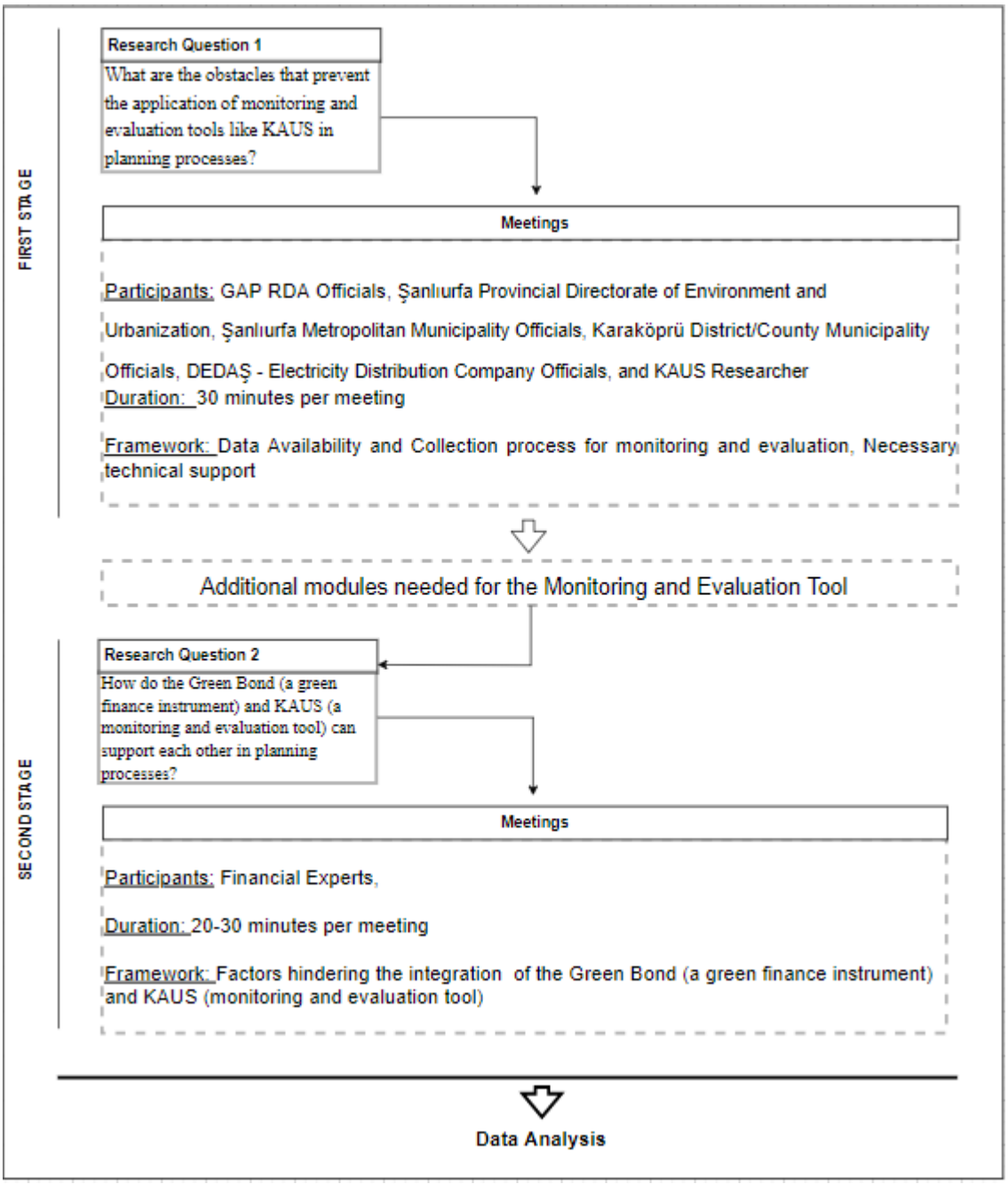

Figure 1. 2. Research Process

The Selection of the Monitoring and Evaluation Tool

This inquiry chose the Carbon Emission Atlas and Expert System (KAUS) as the monitoring and evaluation tool because it assesses the impact of actions by

simulating different combinations of decoupling projects and it is the only tool providing an advanced perspective to the planning process with its monitoring and evaluation capacity. The region where this tool is applied is the GAP Region, and the pilot study area is the Şanlıurfa Province.

The GAP Region presents a suitable context for this study for three main reasons. First, the region ranks among the priority regions in the Public Investment Priorities in the Development Plan in terms of investment (T.R. Ministry of Development, 2018), and it has the most effectively implemented project (GAP) among the regional development plans prepared so far (GAP RDA, 2018). It is seen that the regions that are relatively far from metropolitan life and insufficient in technological infrastructure and technical capacity have high potential in terms of Clean Energy and Low Carbon Production implementations (METU RICBED, 2020). Therefore, evaluating investments in this region can be an excellent opportunity to bring its development to the agenda in terms of sustainability. Secondly, the region generates the Turkey's largest amount electricity, irrigation, and regional development work (Yılmaz, 2012). This makes the region a suitable area for the realization of decoupling projects with its renewable energy infrastructure potential. Third, since I was involved in the development of KAUS, and thereby, could establish dialogue and build trust with local institutions, I would access the representatives of local institutions more easily and conduct interviews more efficiently. I was also able to explain to them the use of new tools more easily.

Selection of Involved Participants

As shown in Figure 1.3., for the first phase of the research, a total of 19 participants were selected from among the institutions in the pilot region of the project. At least one person from each institution participated in the inquiry. They were selected based on four main reasons. They are familiar with the 'Carbon Emission Atlas and Expert System' in the GAP Region Project in the research content. They have the

expertise to discuss the system add-ons. They are the user group of this monitoring and evaluation system. They are capable to issue a green bond.

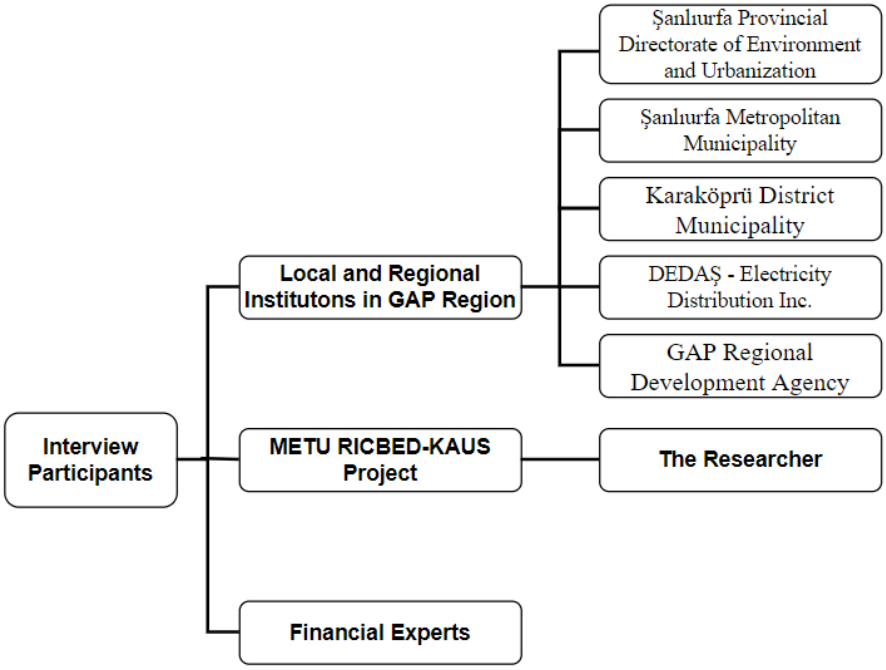

Figure 1. 3. Participants of Interviews

The involved institutions include the Şanlıurfa Provincial Directorate of Environment and Urbanization, the Metropolitan Municipality of Şanlıurfa, the Municipality of Karaköprü District, DEDAŞ - Electricity Distribution Inc., and the GAP Regional Development Agency. The representatives of these institutions participated in the inquiry. While Şanlıurfa Provincial Directorate of Environment and Urbanization, Şanlıurfa Metropolitan Municipality and Karaköprü District Municipality are the users of this monitoring-evaluation tool for project implementation and management, GAP Regional Development Agency is in the role of supervisor and DEDAŞ - Elektrik Dağıtım A.Ş. is a user in the data provider role. Therefore, each participating institution ensures different features of the monitoring-evaluation system.

For the second phase of the research, two independent finance experts participated in the study. Additionally, one researcher from the Carbon Emission Expert System Project team was also interviewed because of her position in the project's development and has extensive knowledge of the project.

Table 1.1. The list of institutions participated in the inquiry

Informant Number	Institutions	Occupation and Position	Number
I1	Şanlıurfa Provincial Directorates For Environment and Urbanization	Deputy Mayor	1
		Departmental manager	1
I2	Şanlıurfa Metropolitan Municipality	Head of Environmental Protection Control Department	1
		Head of Survey Project Department	1
		Environmental Protection Department	1
		Transportation Planning Department Manager	1
		Public Transport Department	1
		Project and Planning Department	1
		Architect/R&D Department Manager	1
		Head of Administration, Informatics, Transportation Department	1
		Electrical engineer	2
I3	Karaköprü District/County Municipality	Civil Works Director	1
		Deputy Mayor	1
		Urban Planning Director	1
I4	DEDAŞ - Electricity Distribution Company	Engineer	2
I5	GAP Regional Development Agency	Mayor	1
		Deputy Mayor	1
		Electrical engineer	1
I6	METU RICBED- KAUS Project	The Researcher	1
I7	-	The Financial Experts	2
Total			**22**

Data Collection and Analysis

In the first phase, five group interviews and five in-depth interviews were conducted via face-to-face communication between January 25, 2022, and April 25, 2022, with

the participation of the GAP decision-makers. At least one person from each institution participated to data collection process. Figure 1.4. illustrates the interview process conducted in this phase.

As can be understood from the Figure 1. 4. Interview Process, in the first meeting held after the Carbon Neutral Economy Transition Action Plan in the GAP Region meetings, a request for an atlas regarding the current emission amount, the amount of emissions to be obtained by the implementation of the actions in the action plan and numerical targets was stated by the GAP RDA. At the first meeting, the algorithm of this atlas was discussed to meet the needs of the GAP region, and it was decided which needs it could meet. This decision is that the atlas should include monitoring of the existing data, the actions' impact, audition of their timely and comprehensive implementation, and impact assessments.

Each group interview lasted approximately two hours, and the interviews about half an hour. Interviews were typed simultaneously during the conversation. A research diary was produced to document all notes about the institution representatives' opinions, expressions, and reactions.

The generated meeting notes and transcriptions were analyzed by the use of the Content Analysis Technique. This technique allowed a systematic categorization of replicable inferences from participant expressions. The concepts repeated at each group and one-on-one interview constructed main content groups. The quantification of descriptives through the frequency of mention helped reveal the most referred issues, and thus, the most important ones by the participants.

In the second phase of the inquiry, in-depth interviews were conducted with independent finance experts to investigate how green finance perspective can be a channel to ameliorate green project management. More specifically, this phase aimed at generating an expert opinion on the financial integration of the KAUS. Therefore, an interview was started with questions focused on whether a monitoring-evaluation system is used in financial evaluations to obtain the requirements and capabilities of

M&E in finance. Thus, the open-ended questions focused on integrating the monitoring-evaluation tools in the carbon-neutral transition process. The descriptives collected through this phase were conceptually presented. No quantification was calculated for the reason of seeking guidance for future action steps.

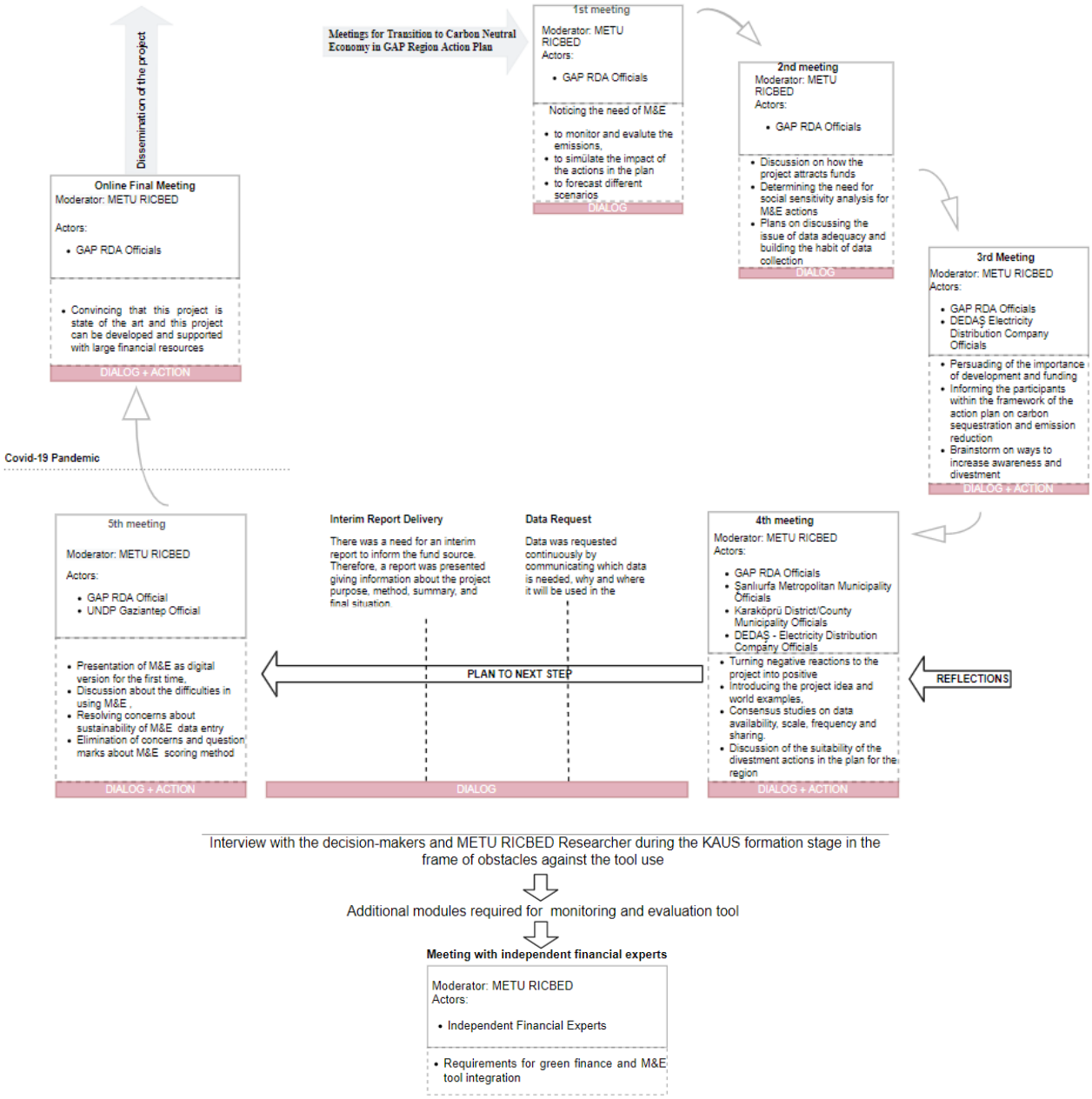

Figure 1. 4. Interview Process

1.4 Structure of the Study

This research consists of five chapters, including the introductory and concluding parts.

The first chapter, the introduction part, explains the problem definition, the aim and justification, the research questions and the sub-questions, and the research methodology. Also, this chapter briefly summarizes the framework of the research (Figure 1. 5.).

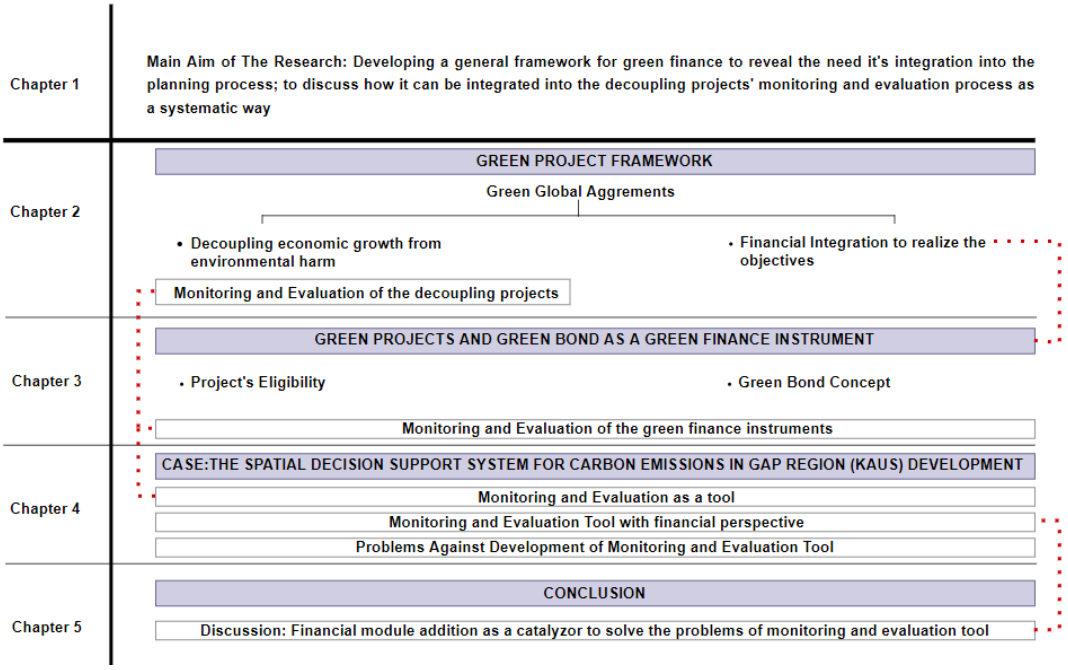

Figure 1. 5. Research Framework

The second chapter starts by giving a background on the subject. A literature review has been written on decoupling and green finance, which is the content of green local and regional projects to be included in the planning. At the same time, the necessity of monitoring and evaluation for decoupling is emphasized.

In the third chapter, a green finance instrument, the green bond, is explained in detail. Also, the eligibility criteria for the projects are mentioned because green finance

makes use of monitoring-evaluation tools. Therefore, the requirements for monitoring-evaluation were also mentioned.

In the fourth chapter, the KAUS Project (Carbon Emission Atlas and Expert System) developed by METU-RICBED has been determined as a case study as it is a monitoring-evaluation system. Semi-structured interviews were conducted to identify the obstacles that may be encountered while developing this monitoring-evaluation objective. These interviews were held with a researcher in the project team, institutions that will be KAUS users in Şanlıurfa, the pilot region of the project and financal experts. In addition to these, all the features of KAUS are explained in detail in this chapter.

Finally, the last chapter, the conclusion, discusses all research findings evaluate from a critical perspective. It discusses the solutions to the obstacles to the integration of decoupling-oriented projects with green finance through the monitoring and evaluation system. The concluding remarks also lead to further research that can be carried out on developing a framework for green finance and decoupling projects applied in planning via monitoring and evaluation tools.

CHAPTER 2

GREEN PROJECT FRAMEWORK

2.1 Global Agreements and Methods Overview

Many environmental problems are encountered due to the climate crisis. There is substantial evidence that climate change is partially caused as a consequence of release of greenhouse gases (GHGs) into the atmosphere that leads to temperature rise and fall (European Commission, 2022). Some (Wang & Chameides, 2007) also claim that this issue arises not as a result of the geological evolution of our planet but from global warming as a result of human interposition. Crutzen and Stoermer (2000) argue that in the current geological period, irregularities occur in the earth systems cycles occasionally (e.g., carbon cycle, nitrogen cycle, etc.) due to human activities. One of these human-induced irregularities is claimed to be climate change. Acidification of the ocean and chemical and physical changes in soils unprecedented in human history are just some of these irregularities. The Anthropocene epoch can be associated with the logarithmically increasing carbon footprint, primarily because of industrialization (Crutzen & Stoermer, 2000). Therefore, its solutions can also be provided by human intervention. It creates the need and urgency to realize sustainable development models that support the transition to a green, low-carbon, and climate-resilient economy and takes concrete measures to combat the adverse effects of climate change.

The depicted diagram shows the evolution of focus of the policies from anthropocentric to ecocentric. These approaches are not independent of each other because income growth, a long and healthy life, and a good education are not possible without a good and healthy environment (Aydın et al., 2017).

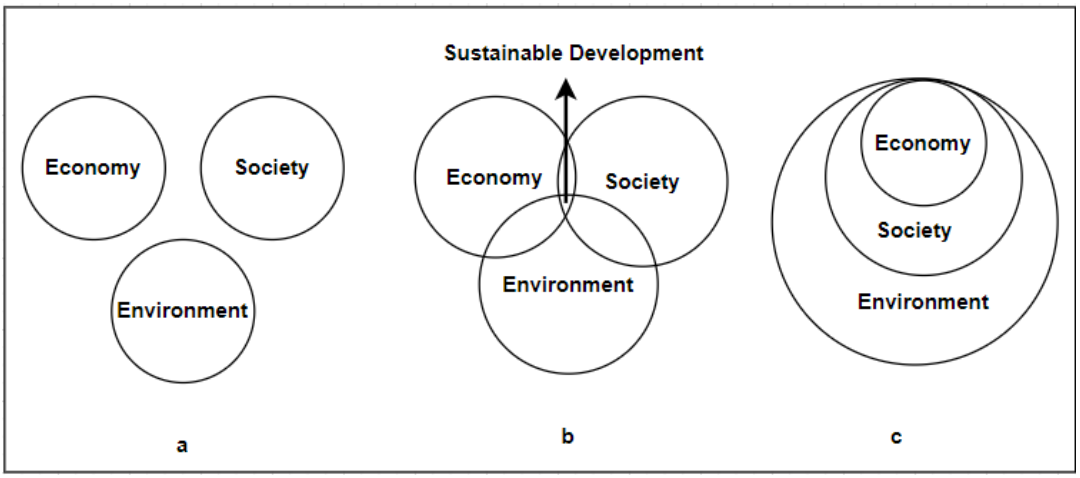

Figure 2. 1. The evolution of the concept of human development in terms of environmental sustainability

Source: http://www.skdturkiye.org/files/yayin/100-maddede-surdurulebilirlik-rehberi.pdf

The dynamic interaction between the social need for an opted development plan and supply of both economical and environmental services and goods to satisfy this demand could be interpreted as sustainable development. The research field whose concern is the relationship between the terms economy, society, and environment has altered from multidisciplinary to interdisciplinary and even transdisciplinary. Sustainable development is increasingly seen as a guide for the future. It is understood that besides the environmental, economic, and social dimensions, it is also necessary to think from the point of organization to make the required institutional arrangements (Briassoulis, 2001).

Some international agreements are conducted in this direction, and targets are determined.

2.1.1 Paris Agreement

The Paris Climate Conference on December 12, 2015, was adopted as the first universal agreement signed by 195 countries to refer to global warming. This

agreement has been the starting point for tackling climate change. The agreement is in the context of sustainable development and poverty eradication. The primary objective of this agreement is to retain the global average temperature increase below 2°C to avoid the risks and effects of the change in climate. However, it was set as a symbolic target, as 1.5°C would be unattainable for many countries. In the Paris Agreement, which called for "consistent financing flows with low greenhouse gas emissions and a path towards climate resilient development", countries recognized the need for specific climate finance (UNDP, 2016).

Also, governments are expected to meet every five years to evaluate progress and report to each other on planned actions to provide clear transparency and mutual accountability to this agreement. Developed countries, currently operating as the top polluters, will need to do more than developing countries to prevent their own economic growth from slowing in the process of becoming carbon neutral. Agreed countries are also committed to help developing countries to cope with the effects of climate change and overcome the loss and harm caused by climate events in extreme degrees (European Commission, 2021).

However, the agreement offers no sanctions to those who do not comply with the contract. As a matter of fact, in 2019, the US formalized the beginning of its withdrawal process from the Paris Agreement. The reason for its withdrawal was associated with the agreement’s undermining the competitiveness of US companies. The second-largest country's withdrawal from CO_2 emissions has, in turn, generated many doubts for the international community about the ability of the agreement to meet climate change targets (Ferrara, 2020). While Turkey signed the Paris Agreement in New York on April 22, 2016, with the representatives of 175 countries, The Law on Approval of the Paris Agreement by the Turkish Grand National Assembly entered into force on October 7, 2021 (T.R. Ministry of Environment, Urbanism and Climate Change, 2021).

Therefore, a supervisory mechanism that can monitor and evaluate the process is needed for these objectives. In this way, it will be possible to intervene before the deadline for those responsible for rejecting the targets and detect the problems as to why the marks could not be reached. It was also stated that specific financing model was needed to achieve the objectives.

2.1.2 The 2030 Agenda for Sustainable Development (SDG)

In 2015, the United Nations Organization contributed SDGs to promote human well-being and protect the environment by adopting the 2030 Sustainable Development Agenda with 17 Sustainable Development Goals (SDGs) and 169 sub-goals characterized by economic, social, and environmental dimensions. It is expected that all countries contribute to achieve the targets according to their capacities due to the universal validity of the SDGs. The targets to be pursued until 2030 represent common goals on many key development issues, such as fighting poverty, ending hunger, protecting human rights, and building peaceful societies. It is an agenda that calls on the financial sector to contribute to the realization of these sustainable world objectives (UN, 2021).

Even though all objectives within the scope of sustainable development goals have implications for urban planning, the 11th article, Sustainable Cities and Communities, aims construction of inclusive and safe cities and settlements with durability and sustainability attributes, and establishing a more direct connection with the field. In this respect, some highlighted issues include accessible transportation systems and housing, sustainable transportation systems and urbanization, protection of not only natural but also cultural world heritage. In addition to these, reduction of the harmful impacts of natural disasters such as earthquake, forest fire, etc., guaranteeing access to green and public spaces which are safe and inclusive, national and regional development planning, inclusion policy implenetation, lessening disaster risk and maintaining resource efficiency, and

providing support to developing countries for them to build sustainable and resilient structures (T.R. Presidency Strategy and Budget Office, 2019). It is also an agenda that calls on the financial sector to contribute to the realization of a sustainable world by 2030.

The implementation process will need to be monitored and evaluated with specific parameters to advance the objectives in these Sustainable Development Goals. Otherwise, they will remain abstract targets, and analysis in line with the target between applications will not be possible. Consequently, assistance should be sought from systems such as monitoring and evaluation in terms of realistic practices and feedback for the problems.

2.1.3 Actions against climate change: mitigation and adaptation

Two types of measures are used to prevent and limit the effects of climate change: mitigation and adaptation to obtain the goals set in the Paris Agreement for a carbon-neutral future (Ferrara, 2020). Climate change adaptation and mitigation are the basic concepts of political, social, and economic arguments developed to combat the climate crisis and its impact on human life and the planet ecology. IPCC defines climate change adaptation as an adaptation to natural or human systems that reduce harm or take advantage of beneficial opportunities in response to actual or anticipated climatic stimuli or their effects. On the other hand, the IPCC identifies climate change mitigation as human-induced interventions to reduce greenhouse gas sources or sequester emissions by increasing carbon sinks (IPCC, 2007).

The concept of adaptation refers to the ability of humans and natural systems to adapt in response to expected climate change and its effects. UNFCCC considers adaptation to climate change as two basic concepts: resilience and vulnerability. The notion of resilience refers to the ability to absorb disturbances, while vulnerability relates to the inability to overcome the adverse effects of climate change (UNFCCC, 2009). In addition, the IPCC emphasizes the distinction between incremental

adaptation, whose purpose is to preserve system integrity, and transformational adaptation, whose goal is to make changes in the system in response to climate impacts (IPCC, 2014).

In this context, a technological system with numerical outputs and process control will be helpful since climate mitigation is a kind of management process and aims to reduce emissions analytically. In terms of adaptation, since not every application can carry quantitative data, it is essential to ensure that compliance with the results of the climate crisis is measurable and under control in terms of intervening in the problems of the actions and improving the conditions.

2.1.4 EU Green Deal

European Green Deal, which is a plan of investment, was approved on January 14, 2020 to make the European Union region a climate-neutral continent until 2050. The European Green Deal adopted by the EU Commission has the long-term target of climate neutrality by 2050 by reducing greenhouse gas emissions by 50-55% from 1990 levels by 2030. The agreement aims to transform the EU into a society with a fair, prosperous, competitive economy that uses resources efficiently. The Green Deal is a commitment to re-transform economies to achieve carbon neutrality. The European Commission has set some investment targets (UIB, 2021; Ferrara,2020).

These:

• 503 billion liquid resources from the European budget

• 114 billion co-financing from the Member States

• 25 billion from revenues from ETF(exchange-traded funds) securities

• 280 billion investments expected from public and private operators to be guaranteed by InvestEU and the European Investment Bank (EIB) (Ferrara,2020). The remainder will be provided by the Just Transition Mechanism, which the

Commission aims to support its social and economic costs. The "Just Transition Mechanism" is much more than a fund to which it is demoted. It is part of the "European Sustainable Investment Plan," which aims to accelerate financing of €1,000 billion in the green economy by 2029, primarily through the multi-annual budget and the "InvestEU" program, before the proposed recovery plan. Its aim is the elimination of high carbon-emitting activities in East Germany and Eastern Europe (Poland, Romania, Czech Republic, Bulgaria) and climate and social transition policies in the most affected regions in the South (France, Italy, Spain, Greece, etc.) (The Robert Schuman Foundation, 2020).

The objectives of Green Deal can be grouped under three main headings;

(i) reducing net greenhouse gas emissions to zero by 2050;

(ii) decoupling economic growth from resource use; and

(iii) leaving no one and no country behind in achieving these first two goals (UIB, 2021).

This Investment Plan will mobilize European funds, i.e., EUR 1 trillion investment for the next ten years, and encourage the public and private investment needed to support the fight against climate change and reduce CO_2 emissions (European Commission, 2020). Likewise, the double-catalyst of the Paris Agreement and the UN Sustainable Development Goals, and the UN's declaration that the world needs $90 trillion in climate investment by 2030 to achieve them, is an indication of the need to expand green finance and bonds (UNDP, 2016).

In essence, the Green Deal is the transformation from fossil fuel-intensive Second Industrial Revolution infrastructure to a smart, green, zero-emissions Third Industrial Revolution infrastructure. In line with this, global decisions started to be taken, but these practices have not been sufficient to comply with goals fully. Thus, this, in turn, has led local solutions to be taken into consideration. In fact, with the Third Industrial Revolution, it is seen that there is a transition from globalization to "glocalization" as individuals, businesses, and communities interact directly with each other, bypassing many of the global companies that mediate them. This

infrastructural revolution requires establishing a healthy social market economy system that connects government, industry, and civil society at all scales with the appropriate mix of public, private, and social capital. Due to the transition from globalization to glocalization, the relationship between national governments and local communities is changing. The focus of responsibility for the economy and governance is shifting from the nation-state to the regions (Rifkin,2019).

In Europe, after recognizing this glocalization need, the working group known as 'Green Deal Going Local', which is a committee of the European Committee of the Regions, emerged. The objectives of this committee are centering European Green Deal upon cities and regions, ensuring a strategy for the EU for sustainable growth, and providing a smooth COVID-19 recovery process through direct monetary funding for concrete projects (European Committee of the Regions, 2021). In a nutshell, the Green Deal Going Local movement builds partnerships between local governments, local economy stakeholders, and citizens to create and implement Local Green Deals for the sustainability of their local economies (Gryffroy,n.d.) The Turkish Ministry of Commerce has also prepared a Green Deal Action Plan for 2021. The content of this action plan starts with Carbon at the Border, Circular Economy, and Green Financing, and local institutions are covered as active stakeholders in this action plan (The Turkish Ministry of Commerce, 2021). However, no actions have been taken yet in this line.

Existing practices show that three critical qualities need to be applied to successfully implement the green deal by local and regional authorities (Gryffroy,n.d.). Green Deal should pursue "a bottom-up," "targeted," and "balanced" approach.

A BOTTOM-UP: A top-down approach can lead the Green Deal to fail. A bottom-up approach should be adopted, and local and regional authorities should participate in the implementation of national plans related to the Green Deal.

TARGETED: It is necessary to focus on measures that allow further carbon emission reductions at lower costs, considering local conditions and different energy mixes.

Recovery and resilience plans must respond to the specific needs of regions to ensure their effectiveness, so local and regional authorities must have a more significant say.

BALANCED: A flexible approach considering each region or country's contribution should be adopted, and emissions gaps should be taken into account. The importance of local-regional authorities in this complex context is recognized at all levels but is rarely reflected in practice in governance and financing mechanisms (Gryffroy,n.d.).

Administrative developments are also needed to achieve these three qualities. Governance stands out as a supportive management style in this regard. In terms of governance, decision-makers must work with Local and Regional Authorities when decisions are related to specific regions. Collaboration with these institutions should be made in setting general guidelines for the recovery and resilience strategy. Also, financing schemes should be established to ensure cities have direct access to funds to implement Green Deal projects (Gryffroy,n.d.).

Therefore, the green deal as content is shaped around two main issues. The first is to set targets that will ensure emission reduction, and the second is to provide a financial integration to achieve these targets. Indeed, the approach to these two issues and the management process are also necessary. As a process, it includes inter-institutional communication and participation as it is bottom-up and balanced. At this point, a management tool that can be audited and used transparently by institutions will support the process of reaching the target.

From the Paris Agreement to the SDGs and the Green Deal, it appears that a path towards sustainable development based on decarbonization has been launched. In other words, it can be understood from the Green Deal and Sustainable Development Goals that a competitive and fair economic development model is on the agenda. In addition, implementations should be made by setting targets within the scope of emissions starting from the local and green finance support within the scope of the Green Deal required for these applications to achieve sustainable development. In

this way, a transition to a sustainable development model may be possible. Therefore, it is aimed to achieve green growth by removing the pressure on the environment while ensuring economic growth (decoupling). However, a monitoring and evaluation system will be needed to prevent uncontrolled progress as in all agreements, achieve the targets in a controlled manner, and act according to a standard.

2.2 Comprehension of the Local/Regional Green Projects

Global agreements were made in the face of the growing effects of the climate crisis. As a result of these agreements, some targets were determined, and states' necessity to take action for their realization was revealed. The critical point in completing these actions is channeling capital to more sustainable investments that will benefit the environment and climate. Significant issues within this environment and climate benefit framework include energy efficiency, reducing pollution, using clean energy, climate mitigation, and adaptation (Ferrara,2020). It is essential to define these projects and draw their boundaries because the measurable project effects in line with the determined targets will facilitate the process management and enable concrete results. If the definition and needs of the projects are known, targets can be determined according to this definition, and project impact measurement can be made in line with these targets.

According to a survey conducted by UNEP Inquiry (2016), the common assessment of what is "green" includes green buildings, renewable energy, energy efficiency, and sustainable forestry/agriculture sectors. Other sectors such as conservation, carbon capture and storage, transportation, and climate change adaptation include some country-specific differences in definitions. Some localized explanations, such as noise reduction, stormwater storage, sustainable transport, and capacity building for designated sectors, are addressed as "green-related" (UNEP Inquiry, 2016).

Despite of the fact that there is not any universal definition, green projects are generally long-term projects developing technologies to reduce greenhouse gas emissions, studying environmental protection, and providing energy infrastructure in various sectors such as transportation, agriculture, and construction. The lack of a precise definition causes investors to be hesitant to invest in these projects. Therefore, guidelines and standards have been prepared to make it more understandable and accurate (New York State Department of Economic Development, n.d. ; Ferrara, 2020).

In summary, although these projects' application area or sector changes, the framework sought to reduce carbon emissions. While doing this, financial investments can be made, and it is expected not to harm the economy. Likewise, it should be aimed that projects containing economic growth objectives do not create environmental pressure, decoupling economic pressure from environmental resources.

2.3 Decoupling Objective of the Projects

Projects are produced to reduce carbon emissions with behavioral changes or renewable technological tools and create a positive economic impact while these goals are realized. The important thing is that this positive effect does not turn into negative environmental, contributes to the project objectives, and provides green growth.

Green growth supports the balance between the sustainable development pillars; an economical, environmental, and social pillar to achieve measurable progress in economic and environmental foundations while fully taking into account the social scale of greening the growth dynamics of economies (OECD, 2011).

Green growth is defined similarly in different sources. While OECD (2011) defines it as "fostering economic growth while ensuring the sustainability of natural assets

to provide the resources and services on which our well-being relies," GGGI (2014) defines it as a set of green policies, innovation, and investments for sustainable economic growth. In addition to these, green growth has been described in the same direction as the financial process that embraces environmental sustainability and promotes low carbon and socially inclusive development (UNECE, 2011), resource-efficient, clean, and durable growth process without slowing down (The World Bank, 2011).

Green growth shifted the environmental agenda to the expectation of the decoupling of environmental pressures and economic growth. However, determining the scientific basis behind the decoupling hypothesis, an economically high-risk situation, requires careful evaluation (Parrique et al., 2019).

OECD (2011) formally adopted decoupling economic growth from environmental harm as a goal, playing a key role in its strategy towards Green Growth. That was followed by the European Commission, which in its 6th Environment Action Program (Environment 2010: Our Future, Our Choice) declared its goal of "breaking the old link between economic growth and environmental damage" (EU Commission, 2010). The commitment to "decoupling growth from resource use" was also based on the EU Roadmap to Resource Efficient Europe and the United Nations Environment Program (UNEP) green economy strategy by addressing to reduce environmental risks and ecological scarcities (Parrique et al., 2019).

Shortly after, the World Bank joined the "bandwagon," accompanied by Inclusive Green Growth: Road to Sustainable Development (2012). Since 2012, the 7th Environment Action Program of the European Commission, which has guided environmental policy until 2020 about Living well within the limits of our planet, emphasizes "absolute separation of economic growth and environmental degradation" to live well within the borders of our world. Also, in 2015, decoupling became prominent in the Sustainable Development Goals (SDGs) (Parrique et al., 2019).

Last of all, economy and climate are highly related, and economic and climate policies should be designed to optimize consumption flows over time. At this point, the concept of decoupling, which reflects the understanding that the economy can grow without using more resources and aggravating environmental problems, comes to the fore. When the economic impulse (e.g., GDP) overwhelms the growth rate of an environmental pressure over time, it leads to decoupling (Ruffing, n.d.). It is essential to determine which economic factors affect the natural resource and which aspects of the economy are affected by environmental degradation to monitor the status of natural resources and their links to economic development (Kristensen, 2004).

2.3.1 Modes of decoupling

Decoupling has two modes as resource decoupling and impact decoupling.
On the one hand, resource decoupling reduces the use rate of (primary) resources per unit of economic activity. This "dematerialization" relies on using fewer resources such as materials, energy, water, and land for the same economic output. Resource decoupling drives an increase in resource utilization efficiency. Such increased efficiency can be measured by dividing the value added by resource use (e.g., GDP / Native Material Consumption) and expressed for a national economy or a specific economic process or production chain. Another way to show resource decoupling is to compare economic output's degradation over time with the gradient of resource input (Fischer-Kowalski et al., 2011).

On the other hand, impact decoupling request decreased negative environmental impacts while increasing economic output. These impacts can be seen in the resources necessary (e.g., agriculture and/or mining caused groundwater pollution), production (e.g., waste material, harmful gas emissions, and land degradation), the use phase of the goods (e.g., CO2 emissions caused by transportation factors), and the post-consumption step (e.g., harmful gas emissions and waste material).

Methodologically, these listed effects can be predicted by life cycle and various input-output analysis. At the national scale in terms of the economy, measurement of impact decoupling is highly desirable due to the need of the identification of possible environmental impacts. The reason behind is that the trends of these environmental impacts may differ excessively and this could make tracking impossible over time (Fischer-Kowalski et al., 2011).

Resource and impact decoupling are two intertwined modes. Their way of working differ from each other in several ways. Resource decoupling aims to respond to the issues of scarcity and sustainability of intergenerational equity by reducing the level of resource abatement at the same time increasing resource productivity. It is relatively easy to measure and track but can be more challenging to obtain than impulse decoupling (Fischer-Kowalski et al., 2011).

As a concept, impact decoupling indicates better, cleaner and wiser resource usage. However, any action with the aim of environmental impact reduction may not end up saving resources or decreasing the production costs when the whole process is considered. Indeed, it may lead to an increase in these. For example, resource decoupling does not occur since carbon capture and storage require more energy per output unit. Still, the environmental impact on the life cycle is reduced as released CO_2 amount into the atmosphere drops to zero (Fischer-Kowalski et al., 2011).

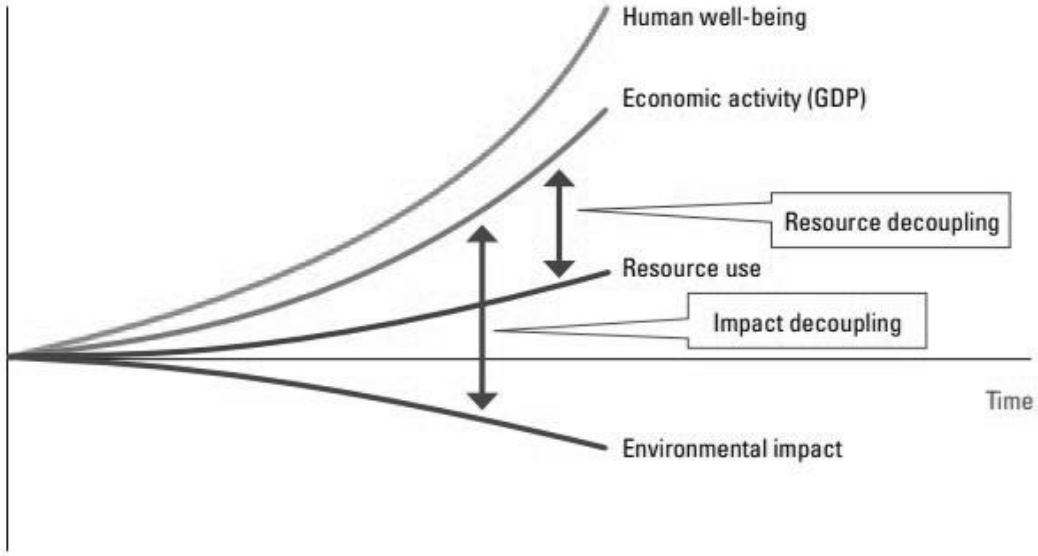

Figure 2.2. Decoupling Modes (UNEP, 2011)

Decoupling can be overall or partial; absolute or relative; permanent or temporary; global or local; fast or slow.

Decoupling is relative if it succeeds in several essential criteria. In relative decoupling, environmental pressures still increase, but at a slower rate than GDP. In temporary decoupling, reliable long-term solutions cannot be obtained. The ecological burden may shift to other areas if a local decoupling is achieved. The ecosystem can degenerate if it goes too slowly (Noonan &Vrizzi,2020).

Considering the behavior of both variables, if they evolve in the same direction with different speeds, that indicated relative decoupling while moving in opposite directions specifies absolute decoupling. Evaluating decoupling is estimating the loss of proportionality between one variable to another over time. Although the economy was relatively less influential per unit of GDP than before in the relative decoupling between GDP and carbon emissions, the absolute emission volume can still increase. When decoupling is absolute, environmental pressures decrease without decreasing economic activity, or economic activity increases without increasing ecological pressures (Parrique et al., 2019).

It is possible to discuss a general decrease in our unit resource intensity by using the greenhouse gas emissions. Still, despite this, the total emissions continued to increase continuously. Therefore, it is impossible to talk about absolute decoupling in this context. The Ehrlich-Holdren (IPAT) equation says that the impact of human activities on the planet and its resources is the product of three key factors: Population, abundance, and technology = the negative pressure people place on resources for every dollar spent (I = P*A*T). It is necessary to achieve decoupling as close to the absolute as possible to sustain a growing population and prosperity. At this point, it is hard to get out of this "simple equation." Experts suggest that a trajectory based solely on relative decoupling will not answer socio-ecological crises without questioning the dominant economic system (Gündoğan et al., 2014).

2.3.2 Measuring decoupling

The decoupling indicators do not mean to be all-encompassing or summarize the environment's general state. Instead, they aim to measure countries' progress towards alleviating specific environmental pressures from the relevant drivers. This is formulated by measuring the proportional rate of change (growth) in a driving force and pressure variable.

$$DR_{t_0,t_1} = \frac{EP_{t_1} / EP_{t_0}}{DF_{t_1} / DF_{t_0}}$$

$DR_{t0,\,t1}$ stands for decoupling ratio, EP_t is an environmental pressure variable level at time t, and $DF_{t\ is}$ an economic driving-force variable level at time t (Nordic Council, 2006). Sample indicators used as decomposition indicators are tabulated below.

Table 2. 1. Variables used for Decoupling Research (Bodur, Küpeli, Alp, 2021)

Variables	**Research object**	**Period**	**Authors**
Gross domestic product	China	1980-1997	Zhang (2000)
	EU-15	1970-2001	Tapio (2005)
	New Eastern EU members	1991-2002	Juknys et al. (2005)
	Brazil	2004-2009	Freitas and Kaneko (2011)
	The EU-13 countries	1990-2011	Bampatsou et al. (2017)
	Greece	2003-2013	Roinioti and Koroneos (2017)
	The World	2000-2014	Shuai C, Chen X, Wu Y, et al. (2019)
CO_2 emissions	China	1980-1997	Zhang (2000)
	EU-15	1970-2001	Tapio (2005)
	New Eastern EU members	1991-2002	Juknys et al. (2005)
	Brazil	2004-2009	Freitas and Kaneko (2011)

Table 2. 2. (Continued)

	The EU-13 countries	1990-2011	Bampatsou et al. (2017)
	Greece	2003-2013	Roinioti and Koroneos (2017)
	Cameron	1990-2016	Engo (2019)
	The World	2000-2014	Engo (2019)
Transport sector/traffic volumes	EU-15	1970-2001	Tapio (2005)
	China	1980-1997	Zhang (2000)
	Cameron	1990-2016	Engo (2019)
Final energy consumption	New Eastern EU members	1991-2002	Juknys et al. (2005)
Economic growth of the equipment manufacturing industry	China	2000-2014	Wan et al. (2016)
Material flows and land use	The EU-13 countries	1990-2011	Bampatsou et al. (2017)

There are mainly two different variables for decoupling measurement, the Gross domestic product, and CO_2 emissions. Various parameters such as Transport sector/traffic volumes, Final energy consumption, Economic growth of the

equipment manufacturing industry, Material flows, and land use can also be an indicator for the project.

2.3.3 Decoupling Implementation Samples

There are different examples in terms of decoupling on a global scale. Information on the application forms of these examples is summarized below.

- In 1999, the program known as Japan's Top Runner was introduced and it provides standards to achieve energy efficiency in energy-intensive products (e.g., transportation vehicles and household appliances). As of 2014, 23 product categories covered by the program were included because of the high energies they have, extensive usage, or significant scope they have in energy efficiency improvement. At the selling point, the Top Runner label is given to the products which meet the energy efficiency standard. It motivates companies to follow a persistent production of efficient models to get the award known as Japan's 'Top Runner'. Although the Minister of Environment (METI) has the authority to announce the company names which performed insufficiently to reach the goals and issue recommendations, orders, and fines, no sanctions have been imposed to date as the goals have been met in a systemic way or exceeded. Manufacturers strongly support the program as they are directly involved in setting goals and see energy efficiency as a competitive advantage (Future Policy, 2022).
- Absolute decoupling of economic growth from freshwater supply in Australia has been studied. Between 2001 and 2009, Australia's GDP grew by more than 30%; Water consumption in the country has decreased by approximately 40%, thanks to cost-effective investments in water efficiency and demand management. E.g., water consumption in agriculture, which was 12200 GL (Gigalliters) in the 2004-2005 period, decreased to 7000 GL in the 2008-2009 period. Less water use, especially in high-value sectors, has led

to significant improvements in efficient water use, increasing earnings per 1 GL of water from AU$50 million to AU$95 million (İklimin, 2017).

- Sweden introduced an energy efficiency program for energy-intensive industries in 2005. According to a study conducted in 2013, the return on such investments takes at most 1.5 years (Stenqvist and Nilson, 2012). Therefore, applications do not seem impossible. However, they are the relative decoupling, not the absolute decoupling samples.

2.3.4 Monitoring and Evaluation of Decoupling

Projects aimed at decoupling and removing economic activities' pressure from the environment should be followed up with the necessary technological tools and a monitoring and evaluation system. The reasons for this need are stated under three main headings.

First, this need comes from the fact that the concept of decoupling is comprehensive and new. This concept is very new and needs to be understood by examining clear parameters. It can also be achieved through activities in many different sectors. For these reasons, parameters should be determined based on sector, and measurability should be ensured in an understandable way. In this way, actions can be developed to achieve the decoupling goals.

Second, monitoring and evaluation are necessary to ensure the controllability of the decoupling concept. This process should be continued with monitoring and evaluation to obtain better results by providing the controllability of the decoupling level with the necessary numerical calculations and providing feedback on the activities to be done accordingly. In this way, it is possible to avoid superficial and unrealistic results and work with accurate data to get better results.

Third, the monitoring and evaluation process is required to standardize decoupling targets. It is essential to control whether the desired goal has been achieved even if

some activities are carried out to provide decoupling goals. In this way, a basis can be formed for setting standards. A competitive environment can be created with the measures supplied at these local, regional, national or global scales. In addition, recommendations may be made, or sanctions may be imposed when these standards are not complied with.

As a result, a clear understanding of the decoupling, ensuring its controllability, and establishing a basis for standardization of targets will empower applications in this field. On the other hand, monitoring and evaluation systems enable these three fundamental issues thanks to technological capabilities.

2.4 Financial Integration to Realize The Project Objectives

The dramatic environmental consequences of climate change has increased the requirement of a sustainable economy more than before and set it as the top priority on the agenda. Huge investments are required to make the economy more sustainable, primarily to ensure a green and low-carbon transition. Meeting this financial need will not be possible if the public sector acts alone, so a need for solutions has arisen that will also engage the private sector. Globally, interest among the investors concerning sustainable and green finance has overgrown. While assessing the risks, the companies require higher rate of standardization and disclosure of their non-financial technical knowledge . This audit will help improve the availability of data, make it more comparable. In addition to that, the investors will have more transparent working environment (Spinaci, 2021).

2.4.1 Green Finance

In Defining "Green" In the Context of Green Finance Final Report by the European Commission, it is stated that environmental, social, economic, and governance complements should be provided to ensure sustainable development. The

environmental title is divided into climate change mitigation, adaptation, and other environmental, in this report. The concept of "Green" is defined as activities to support these three topics (European Commission, 2017).

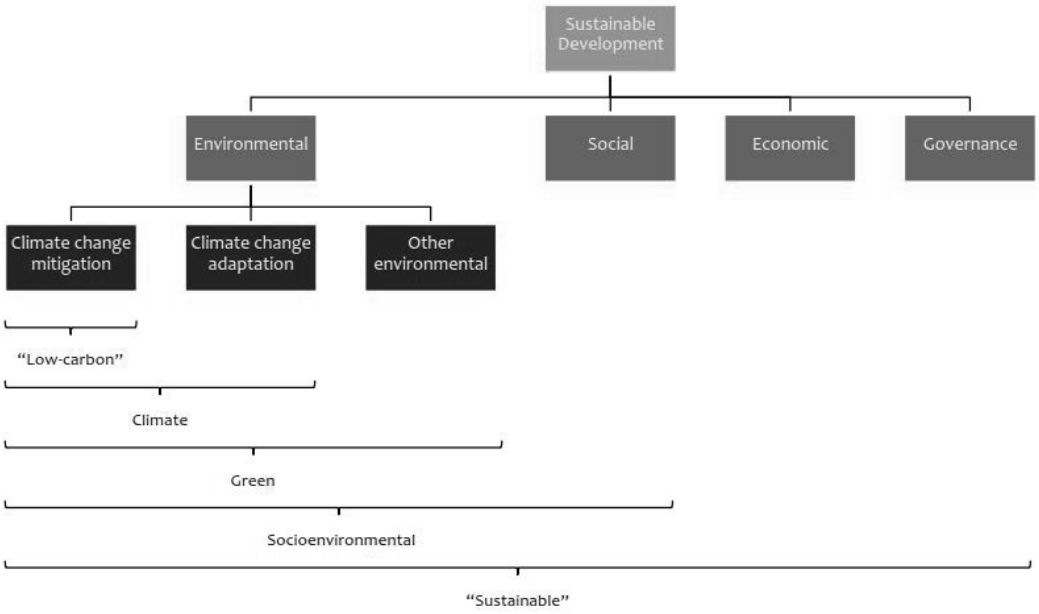

Figure 2. 3. Defining "green" in the frame of green finance (European Commission, 2017)

The Brundtland Commission stated in its Our Common Future Report that economic growth is essential and that development is the way of alleviating the deepening poverty in much of the developing world. Additionally, in the report, sustainable development is defined as the ability of future generations to meet their needs in the developing world, just as the requirements are met today from various sources (UN, 1987).

Sustainable finance, therefore, aims to create value for the resources that will meet the needs in the long term by using investment strategies that integrate the analysis of financial data with the environment and social or governance (ESG) criteria (Ferrara,2020).

It is possible to draw a harmonized framework with the definitions of green finance in the reports of the relevant institutions. These definitions are common under different headings such as broad general statements, market-led standards, and official criteria for policy, regulatory, fiscal, or statistical purposes.

- the German Government says green finance is the strategic approach to involve the financial sector in the transformation process for the low-carbon and resource-efficient economies and in the case of climate change adaptation.
- Similarly, the People's Bank of China defines green finance as a set of policies and institutional arrangements to attract private equity investments in green industries such as clean energy applications, environmental protection and energy conservation through financial services including lending, private equity funds, bonds, stocks, and insurance.
- Also, the Swiss Federal Ministry of the Environment (FOEN) defines sustainable finance as financial products and services provided to encourage responsible investments, taking into account environmental, social and governance factors throughout the entire risk management and decision-making process (UNEP, 2016).

'Green finance' is also often addressed by institutions as financing for green growth.

- The World Bank defines green finance as the type of efficient growth in the use of natural resources, clean because it minimizes pollution and environmental impacts, and flexible in terms of the environmental management and natural capital in anticipating physical disasters.
- While UN ESCAP defines green finance as environmentally sustainable economic progress to promote low-carbon, socially inclusive development, the OECD ensures economic growth while reducing pollution and greenhouse gas emissions and financing to increase the efficiency of natural

resources use and environmental services the well-being depends (UNEP, 2016).

On top of all these definitions, the European Parliament Briefing can be used to specify the distinction between sustainable, climate, and green financing. According to this briefing, climate finance provides funding to address mitigation and climate change adaptation. Contrary to that, green finance has a broader scope as it covers other environmental objectives (e.g., biodiversity conservation/restoration), and sustainable finance expands its scope to environmental, social, and governance factors (ESG) to increase long-term investments. Therefore, it can be said that sustainable finance covers green finance, or it is the evolution of green finance (Spinaci, 2021).

Although there is not any precise definition of sustainable or green finance, the term could be deduced that it deals with investments and strategies to improve and protect the environment and related resources. In this case, question marks arise about green investments. Therefore, sustainable green finance actors should have reliable and transparent data on the environmental impact, risks, and the degree of sustainable economy measures better to define sustainable investment opportunities (Ferrara, 2020).

2.4.2 From Economic Recession to Green Growth

Some studies consider economic recession an alternative to achieve more sustainable environmental conditions. Therefore, it should be discussed whether green growth is essential.

In his book Contract with Nature, Michel Serres touches on the problem of the human being only as a subject regarding the limits of rights for ordinary life. He says that the relationship between nature and human must be reorganized with another connection, a kind of contract (Serres, 1994). In this direction, the idea of Deep Ecology, which has established its strategies through the capitalist system can

change, has offered two suggestions as restoration of nature and natural capitalism. On the one hand, the restoration of nature aims at restoring the integrity of life. In order not to ruin this integrity again, it is necessary to have the capacity to fully understand nature and human beings, which is not a realistic approach (Tekeli & Ataöv, 2017).

On the other hand, the authors of "Natural Capitalism-Creating The Next Industrial Revolution" support establishing natural capitalism recognizing the critical interdependence between the production and use of artificial capital and the maintenance and supply of natural capital. According to the authors of the book, "the next industrial revolution" will lead to the adoption of four central strategies: "conserving resources through more efficient production processes, reusing materials found in natural systems, a shift in values from quantity to quality, and investing in or restoring natural resources" (Hawken et al., 1999).

The historical coincidences between the global capitalism's emergence and the atmosphere transformation are not an accident. The sharp increase in carbon emissions begins in the late eighteenth century when capitalist social relations have started to come inside in the world. Even it is impossible to explain any environmental change without considering capitalism and politics, it cannot be denied the inherent dynamism of capitalism or its capacity to generate enormous monetary wealth but to emphasize that natural-historically new social formation has fundamentally changed our relations with each other and the Earth (Elkington,2020).

The link between this environment and economic growth is typically framed around two different but related causality. First one is whether the indicators reduce planetary warming suppress or increase potential growth. Second one is the extent of that the possible negative consequences of global warming change the growth capacities of the countries that suffer from these effects in the long run? (Guttman, 2018). Therefore, whether the dominance of economic growth can be re-established for planetary management purposes. The "Climate Leviathan" describes the extent

of an emergency situations, and determine who to emit carbon and who not. This dominance appeals to a large audience because carbon emission managements are a collective action issue. The climate change is so fundamental problem for the global order. Therefore, complex and diverse responses to climate change will restructure the world. Thus, it produces four potential global political responses to climate change: the hegemony of a particular group: the capitalist climate Leviathan; an anti-capitalist and state-centered climate Mao; a reactionary capitalist Behemoth; and the anti-capitalist and anti-sovereign climate X. Not only all future politics will be determined simply by climate, but the central idea is also that the world's future will be defined by Leviathan, Behemoth, Mao, and X and the conflicts between them (Wainwright and Mann, 2018).

Especially in many, the boom period, so-called emerging market economies that experienced rapid urbanization behind export-led growth, put the world on a steeper greenhouse gas emissions growth, accelerating global warming. Then the world economy suffered a severe and sudden financial crisis in the late 2000s and only slowly recovered from it. This situation has separated people as those concerned about further growth and those who see the climate challenge as an excellent opportunity to rekindle faster growth. Against this polarized background, according to French Regulation Theory, the challenge of climate change requires a profound structural transformation towards a different kind of capitalism which is eco-capitalism (Guttman, 2018).

2.4.2.1 From black to green swans / Future's capitalism

Nassim Nicholas Taleb (2007) wrote a series of paragraphs about the "impact of the highly improbable" in his book The Black Swan. Inspired by Taleb's descriptions, the "Black Swan" metaphor can refer to unpredictable events mainly driven by negative exponentials. Capitalism can reflect the characteristics of democracy and sustainability with either Black or Green Swan features, and sometimes a

combination of both. A Green Swan can be defined as a profound market shift catalyzed by a combination of Black and Gray Swan challenges and changing paradigms, values, mindsets, policies, technologies, business models, and other key factors. Green Swan has progressed exponentially in the way of economic, social and environmental wealth creation. Even there may be a period that one or more dimensions underperform, the goal is to provide an integrated order in all three dimensions (Elkington,2020).

Schumpeter's view of the mortality of capitalism is often compared to Karl Marx's prophecy of the inevitable end of capitalism. However, the most exciting point in Schumpeter's thinking is his analysis of capitalism's longevity, not its mortality. According to Schumpeter, what sustains capitalism is the spirit of innovation and enterprise. The most significant risk to this essence comes from giant companies. Despite the efforts of transnational monopolies and organizations working to increase and expand trade on a global scale, it can be said that some mobilizations have started in the spirit of innovation and entrepreneurship. One of them is the activities developed by the organizations within the framework of "sustainable development" (Çıvgın, 2011).

The global economy is failing in three critical ways, and we need to figure out how to deal with them if we want to survive.

- First and foremost, humanity disrupts Earth's natural processes, and as the global population grows, the climate emergency puts more strain on economies and societies.
- Second, the basic needs of millions of people around the world are far from being met.
- Third, while governments and public sector institutions can set any goals and objectives they wish, the business sector has the power to address critical challenges at the necessary speed and scale. Despite this, most companies still have Black Swan crashes rather than Green Swan breakthroughs.

In this future, changes due to threats to existing business models will only continue to increase as societal expectations change and environmental pressures increase (Elkington,2020).

Many contemporary economists and policymakers describe "market failure," in the context of capitalist markets, as the rational self-interest of the actors prevents the emergence of well-functioning markets. Classic market failure is a "public interest" problem linked to the "tragedy of the commons" (Wainwright and Mann, 2018).

When we turn to the four hegemonies that emerged to set aside these market failures, Climate Leviathan is currently leading among the four hegemonies discussed above in the future political-economic order. Possible future scenarios that exist outside of The Climate Leviathan can largely be seen as responses to it because of its dominance in the short term. If Leviathan essentially reflects the dream of a sustainable capitalist status quo and the Behemoth reacts conservatively to it, then Mao and X are treated as rival revolutionary figures. Firstly, in Leviathan, capitalism is not treated as a problem but as a solution to climate change. Indeed, Leviathan's lifeblood concepts such as trading in emissions permits, "green" business, corporate leadership, carbon capture and storage, and green finance demonstrate that climate change is an opportunity for capital (Battistoni,2018).

Climate Behemoth represents a "reactionary populism" (Wainwright and Mann, 2018) that moves away from global elitism regarding climate change and turns towards nationalism to give information about other hegemonies. The Climate Behemoth supporters, seen in Narendra Modi's India, Trump's America, and the rise of Eurosceptic parties in Europe, are a mix of fossil fuel capitalists, petty-bourgeois reactionaries, and the working class who want to unite. Mann and Wainwright (2018) argue that the contradictory but potent combination of ethnonationalism, religion, masculinity, and scientific denial makes it a powerful but ultimately unstable form that is most likely unsustainable. However, Climate Mao needs a more robust radical ecological policy. Still, only Asia has the necessary combination of solid states, large

economies, and popular movements that will meaningfully impact the world's resource use. Therefore, it is not possible to talk about global dominance in the short term. On the other hand, Climate X rejects both capitalism and sovereignty and represents a world unknown as "X." Therefore, Climate Leviathan would be just such a world state in an age of ecological disaster as thinkers from Kant to Einstein imagined a world state in response to the threat of war (Battistoni, 2018).

In summary, apart from choosing between economic growth and recession, it should be considered at what point these two oppositions can be used as a solution. This solution will not be possible with traditional capitalism. Hints of a monetary system that will be shaped around the environment have begun to emerge.

2.4.3 Green Finance Framework

Green finance is a financial instrument that supports green growth and whose proceeds are used to elaborate sustainable development projects and initiatives, carbon-neutral, sustainable, and green economic transformation for environmental products and policies (Berensmann and Lindenberg, 2016).

The use of green products/services has become prevalent among institutions such as traditional banks, insurance or asset management companies, and diversified financial service providers. When we look at what makes a financial product green, in most cases, it can be said to refer to the sustainable aspect of the product (such as an investment in a renewable energy project) and encourage environmentally-friendly activities. Products must be accepted by the universe, such as credit cards or environmental disaster insurance. To protect or improve natural systems and the environment, the essence of the product must be green (Ferrara,2020).

Also, in the retail banking sector, the range of products/services offered to customers is differentiated to encourage those who want to support more sustainable choices.

• **Green mortgages**: This type of mortgage provides customers with better interest rates for those who buy energy-efficient homes or appliances.

• **Green home equity loans**: Low-rate equity loans help households install renewable energy technologies in their homes.

• **Green commercial building loans:** They are loans for building projects characterized by lower energy consumption, less waste, and lower pollution.

• **Green car loans:** They encourage the purchase of more sustainable vehicles at lower than market rates.

• **Green cards:** Cards that include debit and credit cards associated with environmental activities (Ferrara,2020).

The need to finance green projects in the corporate and investment banking sector has led to the creation of service departments or teams dedicated to finance new instruments.

- **Green Project finance:** The financial system includes debt portfolios of banks that have lines committed to finance renewable energy assets. Banks are also implementing innovative financing arrangements for large-scale clean fuel and renewable energy projects. Leaders in this field can also earn reputation through media exposure, corporate responsibility awards, and public recognition.
- **Green venture capital and private equity:** As companies finance themselves through the capital market (through public offerings and bond issuances), an emphasis on environmental issues increase. It can play a crucial role in assisting international political organizations, especially for banks, clean technology providers, carbon credit developers, and other firms that market environmental products and services.
- **Green securitization:** It covers various innovative environmental securitization techniques such as forest bonds, eco-securitization pilot programs, and green mortgage-backed securities. For example, a forest vineyard has recently been designed in Panama to fund large-scale reforestation that will improve water flow management and transport along the Panama Canal by capturing sediment and nutrients along its banks. The reinsurers commit a 25-year bond, frequent users of the waterway, and

investors purchase the bond, and it is expected that the long-term nature of the forest will be preserved, and the long-term asset needs of traditional investors will be effectively met thanks to the project (UNEP, 2007).

- **Carbon finance** is a trading system, countries can trade emission units to meet their national emission limits under the Kyoto Protocol or other agreements between member states. The "carbon" term comes from carbon dioxide, the dominant greenhouse gas, and other gases can be measured in "carbon dioxide equivalents" units. The carbon markets can offer a way to expand the available pool of financial resources channeling into urban carbon reduction projects. Carbon market financing can benefit many cities facing budgetary constraints, as cities and urban authorities often have limited capacity to raise capital in private markets (OECD, 2009).

With the spread of risk management practices such as operational, compliance, market, and credit risk in the asset management sector, the green fund has also emerged as a mutual fund and an investment tool that will only invest in companies considered to be socially conscious in their business relationships or promoting environmental responsibility (Ferrara, 2020).

- **A green investment fund:** Sustainable mutual funds have differentiated over three generations according to the assessment of investment suitability. First-generation funds use only social and environmental criteria; second generation funds use relevant criteria focused on progressive social and environmental policy and practice; third generation funds consider all criteria to evaluate and select potential investments using best-in-class approaches.
- **A green fiscal fund:** In this type of funding, citizens who buy shares in a green fund or deposit money in a green bank are exempt from capital gains tax and receive a reduction in income tax. In this way, investors accept a lower interest rate on their investments, while banks can offer green loans at a lower cost to finance environmental projects.

- **Carbon funds:** Cooperation between multilateral development banks and the private sector has triggered the creation of several carbon funds to help finance greenhouse gas emission reductions. Acting as a collective investment scheme, a carbon fund receives money from investors to buy CO_2 emission reduction credits from emission reduction projects or invests in new projects that will generate CO_2 emission reduction credit stream (UNEP, 2007).

Insurance is one of the sectors most likely to grow in the coming years and includes the following products/services in the green area.

- **Green insurance:** This type of insurance typically covers two product areas. The first one is those that differentiate insurance premiums based on environmental features, and the second one is insurance products specifically designed for clean technology and emission reduction activities.
- **Carbon insurance:** In response to the risks involved in emission reductions as well as low-carbon project evaluation, the financial institutions can offer insurance products to manage carbon credit price volatility (UNEP, 2007).

2.4.4 The actors of Green Finance

There is a need for a system that supports green investments in the public and private sectors to convert to a more sustainable economy. Different crucial actors for this system include banks, institutional investors, international financial institutions, central banks, and regulatory authorities.

Banking system assets represent a significant share of global financial assets. Especially emerging markets and developing countries are doing a lot of work to mobilize finance for sustainable development and to spread green finance in the banking system (Alexander, 2014).

The bulk of the budgets need to finance green investments coming from institutional investors, including pension funds, government wealth funds, and insurance.

However, this group of investors often has limitations, such as not being included in the relevant criteria of rating agencies, as they do not have sufficient background to rate (Berensmann and Lindenberg, 2016).

National governments decide the share of public finance allocated to green investments, while Central banks and regulators have the task of establishing appropriate policies and regulations. One of the most pressing problems to be resolved is that the financial system has been driven mainly by short-term returns and underestimated investment in long-term projects. In this frame, it is crucial for banks and financial institutions to support investment decision-making by focusing on the climate risks of bank and due diligence standards (Ferrara,2020).

International financial investors support green transformation in three different technics. Firstly, they have a pioneering role in testing new methods to finance sustainable development, explicitly considering the carbon footprint. Second, international financial institutions have an essential role in bringing together private and corporate capital for green investments by providing innovative instruments such as green bonds. Finally, international financial institutions need to form a coalition of green financiers to support sustainable development. As global financial institutions often have different goals and visions, one of the main challenges is to avoid "greenwashing" in their implications (Berensmann and Lindenberg,2016).

2.4.5 The Risk of Greenwashing

Greenwashing is the deceptive use of public relations, advertising, or marketing to perceive environmentally friendly products or services (Aji and Sutikno, 2015). These greenwashing applications can be for any product, service, and the companies over environmental, social, governance (ESG) factors in the literature.

There have been many calls for investors to associate environmental, social, and governance factors into their investment processes in recent years. However, when

companies "greenwash" and firms make misleading and unproven ESG statements, it will become more challenging to cooperate with the ESG criteria for the investors' asset selection process. This concern also increases the motivation to explore mechanisms that can deter companies from greenwashing ESG (Yu, Luu, Chen, 2020).

Various criteria and standards creation or certification solutions have been proposed against this problem. In the absence of accreditation, the situation resulting from non-certified eco-labeling is also called greenwashing (Genç, 2013). When the typical characteristics of greenwashing companies are examined, it is said that the following four mechanisms can increase the pressure to prevent such ESG greenwashing behavior; more independent directors, more institutional investors, more effective public interests through a less corrupt country system, and cross-list status. Overall, the empirical findings support the view that firms exposed to more scrutiny are less likely to greenwash (Yu, Luu, Chen, 2020).

Besides, greenwashing can have harmful consequences for both consumers and the company. First, environmentally conscious consumers lose their trust in the company, as they are led to purchases that do not fulfill their environmental commitment. In addition, companies that take advantage of consumers' environmental concerns to increase sales may suffer negative customer backlash and lose customers (Genç, 2013).

2.4.6 ESG criteria and SRI strategies

The inadequacy of financial reports to provide investors with sufficient information about the company's future has led investors to seek different sources of information. As a result, investors saw that companies' environmental, social and corporate governance reports affect the value and future of the company as much as financial reports, and they began to demand that companies provide information in these areas (Aras and Sarıoğlu 2015: 23). In addition, the increasing interest of investors and

stakeholders in non-financial reporting has forced companies to consider financial results and non-financial issues to achieve better financial results and growth (Aybars et al., 2019: 521). ESG performances positively affect investors' decisions about firms and increase the value relationship (Mervelskemper and Streit, 2017: 546).

ESG disclosures generally refer to the totality of environmental, social, and corporate governance considerations affecting a firm's ability to implement its business strategy and create value in the long term. Today, there is a shift from philosophical, and aspirational language (sustainability) to more specific, and tactical terms (ESG). ESG reporting is a financially motivated pursuit of best practices and long-term returns enlightening management.

- Increasing transparency,
- Ensuring accessibility of management decisions,
- Promoting the independence of the audit committee Facilitating long-term investor finding,
- Facilitating access to capital,
- Contributing to profitability, growth and risk management,
- Increasing corporate reputation, Increasing brand value,
- Enabling comparison with competitors,
- Protecting shareholders' rights,
- Ensuring the creation of policies to prevent corruption and seizure,
- Encouraging cooperation with stakeholders within the framework of accountability,
- Promoting consumer health, safety, and data privacy in products and services,
- Protecting the health, safety, social rights and working conditions of employees in the best way,

- Environmentally friendly Advantages such as encouraging minimizing the damage caused,
- Supporting innovative products and services,
- Contributing to sustainable development and the country's economy can be counted as examples of these practices (Şeker, 2020).

The ESG rating is a type of rating used to confirm the soundness of an issuer, security, or fund. This type of ESG assessment is combined with a traditional rating based on economic and financial variables. Combining these activities provides a more comprehensive analysis to improve investment selection. In addition, companies interested in documenting their quality through independent analysis make agreements with rating agencies (such as Morningstar, MSCI, Sustainalytics) responsible for evaluating companies' performance in terms of sustainability. There is no single standard for ESG assessment as measurement methods may vary, and qualitative parameters may be more challenging than quantitative variables. ESG ratings are based on available information in public, documents produced by companies themselves, surveys or interviews, and information provided by outside organizations, so transparency and cooperation are required to ensure an accurate assessment (Ferrara,2020).

The ESG score expresses the company's total score obtained from 3 primary dimensions: environmental, social, and corporate governance. The categories' definitions under the ESG score's basic dimensions are briefly given in the table below.

Table 2. 3. Environmental, Social and Governance (ESG) Scores (Refinitiv, 2019)

Scope	Category	Definition
ENVIRONMENTAL	Resource Usage Score	It reflects a firm's performance and capacity to reduce material, energy, or water use and find more eco-efficient solutions by advancing supply chain management.
	Emissions Score	It measures a firm's commitment and effectiveness in reducing environmental emissions in production and operational processes.
	Innovation score	It reflects a firm's environmental costs and its capacity to reduce its burden on customers. Thus, the firm creates new market opportunities through new environmental technologies and environmentally designed products.
SOCIAL	Labor Score	It measures a firm's effectiveness against job satisfaction, a healthy and safe workplace, protection of diversity and equality of opportunity, and development opportunities for the workforce.
	Human Rights Score	It measures a firm's effectiveness in respecting fundamental human rights conventions.
	Community Score	It measures a firm's commitment to being a good citizen, protecting public health, and respecting business ethics.

Table 2. 3. (Continued)

	Product Responsibility Score	It reflects a firm's capacity to produce quality goods and services, taking into account the factors of data security integrity and ensuring the health and safety of customers.
CORPORATE GOVERNANCE	Management Score	It measures a firm's commitment and effectiveness following the best corporate governance principles.
	Shareholders score	It measures a firm's effectiveness in treating its shareholders equally and using anti-takeover tools.
	CSR Strategy score	It reflects practices that a firm integrates its economic (financial), social and environmental dimensions into its daily decision-making processes.

ESG is an absolute part of most investment strategies that promote 'responsible investment.' ESG investing is used to evaluate a company's non-financial market data and give investors an idea of the company's social and environmental commitment. While the economists of the 1970s stated that "the social responsibility of the enterprise is to increase its profits," it is pretty standard today for publicly traded companies to highlight their "corporate social responsibility" regardless of their commercial activities (Leins, 2020).

Socially Responsible Investing (SRI) has experienced expansions across fund industries over the past decade due to the development of specialized SRI funds and the incorporation of ESG (Environmental, Social, and Governance) criteria by traditional funds (Nath, 2021). Increasing awareness of ESG firm issues such as environmental scandals or corporate misconduct has also transformed the global financial industry by changing investors' behavior towards sustainable investment (Matallín-Saez et al., 2019).

According to the available literature, responsible investments are primarily a result of increased public interest in social responsibility, not just as a result of increased social awareness by institutions (Cumming and Johan, 2007, p. 397). SRI is also defined as an investment process integrating ethical values, improved social conditions, environmental protection, and good governance into traditional investment decision-making (Sciarelli et al., 2020).

Sustainable and Responsible Investment (SRI) aims to create long-term value for the investor simply as a regular investment. However, environmental, social, and governance criteria are also considered when evaluating or choosing a security to invest in. These two terms are often used in rotation, but they are different. The main difference between the ESG and SRI methodology is how the principles they promote are applied to an investment portfolio (Ferrara, 2020).

Listed below are the different SRI strategies most commonly used.

- **Negative/Exclusionary screening:** It provides the exclusion of issuers, sectors, or countries from investments/funds or portfolios based on specific ESG criteria (e.g., gambling, trade, tobacco).
- **Positive/Best-in-class screening:** It consists of selecting to invest within all possible sectors and the companies that have the best performance in terms of the ESG.
- **Norms-based screening:** The selection and screening of investments is based on adherence to international standards and norms, such as those issued by well-known organizations (The OECD, the United Nations, or other agencies including the ILO, UNEP, UNICEF).
- **ESG integration:** The systematic and explicit integration of ESG variables into the financial analysis improves investment decisions and expected financial returns by investment managers of environmental, social, and governance factors.

- **Sustainability themed investing**: The selection of issuers is based on investments in sustainability themes, assets, or issues (e.g., sustainable agriculture, clean energy, green technology).
- **Impact investing:** This strategy involves investing in companies that aim to generate a positive social and environmental impact, including community investing in addition to financial returns (e.g., renewable energy applications or sustainable building).
- **Corporate engagement and shareholder**: This activity comprehend the company's interaction on sustainability issues and capital participation. It's a process aimed at positively influencing the company's behavior and increasing the degree of transparency by using shareholder power to impress corporate behavior and proxy voting that is guided by comprehensive ESG guidelines (Ferrara, 2020; Vartiak, 2017)

2.4.7 The instruments of Green Finance

The selection of an investment instrument may depend on many factors, such as the development stage of the product/company, the need for partnership, or the need for further support. However, the two main financial instruments of green finance are debt and equity.

Equity financing usually involves the early stages of developing a project or company, where the investor receives an ownership interest in exchange for invested capital. Preferred stock's dividends are generally higher than common stock, and preferred stockholders are paid first in the event of liquidation, so they are exposed to lower risk (GEF, 2017).

Debt financing is predominantly and often used in later stages of development along with equity. In this case, investors lend money to be repaid with interest. The debt financing is divided into bonds and loans. A bond is an instrument that can provide periodic interest and repayment of principal at maturity to the purchaser at a

predetermined price, while a loan is a transfer of money from one person, institution, or other entity to another (GEF, 2017; Ferrara,2020).

Different types of bonds and loans within green finance are listed below.

A bond is essentially a fixed income instrument and a kind of promise made by an issuer (similar to a borrower) to repay a debt to a bondholder (identical to a lender), usually with interest (Fernando, 2021). The labels green, social, and sustainability cannot be termed as bonds; they need to meet specific criteria.

- **Green bonds**: Green bond instruments are used to finance or refinance projects that ensure clear environmental benefits. Renewable energy, energy efficiencies such as building refurbishing, environmentally sustainable agriculture, a natural resource such as climate change mitigation or adaptation can be the theme of these projects.
- **Social bonds**: Emerging as a response to the growing awareness of global environmental and climate issues, social bonds seek to address the social problems that threaten, hinder or harm the well-being of society or a particular population (e.g., clean drinking water, sanitation, access to health and education, provision of adequate food) (Nelson,2021).
- **Sustainable bonds**: As projects that have environmental benefits often also have social benefits, and vice versa, a sustainability bond finances projects aiming to achieve both environmental and social benefits and in line with the objectives set by the SDGs (providing energy-efficient and low-cost houses for the ones with limited access to the housing market) (Ferrara,2020; Nelson,2021).
- **Blue bonds**: Blue bonds are used to fund marine or water projects (such as investing in more sustainable fish stock). Blue bonds can be issued under the green, sustainable or social bonds and should be performed in globally recognized principles (Samtani et al., 2021).

A loan is a money transfer from an individual, organization, or entity to another (Ferrara,2020).

- **Green loans:** Green loans finance or re-finance new and existing eligible climate or environmental projects in whole or in part.
- **Social loans**: In this case, finance or re-finance, in whole or in part, new and existing eligible projects that have a social impact (such as encouraging the employability of people with disabilities through better training).
- **Sustainability loans**: Sustainability-related loans are any loan instrument or contingent opportunity that encourages the borrower to achieve its claimed predetermined sustainability performance targets. This loan type is designed for green and social impact projects, such as providing a job for disabled people at a recycling factory (APLMA & LMA & LSTA, 2021; Ferrara, 2020).
- **Crowdfunding** has been another tool that has become particularly popular in recent years. This Australian and United States-born venture may be social, economic, or charitable. The executor of the initiative asks the public (the crowd) for any amount (even small) money to support (finance) the project through a website. Crowdfunding platforms are used to announce new projects and raise specific amounts of money within a certain period (Ordanini & Miceli & Pizzetti & Parasuraman, 2011).

The different crowdfunding types are as follows.

- In the donation-based model, individuals donate small amounts to nonprofit initiatives and meet a particular project's more significant funding goal without receiving any tangible benefits.
- In the reward-based model, the donation provides a non-monetary reward such as a reward or recognition (such as a public thank you on the company website).
- The lending-based model deals with micro-credits to individuals or companies. Individuals or businesses seeking loans apply through the platform, and crowd members receive a small portion of the total loan.

- The equity-based model involves participation in the company's capital. Individuals invest in equity capital or profit/income sharing in businesses or projects in the hope of obtaining a financial return (Bone and Baeck, 2016).

2.4.8 The Importance and the Limits of Green Finance

Green financing increases flows from the public, private and not-for-profit sectors towards sustainable development priorities. An essential part of that is better managing environmental and social risks, increasing the valorization of opportunities of environmental benefits and greater accountability. Multi-stakeholder partnerships will be encouraged to include key players in financial markets, banks, investors, insurance companies, and the public sector (UNEP, n.d.).

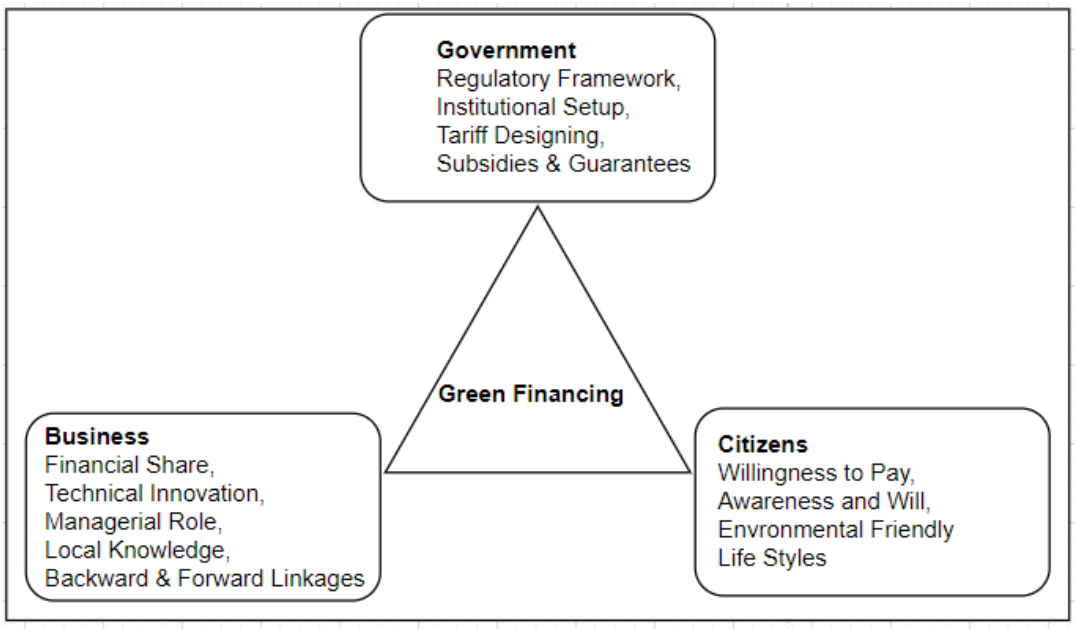

Figure 2. 4. Green Financing Partnership

Source: https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/green-financing

The participants should have motivation for the system to be run by providing this partnership and participation. Therefore, what motivating a company to be green is important. According to the shareholder view, companies' sole purpose is to make a profit, the stakeholder view emphasizes the importance of all stakeholders in the company's decision-making process. Accordingly, stakeholders mean “individuals and groups who can significantly affect or be affected by the firm's well-being” and include not only beneficiaries but also employees, customers, suppliers, communities, and government officials. This definition also suggests that the firm's well-being should depend on meeting society's broader expectations regarding the "greenness" of its operations. In total, two evidents emerge from that, justifying corporate investments made in eco-friendly projects. First one is an insurance like limiting strategy as a precautionary tool for corporate environmental risk. Second one is a reputation-building strategy to accumulate valuable social capital (Gilchrist & Yu & Zhong, 2021).

Considering the environmental conditions stated in the previous chapters, if the Sustainable Development Goals are achieved, it is necessary to increase investments providing environmental benefits through green bonds, carbon market instruments, new financial instruments, and new policies. There are currently three challenges facing such a strategy: identifying suitable projects, developing complex plans involving the public and private sectors and financing structuring. In this regard, governments must have the ability to effective long-term planning, budgeting, and project implementation. The world needs significant investments to disseminate green energy systems and to end constructing new coal-fired power plants. In this case, the financial sector should embrace the concept of institutionally motivated long-term investment; support investment opportunities securing a sustainable future for all to realize the large-scale benefits of these new technologies; and avoid investments that exacerbate subsequent environmental crises (Sachs et al., 2017).

To make green finance work effectively, the three “Ds” – data, definition, disclosure have to be solved. Improving the quality, availability, and comparability of required data; developing coherent definitions or classifications for existing and green transition activities; and establishing and enforcing a consistent set of global standards for disclosures and reporting are the main activities to provide that. Technology is a potential game-changer in addressing these challenges. Infrastructure systems to retrieve relevant environmental and energy consumption data; Internet of Things or IoT, and sensors measuring carbon emissions and pollution levels directly at the source and in real-time; blockchain-based platforms to ensure the provenance of ESG certifications are the example of technological developments in this field (Menon, 2021).

Public funding resources will be insufficient to finance this technological structuring and green transformation. Therefore, substantial private capital is needed. However, internalizing environmental externalities, the insufficient analytical capacity of issuers and investors, lack of generally accepted green definitions, and maturity mismatches are general problems. It is a particular problem that the vague definition of green finance cause “greenwashing”. The short-term time horizons of issuers and investors do not match the long-term goals of green investment projects, which usually last more than ten years (Berensmann and Lindenberg, 2016).

CHAPTER 3

GREEN PROJECTS AND GREEN BOND AS A GREEN FINANCE INSTRUMENT

3.1 Green Bond Selection Reasons

Among the green financing instruments, green bonds were selected for the research topic and continued. The main reasons for this are establishing a relationship between green bond actors and planning actors, the privatization of green bonds as green city bonds, and being a bond instrument with an increasing market value.

First of all, issuers or borrowers, who are green bond actors, are institutions such as municipalities, development agencies, private companies that are also in the planning process. These institutions can be institutions that issue bonds or they can be institutions that carry out projects that issue bonds. Green bond investors can be citizens who are both investors and beneficiaries of projects in the planning process. Also, while banks dominate the market in terms of lending, institutional investors are playing a more significant role by investing in bonds. Green bonds are an instrument to provide a greener and longer-term financing that can be adopted due to the involvement of multiple actors (The World Bank, 2017).

The second is the existence of a bond group called green city bonds. These bonds support sustainable urban development, especially by giving them to city projects (Climate Bonds Initiative, 2015).

Finally, sales of green bonds have grown rapidly (from roughly $4.2 billion in 2012 to nearly $300 billion in 2020) over the past decade (Catt et al., 2021). Green bonds can be an opportunity to contribute to a more sustainable world and low-carbon society (The World Bank, 2017). For this reason, considering that the integration of such a fast-growing financing tool with planning projects should be on the agenda,

the research continued with the green bond financing tool. Detailed information on green bonds will be explained in the rest of Chapter 3.

3.2 Green Bond Detailed Definition

Like any other bond type, an agreed definition for green bonds is a fixed income instrument for promoting the debt capital market (Cheng et al., 2016). In other words, the green bonds are standard bonds with a "green" specialty. Therefore, distinctly from regular bond, in a green bond system, the issuer publicly states that the overall goal of the bond is to support mobilizing private sector financing for climate-friendly investments and raising capital to fund "green" projects or business activities with positive environmental impact such as renewable energy or low carbon cities (Cromwick et al., 2020).

Green bonds mobilize resources from local or international capital markets for renewable energy, climate change adaptation and other eco-friendly projects. Simply, a bond issuer raise a fixed amount of capital by repaying the money (principal) and accrued interest (coupon) over a given period, while the issuer will need to generate sufficient cash flow to repay the interest and capital. After electricity and buildings sectors, the next largest sector for green bonds is the low carbon transport sector, including electric vehicles, rail, public transport, and other related investments. This sector accounts for approximately 20% of the market. Agriculture, water infrastructure, industry, waste, and broadband are among other sectors financed with green bonds (Cromwick et al., 2020).

Onward, the World Bank issued the first green bonds in 2007, and the cumulative issuance has grown to $1.002 trillion as of December 2020 (Jones, 2020). In 2019 alone, over $257.7 billion in green bonds were issued, increasing 49% from the previous year (Climate Bonds Initiative, 2020a). Despite the overall growth in global bond markets, green bond issuance in the first half of 2020 became less than 2019, possibly due to the ongoing COVID-19 pandemic (Climate Bonds Initiative,

2020b). The green bond market hit a new record in the third quarter of 2020, with issuances of $64.9 billion. This is the highest volume in any third quarter since the start of the market and the highest amount recorded in any quarter after $73.1 billion in the second quarter of 2019 (Climate Bonds Initiative, 2020c).

3.3 Green Bond History

Governments, companies, or other entities issue bonds that is an agreement in which issuers borrow financial support from investors and have to repay investors at an agreed rate after a certain period. World Bank has been issuing bonds since 1947 to fund development projects. However, green bonds are dedicated to a particular type of project. Investor interest in their investments' social and environmental purpose reflecting a fundamental shift in the bond market. In addition, investors want data showing how they address environmental, social, and governance factors because they want to know how they reduce the risk for their investments and create social value. For example, an issuer with sustainability experiments can often be a better investment. Thus, issuers engage with investors to demonstrate how their bonds offer opportunities to generate both financial and social returns. Accordingly, the green bond will become a history-making event revolutionizing the way of investors, policymakers, development professionals, and scientists work together (The World Bank, 2018).

In the last ten years, capital markets have turned into a market that focuses on non-financial outputs such as social and environmental problems rather than a market where investors do not know the outcomes. This can be attributed to the individuals coping with more concrete disasters such as pandemics or natural disasters, both socially and individually. This change in investment relationship was sparked by green bonds (The World Bank, 2018; Eccles and Klimenko, 2019).

The green bond market had started in 2007 by European Investment Bank (EIB) and the World Bank. Following the first $ 1 billion green bonds sold by the IFC in March

2013, the broader bond market reacted within an hour of its issue. The turning point in the market as it became the first corporate green bond issued by Vasakronan, a Swedish real estate company in 2013. Large corporate issuers such as this real estate company include SNCF, Berlin Hyp, Apple, Engie, ICBC, and Credit Agricole (The World Bank, 2018).

In 2007, the Intergovernmental Panel on Climate Change, a United Nations agency published a report showing the undeniable effect of human activity on global warming. They called the banks SEB (Sandinaviska Enskilda Banken AB) to see what could be done. SEB has linked the World Bank with its deep knowledge of financing, which strives to reduce risks, create a positive impact for investors, and invest in environmental projects worldwide (The World Bank, 2019).

Massachusetts issued the first green muni bond which is debt securities issued by states, cities, counties and other government agencies to finance day-to-day obligations and capital projects such as building schools, highways or sewer systems (Climate Bond Initiative, n.d.)

On the other hand, the Sustainable Development Goals (SDGs), a collection of 17 global goals adopted by 193 countries in 2015, including sustainable cities, can be helpful for investors and issuers to focus on complementary fields of the climate. The World Bank has begun to raise awareness of specific development challenges and engage investors around specific SDGs through sustainable development bonds (The World Bank, 2018).

In 2019, the United States, China, France, Germany, and the Netherlands were the top countries issuing green bonds, Fannie Mae ($22.9 billion), the German state-owned development bank, and the Dutch State Treasury Agency were the top individual issuers. In recent years, the Kingdom of Belgium, the Industrial and Commercial Bank of China, the Republic of France, and the National Treasury Management Agency of Ireland issued green bonds. Green bond issuers in recent years include Major U.S. companies such as Apple, Unilever, and Bank of America.

In 2019, PepsiCo issued its first green bond with $1 billion in revenue to reduce plastic use, decarbonize the supply chain and increase water efficiency in production processes. According to credit analysts, these bonds were priced relative to its other debts and provided PepsiCo with an appropriate public relations opportunity to explain its sustainability efforts. Investors did not suffer a comparative return loss by purchasing these bonds while financing environmentally beneficial initiatives (Cromwick et al., 2020).

In the European Green Deal Investment Plan of 14 January 2020, the Commission would set an EU Green Bond Standards (GBS). The green bonds play an increasingly important role in financing the assets required for the low-carbon transition. Nevertheless, there is no uniform green bond standard within Europe. An action to establish such a standard on financing sustainable growth has been included in the 2018 Commission Action Plan (European Commission, 2019)

Timeline of significant and related developments in the green bond market in summary;

- "2007- EIB and World Bank issue first climate awareness bonds
- 2010- The Climate Bond Initiative launches the Climate Bond Standard and Certification Scheme
- 2014- ICMA publishes the ICMA Green Bond Principles
- 2015- UN Sustainable Development Goals and 2030 Agenda for Sustainable Development
- 2016- Paris Agreement on Climate Change – ratified by 170 countries
- 2018- Green bond issuance hits $167.3 billion
- 2018- EU Commission publishes action plan on financing sustainable growth
- 2019- Green bond issuance estimated to be over $200 billion
- 2019- As the attachment of the EU action plan, critical papers, guidelines on corporate climate-related information reporting, are published:

- Classification system –taxonomy – for environmentally-sustainable economic activities
- EU climate benchmarks and ESG disclosures" (Doran and Tanner, 2019).

The geography of the green bond market is diversifying and expanding. Green bonds were issued in 23 countries (Australia, Brazil, Canada, China, Colombia, Eurozone, Hungary, India, Japan, Malaysia, Indonesia, Mexico, New Zealand, Norway, Peru, Poland, Russia, South Africa, Sweden, Switzerland, Turkey, UK, USA) (OECD, 2015).

Turkey is one of these countries which green bonds are issued. In 2017, Turkey signed the Sustainable Finance Statement to consolidate environmental and social risk analysis into banking activities and market strategies. Eight Turkish banks, whose asset value represents approximately 40% of the Turkish banking sector, have signed the Sustainable Finance Statement. Turkey also followed the rising trend in sustainable finance and green bond issuances. In Turkey, green bonds were issued for the first time in 2016 by the Turkish Industrial and Development Bank (TSKB). Under the coordination of seven banks, TSKB exported green bonds with a maturity of five years and amounting to USD 300 million (Kandır and Yakar, 2017; Altıparmak et al., 2021).

Lately:

• In March 2021, the Turkish government announced that efforts are underway to establish a 'bond guarantee fund' as a new economic reform package component.

• In May 2021, Istanbul Metropolitan Municipality signed a memorandum of understanding with the European Bank for Reconstruction and Development in the "Green Cities" urban sustainability program. Following Ankara and Izmir, Istanbul will be the 47th city to participate in the EBRD's Green Cities urban sustainability program.

• In June 2021, Turkey announced its Foreign Direct Investment Strategy (2021-2023), which states that efforts are underway to align Turkey's business environment and regulatory framework with the UN's Sustainable Development Goals and the

European Green Deal. As a developing economy, Turkey's sustainable debt market volume is USD 4.2 billion in total. Of this amount, USD 3 billion, approximately 3/4, consists of bonds, and the remaining USD 1.2 billion consists of loans (Altıparmak et al., 2021).

3.4 Green Bond Process

Green bonds are financial instruments standing out with their innovativeness, where revenues are invested especially in projects providing climate or other environmental benefits such as renewable energy, energy efficiency, sustainability. (UNDP, 2016). Bonds are simply a loan from a private investor to government or company. The process begins when the bond issuer asks for specific amounts of money, usually from the government, a company, or private investor groups, to finance green projects. If investors believe that a company is stable and able to pay off its debts, they will have purchased the bond by lending the issuer any amount they want. These bonds have a specific maturity date when the issuer will return the principal amount to investors. There will also be a special bond coupon rate, which is the interest payable to investors at the time of purchase. More unstable bonds have less maturity and are less likely to repay over a more extended period tend to be riskier investments and are often offset by higher interest rates and higher potential returns.

In contrast, bonds from more rapidly maturing financially predictable actors tend to have lower interest rates. Thus, bonds tend to be more stable forms of investment for both borrower and lender, as the value of the money lent does not fluctuate with the market or the business's success. But investors allow their financial interactions even after the bonds are first issued. Generally, green bonds must pass third-party verification/certification, such as the Climate Bond Standards Board, to determine that the proceeds finance projects that generate environmental benefits (Rajwanshi, 2019; UNDP,2016; Cromwick & Milko & Prieto, 2020).

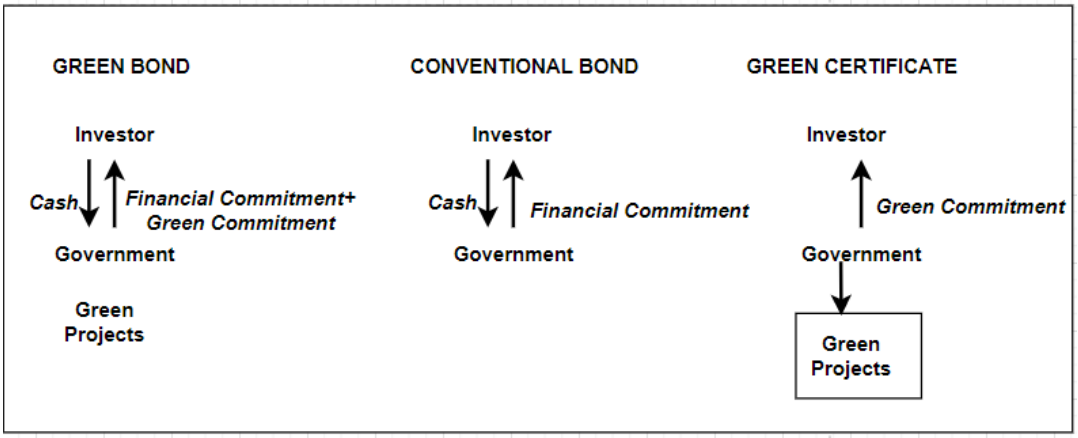

Figure 3. 1. Danmarks Nationalbank -New model for sovereign green bonds
Source: https://insights.nordea.com/en/sustainability/sovereign-green-bonds/

3.5 Project Eligibility Measures

Currently, no common European or global classification and eligibility system define which economic activity is considered sustainable. In 2018, the European Commission established the Sustainable Finance Technical Expert Group (TEG) to advise on different issues, one of which relates to a European classification system called the EU Taxonomy, and identify economic activities that can be defined as sustainable with a "green list" providing a common language. The main goal here is to reduce greenwashing practices and reduce fragmentation from market-based initiatives and national practices. While preventing greenwashing is an essential step towards achieving the decarbonization targets set for 2050, above all, it will help investors and financial institutions allocate capital efficiently and make informed decisions (Ferrara, 2020; Bongaerts and Schoenmaker, 2020).

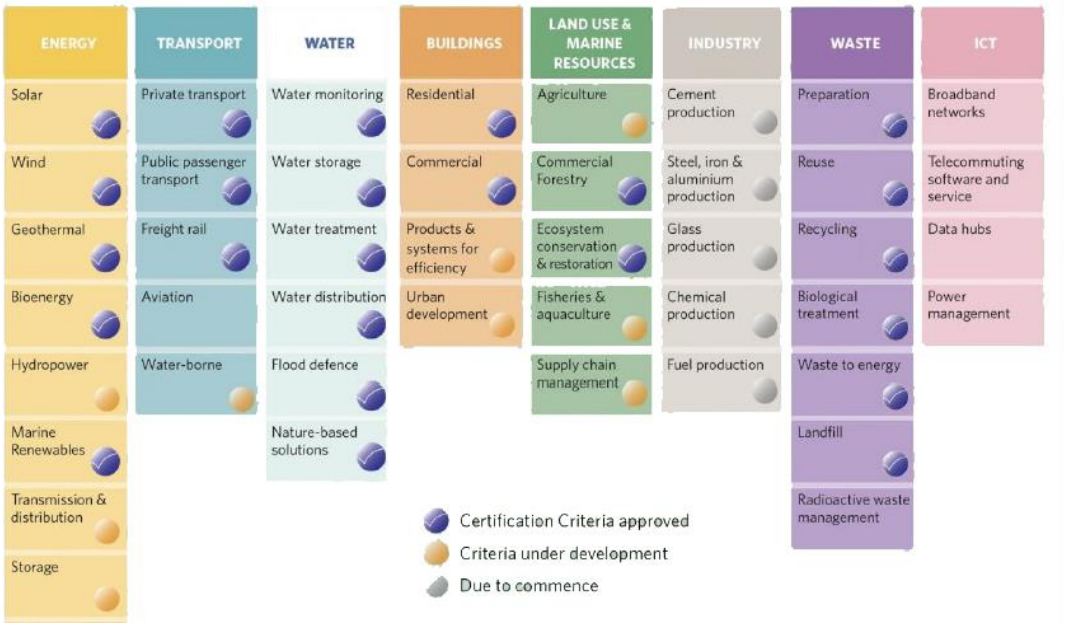

Figure 3. 2. Climate Bonds Initiative Taxonomy

Source: https://www.climatebonds.net/standard/taxonomy

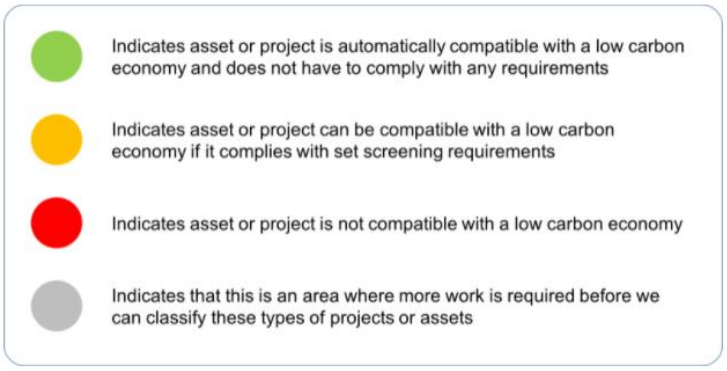

Figure 3. 3. Climate Bonds Initiative Traffic Light System For Determination of Project's Suitability

Source: https://www.climatebonds.net/standard/taxonomy

A traffic light system was adopted to determine whether this taxonomy system's assets and projects are suitable for decarbonization. A green light indicates compatibility, an orange light indicates possible compatibility, and a red light

indicates incompatibility. The gray circle indicates that color is still not and must be defined for that particular entity to select projects according to inclusion and exclusion criteria. For example, while activities producing energy from renewable sources are included in the energy sector, energy production from fossil fuels is excluded (Climate Bonds Initiative, 2021)

Similar to the taxonomy provided by the European Commission, the Climate Bond Initiative has established aa a certification system for green bonds to encourage investors, issuers, governments, and financial markets to prioritize investments that contribute to climate change. This system includes its taxonomy to classify the areas of interest they can refer to (Ferrara, 2020).

3.6 Green Certification

There are two regulatory frameworks for the green bond market, the Green Bond Principles and the Climate Bond Standard, that do not converge internationally. However, there are national regulations adopted by certain countries, such as China and India, which are similar but have differences. Comparing different standards to validate green requirements creates high costs for investors. There is currently no global standard that certifies a particular bond as "green," but guidelines are improved by the International Capital Markets Association (ICMA). Depending on the instrument used, ICMA has introduced the green bond principles certificate type to determine the requirements for a bond to be considered green, social, or sustainable (Ferrara, 2020).

3.6.1 Green Bond Principles

There are four Green Bond Principles established by The International Capital Market Association (ICMA) to define green bonds for use in this process. Green Bond Principles (GBP) is a guide that clarifies the Green Bond issuance approach, recommends transparency and information sharing, promotes integrity, and plays a

role in developing the Green Bond. GBP proposes an open process and knowledge sharing that the investors, banks, guarantors, placement agents, and other issuers can understand the characteristics of a Green Bond. Moreover, GBP emphasizes the importance of transparency, accuracy, and integrity of information disclosed and reported by the issuers to stakeholders. To support these qualities, Green Bond Principles (GBP) has four core components: Use of Proceeds, Project Evaluation and Selection Process, Management of Proceeds and Reporting (ICMA, 2018).

The Green Bond is the use of the bond's proceeds for Green Projects, and these use must be appropriately defined in legal documents. All identified green projects must provide net environmental benefits, and the issuer assess their feasibility. The Green Bond issuer should notify environmental sustainability objectives, and determine how the projects fit the eligible Green Projects, including retention criteria or other processes for identifying and managing potential ESG risks associated with projects to the investors in the project evaluation and selection process (ICMA, 2018; Ferrara,2020; UNDP,2016).

For the Management of Proceeds process, the net revenues of the Green Bond have to be deposited in a subaccount or moved into a sub-portfolio; otherwise, it cannot be appropriately followed by the issuer. Also, the issuer must be certified in a formal internal process linked to investment operations for green projects. GBP promotes a high level of transparency and improves internal monitoring of Green Bond revenues to verify the resource allocation and second/third party opinion. Issuers should keep up-to-date information for the use of the fund available and update it annually or in time in case of essential developments. The annual report should include the estimated amount and the estimated effects of the projects a brief description of the projects. Transparency is vital for communicating the anticipated impact of projects. Therefore, GBP proposes the use of qualitative and quantitative performance indicators. It is crucial to monitor the effects and include them in their regular reporting (ICMA, 2018; Ferrara,2020; UNDP,2016).

It is also essential to explain what second-party opinion means. An environmental-qualified organization issues a second-party opinion, usually including an

assessment of compliance with the GBP. It may include an evaluation of the issuer's overall objectives, strategies, policies, and procedures related to the environmental characteristics of the project. CICERO (The Centre for International Climate and Environmental Research) is the most famous second-party opinion organization (Ferrara,2020).

3.6.2 Climate Bond Standard

Another related certification scheme is the Climate Bonds Standard, an open and transparent certification system for green bonds and other debt instruments in 2011 by the Climate Bond Initiative to guide issuers, investors, governments, and regulators to combat climate change (Ferrara,2020).

CBS requirements are divided into a pre- and a post-issuance phase. The first phase addressing the issuers who need to obtain certification before issuance. Verification is performed by an independent body that ensures that the Climate Bonds Standard requirements are met. After the requirements are verified, the obligation is certified as "Climate Bond Certified." In this case, the certificate refers only to the climatic characteristics of the bond and does not cover other aspects. The second phase is concerning with issuers who wish to continue certification after the issue of the bond and the certification of bonds that have already been issued. Finally, an annual report is required to be submitted to the bondholders and the CBI. The success of this certification system lies in the link between the standards and the Taxonomy system developed by CBI. It also led the European Commission to define its classification system (EU Taxonomy) and its certification scheme (EU Green Bond Standards) (Climate Bonds Initiative, 2021).

3.6.3 EU Green Bond Standards

The need for a global green bond standard has prompted the European Commission. Similar to the GBP, four main components have been identified for the EU-GBS.

1. Green Projects: This is how capital generated through the issuance of green bonds is used to finance a project with specific environmental objectives. Green projects must necessarily be aligned with the EU Taxonomy.
2. Green Bond Framework: It is the document in which the issuer communicates to the investors the process of determining the environmental objectives of the projects to be financed with green bonds and their compatibility with the EU Taxonomy.
3. Reporting: issuers are required to report at least annually until full distribution. The report should include an EU-GBS compliance statement, the amount allocated, the environmental impact of each project, the geographic distribution of income distribution, and the Green Bond Ratio.
4. Verification: becomes mandatory and must be assigned to an external verifier appointed by the issuer who must be officially accredited. This validation includes a pre-edit and post-edit. The verification results should be made public on the issuer's website to inform investors of their investment choices (Chesné & Azoulay, n.d.).
The main difference between GBP and EU-GBS is that the complementaries recommended for the GBP are required for EU-GBS (Ferrara,2020).

3.6.4 Other Green Bond Guidelines

Besides the Green Bond Principles and EU Green Bond Standards guidelines, which have gained an international dimension, some states have decided to regulate the issuance of green bonds with national policies. Examples include the guidelines of China and India.
In December 2015, People's Bank of China (PBoC), the regulatory authority overseeing the interbank bond market, issued the first official Chinese Green Bond guidelines. These guidelines set out requirements to qualify projects as green, revenue management, and reporting. After that, in 2016, the National Development and Reform Commission (NDRC) published a different set of guidelines only for bonds issued by companies. The Shanghai Stock Exchange (SSE) published its green bond guidelines for institutional issuers in the same year, inspired by the PBoC

guidelines. Arguably the most critical development in the Chinese green bond market in June 2020, the PBoC and NDRC jointly published a draft of the updated version of the Green Bond Approved Project Catalogue. It is envisaged that harmonized guidelines will become the future market standard. Also, by excluding controversial categories such as "Clean Coal" and "Clean Fuel," China narrows the gap between green bond guidelines and international investors' expectations (Chang et al., 2021).

The green bond guidelines in India are regulated by the Securities and Exchange Board of India (SEBI) in line with the principles published by ICMA in January 2016. Essential points are listed below.

- The issuance and listing type of green bonds will be subject to the 2008 SEBI Regulations.
- There is no actual definition of a green bond; however, SEBI evaluates a green bond and defines it as green.
- Independent third-party review the pre-regulation and post-regulation process, including project evaluation and selection criteria, optionally.
- The issuer is obliged to submit the use of revenues, traceability and the list of projects to which it has been allocated in its annual report to the Stock Exchanges (Ferrara, 2020).

3.7 Green Bond Types

The Green Bond Principles outline the guidance for green bonds. However, they do not take a position on the quality of green solutions. CICERO plays a vital role in linking climate change science with financial markets. In 2015, the CICERO introduced Shades of Green methodology, which provides transparent future-proof for a low-carbon climate. Shades of Green aims to give investors a better indication of how green the projects they want to invest in are. Their experience in valuing

green bonds aims to increase transparency in the second opinion market (Menteşe, 2021).

Table 3. 1. Cicero Shades of Green Methodology

SHADES OF GREEN	DESCRIPTION
	Dark green corresponds the long-term vision of a low carbon and climate-resilient future.
	Medium green represents a step toward the long-term vision but is not yet there.
	Light green are also environmental friendly but does not contribute to the long-term vision.
	Brown is for projects in opposition to the long-term vision of a low carbon and climate-resilient future.

Source: https://www.cell.com/one-earth/pdf/S2590-3322%2819%2930015-6.pdf

External review can be provided in other ways such as verification, certification and scoring/rating.

- **Verification:** Independent verification of issuer, business processes, and environmental criteria can take. The method followed for the use of the revenues, the allocation of funds from their revenues, the environmental impact statement or the compliance of the reporting with the GPL may be included in the assessment (Menteşe, 2021; Ferrara,2020).
- **Certification:** The Issuer may certify the Green Bond with an approved external green rating standard and label. An accredited third party may test it to verify compliance with the certification criteria (Menteşe, 2021).
- **Scoring/Rating:** The issuer may be evaluated according to the method of scoring/rating its green bond. The result of this assessment may focus on

environmental performance data different performance criteria such as the 2-degree climate change scenario. Such scoring/ratings are different from credit ratings, although they reflect material environmental risks (ICMA, 2018).

There are recently four types of Green Bonds: Green Use of Proceeds Bond, Green Use of Proceeds Revenue Bond, Green Use of Proceeds Project Bond, and Green Use of Proceeds Securitized Bond.

- **Green Use of Proceeds Bond** is a normative recourse to the issuer debt obligation. The proceeds shall be credited to monitoring by the issuer and approved by a formal internal process connected to the issuer's investment for eligible Green Projects.
- **Green Use of Proceeds Revenue Bond** is the issuer debt obligation to the pledged cash flows of the revenue, fees, streams, taxes, etc. The use of proceeds of the bond matches the Green Project(s) according to relation. Therefore, the issuer inform investors of the intended temporary placement for the balance of unallocated proceeds while pending such investment or allocation.
- **Green Use of Proceeds Project Bond** is for the Green Projects where the investor is exposed to the risk of the project.
- **Green Use of Proceeds Securitized Bond** is collateralized by specific Green Project(s). The fundamental source is generally repayment of the assets. For example, these bonds include asset-backed securitizations of rooftop solar PV or energy efficiency assets (ICMA, 2018; Martin & Gaynor, 2019).

3.8 Advantages and Disadvantages of Green Bonds as Green Finance Instruments

US Treasury bonds are an essential part of most balanced portfolios as the dominant segment of the securities category as considered the "gold standard" of reliable

investments. The growing interest in Green Bonds is also driven by the overall increase in impact-based investments on social and environmental benefits (Rajwanshi,2019). For these reasons, revealing the advantages and disadvantages of green bonds and determining their validity as socially conscious investments will be significant to understand the impact.

To start with the disadvantages, first, green bonds do not change creditworthiness in the short term, and investors look at the credit rating, which is the probability of repayment, which interest rate they will apply. Spending on solar panels or oil drilling does not change creditworthiness, at least in the short term, so great returns on initial investment may not be achieved. Second, money can be exchanged. If the government or company that borrows a bond that is thought to enable the purchase of solar panels already has the money to pay for those panels, it can use its resources to do something else. If you don't see the borrower's entire spending plan before and after lending, you can't ignore it. This requires extensive auditing and reporting (Giugale, 2018).

Third, it is not easy to determine the “impact” in the area where the bond will be used. Even if the proceeds of a bond can be shown to increase a given expenditure, proving that the extra expenditure has the desired effect is complex. Accurate assessments may take time and money or may not be available before bonds mature. Many critics argue that the broad scope of what constitutes a "green" bond to allow the issuing organizations to use the capital raised for projects. Although bonds are issued for a project focused on energy efficiency, these projects may not always help the environment as much as the issuers claim (Giugale, 2018; Rajwanshi,2019).

Fourth, over time, tying bond revenues to specific public expenditures. If special-purpose bonds increase, investors will choose which part of the financial budget to finance, such as schools, hospitals, and road maintenance. However, investors may not be willing to fund tax collection, regulation, and prisons. Less desirable bonds may bring higher yields, but there is no clarity on this (Giugale, 2018).

In summary,

- Small issuances may remain less attractive to investors as they have a relatively higher cost in terms of overall revenue.
- Effective coordination between the private and public sector market players, which is difficult to achieve, is necessary for green bonds to be successful.
- It often incurs higher costs due to transparency and accreditation expenses. However, insufficient green contract protection, quality, and transparency of reporting metrics, issuer confusion, and greenwashing are seen as significant challenges and risks for investors in the continued use and growth of the green bond market.
- It is challenging to measure environmental impact.
- As the green bond is a relatively new market, there is no international authority, but some organizations take this role independently (Chua,2020; Doran & Tanner,2019).

On the other hand, the green bond system is ingenious, as a growing number of investors want to get a profit and a positive impact simultaneously. For example, if they buy bonds, the money will be used to install solar panels and their investments will have a positive effect on the climate. In essence, the "green bonds" should expand the pool of interested buyers, make borrowing cheaper, and polish the reputation of everyone involved (Giugale,2018).

If the definitions and uses of Green Bonds are standardized internationally, there can be enormous benefits from their implementation. The leading sustainability projects can be an essential marketing tool for companies and attract media attention. Also green bonds can be fundamental for impact investing because they provide a unique system for an investor to support a specific project. Therefore, monitoring the development of the Green Bond market will be a key element of an action for any sustainability-related discipline (Rajwanshi,2019).

In summary,

- It allows investors to generate profits while supporting positive environmental, social, and governance causes (ESG),
- Especially in developing countries, it can support the financing of projects that would not otherwise be possible,
- It can create a large international market,
- It provides an opportunity for investor diversification,
- In addition to marketing to the invested projects, it also provides the benefit of gaining a reputation to the issuers,
- Its financing potential helps countries reach global commitments (Chua, 2020).

3.9 Connecting Green Bonds to Sustainable Urban Development

Large inflows of money – globally, approximately 53 trillion – will be provided to sustainable development. The majority of this amount will be invested in growing cities in developing countries like Johannesburg, Mumbai and Shanghai. Cities are where capital needs to go, and green bonds will help mobilize private sector capital towards sustainable development (Kotas,2015). Cities in developing countries need long-term sources of finance to implement climate-smart urban infrastructure investment plans. However, only 4% of these cities have access to international capital markets, and 20% have local capital markets. Bonds will increase these rates by allowing cities to obtain private financing (The World Bank 2013). The green bond market has had a relatively little financial impact on cities in developing countries to date. Still, it is growing rapidly with more investors and domestic market players (Oliver,2016). Therefore, studies should be conducted on how a green bond market strategy can expand their access to regular, low-cost capital in cities.

If cities are already able to issue their own green bonds, credit enhancement actions through structuring or guarantees and public institutions acting as key investors are

important (Oliver,2016). However, the cities do not have to issue their own green bonds.

If cities are unable to issue their own green bonds, they should be partners with other city-related institutions or organizations, national development agencies or private sector organizations such as banks or companies to support green city-based projects and investment plans (Oliver,2016).

Whether or not the city issues its own bonds, there are some points to consider. These are;

- Supporting the improvement of city credibility by increasing transparency uses of finance through reporting requirements and internal administrative coordination between city departments.
- Aligning city-based projects with issuers' green bond frameworks, ensuring that urban infrastructure follows national standards.
- Communication between a city's treasury and the environment or infrastructure departments about eligible green projects.
- Assessing a city's investor base and project potential through interviews with city representatives
- Establishing reporting and dynamic monitoring processes that track investment cuts, delays, use of cash revenues and match bond principal to project value.
- Determining which strategy is most suitable for target investors.
- High standards consisting of multiple criteria with a balanced top-down and bottom-up integrated processes.
- Environmental impact assessments for funded projects, reports prepared by external sustainability experts (Yamagata, 2016; Oliver, 2016; Reykjavík Green Bond Framework, nd).

By looking at these bullets, the system features to be installed can be expressed with keywords. In summary, these features;

- Attracting potential new investors by pro-actively aligning plans with green bond frameworks,
- Increasing visibility and ensuring the reliability of investment plans with standardization and transparency,
- Supporting communication between administrators,
- Monitoring and evaluation in the process.

3.10 Green City Bonds Issue Steps

In addition to what to pay attention to when issuing city bonds, understanding how these processes work is also crucial in organizing process management.

City governments can issue Green City Bonds that fund utilities for the water, transport, energy, etc., (Climate Bonds Initiative, 2015). The bond issue process is visualized in Figure 3.4.

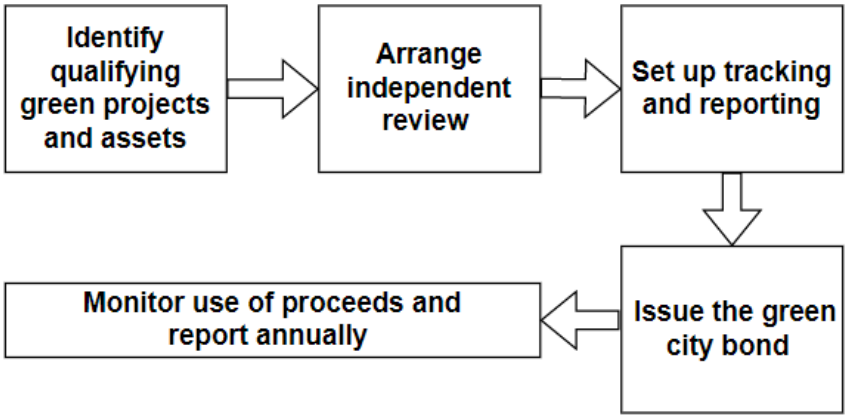

Figure 3. 4. Steps of the Green City Bonds Issue (Adapted from Climate Bonds Initiative, 2015)

- As shown in the figure, the first step in the bond issuance process is to identify qualified green projects and assets. The main feature of the Green

City Bond is that the proceeds go to green projects. The "greenness" of the issuing body of this bond is not important, it only concerns physical assets or projects. But assets and projects must be clearly identified.

- The second step is to organize an independent review. Reliable, independent review and certification protects the bond issuer's reputation and builds trust.
- The next step is to organize monitoring and reporting. The issuer establishes procedures for monitoring and reporting the use of revenues.
- The fourth step is the issuance of the bond. As with other traditional bonds, the usual steps apply. Bonds can be issued by working with an investment bank or advisor.
- The final step is to track revenues and report it annually. At least annually, a public report is required to confirm that funds are still appropriately allocated to green projects (Climate Bonds Initiative, 2015).

Considering these stages and green city bonds, a project selection-monitoring-evaluation and reporting system is required that follows all the steps starting from the project identification.

3.11 Monitoring and Evaluation of Green Bond

In the funding process of projects that will benefit from green bonds, monitoring and evaluation system should be ensured with the necessary technological tools. Currently, the overarching aim of the financial sector is to use green bonds as an opportunity to generate greater social and financial returns. In order to achieve this, the sector can direct its efforts to three sub-objectives.

1. Aiming to contribute to the maturity of the green bond market, creating greater diversity of issuers, for example attracting more companies to invest.

2. Contributing to the standardization of the green bond market through activities such as green bond definition, impact measurement and reporting.

3. Aiming at improving the transparency and communication of the effects of green bonds, enabling companies to use this process in communicating with their stakeholders (The World Bank, 2017). These objectives are explained below in relation to planning.

First, monitoring-evaluation systems are needed to determine the impact of green bond on development to attract potential new investors by pro-actively aligning plans. Green finance is a concept that concerns financial impact and social and environmental impact. For this reason, it will be helpful to see what kind of impact it has in terms of development and the projects to determine the improvement needs in the long term. In addition, project selections can be made according to this effect.

Second, monitoring-evaluation systems can compensate for the lack of integration in project eligibility to promote the reliability of investment plans with projects' standardization and transparency. Although some technological evaluation tools or expert opinions are currently used in project selection for funding, technical information is insufficient in terms of project eligibility evaluation. For example, when the project selection criteria are examined in detail within the framework of the Sweden green bond, the project to be selected must meet the following three issues.

- The expense must contribute significantly to at least one of the environmental objectives.
- The expense must not cause significant harm to another environmental objective.
- The expenditure must be highly likely to contribute to long-term net positive environmental outcomes and impacts (Ramel and Michaelsen, 2020).

These items remain insufficient and superficial criteria for projects carried out with a severe decoupling target because the boundaries of concepts such as "positive impact" are not based on factual data. For this reason, a system based on numerical

data that can be monitored and evaluated together with the technical parameters of the projects should be established. Also, the eligibility evaluations of the projects can be compared if necessary. This will also be beneficial to prevent abuse of the green finance process such as greenwashing, because the results can be controlled by monitoring the practices with a certain standard and transparency. It is essential to transfer information within specific standards to prevent abuse and deception with greenwashing. Although green certification methods are a way to reduce these greenwashing implementations, passing these certifications through an evaluation with the integration of project target and finance as much as possible minimizes the risk of greenwashing by increasing the control.

Thirdly, the monitoring and evaluation tool can support communication and coordination between managers. A system accessible to the relevant personnel from each institution in order to systematize the reporting required for this green bond and to provide internal administrative coordination between city departments will facilitate the process and strengthen communication.

CHAPTER 4

ANALYSIS OF PRACTICAL CASE; CARBON EMISSION EXPERT SYSTEM FOR TRANSITION TO CARBON-NEUTRAL ECONOMY IN GAP REGION (KAUS)

4.1 Carbon Neutral Economy in GAP Region and Şanlıurfa Province

While the assessments made on climate change in the previous years for the Region were generally evaluated under the energy and agriculture, it has been created by including development assessments in all sectors in recent years.

For example, in a regional study conducted in 2015, the assessments in the GAP were evaluated only under the headings of energy and agriculture, and infrastructural and technical targets were determined (TEMA & WWF, 2015). However, the Carbon Neutral Economy Transition Action Plan prepared for the GAP Region is more comprehensive. To illustrate, it includes that the high value-added products can be obtained thanks to low-carbon applications and cost reductions to be provided in energy, and 'Green Energy' companies develop new job opportunities. In addition, actions have been proposed in the building, industry, transportation, agriculture, and tourism sectors. It was also emphasized that the region should adapt to new financing models to realize these actions, but a methodology to achieve this was not mentioned in the plan (METU RICBED, 2020).

At the same time, in this plan, it is defined that the regions with the highest low carbon application potential are concentrated in areas that are relatively far from metropolitan life and where technological infrastructure and capacity are somewhat insufficient. The governments attempt to be carried out the economy in these areas

with continuous incentives. The GAP Region is also in this category (METU RICBED, 2020).

According to the BIDEP Report (2020), the adaptation measures to be taken first in the face of the adverse effects of climate change in the Southeastern Anatolia Region include sectors such as water resources, agriculture, forestry, animal husbandry, health, tourism, energy, transportation, urban infrastructure, and economy. The economic analyzes that will emerge from the climate scenarios are integrated into the investment decision-making process and cooperation with the owners of economic activities (Environment and Urban Ministry, 2020).

Local governments that have signed the Global Climate and Energy Agreement of Mayors are committed to working towards reducing/limiting greenhouse gas emissions, preparing for the effects of climate change, increasing access to sustainable energy, and developing policies. In addition, there are province-district municipalities that do not sign the contract but make greenhouse gas inventory calculations. Şanlıurfa is among these provinces (Kent-LAB, 2021). Şanlıurfa Metropolitan Municipality, which aims to create a more harmonious city to determine the effects and awareness level of regional climate change in 2022, organized a "Climate Change Action Planning training workshop." (Şanlıurfa Municipality, 2022). Although the workshops and training have been established, there is no climate change action plan yet. Also, in the 2020-2024, Strategic Plan of Şanlıurfa Metropolitan Municipality, environmental management, and climate change are the planned titles. However, this plan doesn't include green finance and its complementaries (Şanlıurfa Municipality, 2019).

As a result, despite Şanlıurfa is included in the studies carried out within the scope of the GAP Region, no study specifically emphasizes green finance in the province.

4.2 Monitoring and Evaluation

Monitoring and evaluation is project manager’s or the experts’ operation to make independent decisions about large-scale projects' reliability, efficiency, and effectiveness. Many international organizations such as the United Nations, the World Bank, and the IMF participate in monitoring and evaluation processes to measure and estimate the impact of projects (Puaschunder, 2021).

Monitoring ensures continuous evaluation to provide detailed information to all stakeholders about the progress of the activities under review. It also makes it possible to compare actions, individuals, types of programs and geographical locations. Evaluation is the systematic and objective examination of the suitability, effectiveness, efficiency and impact of activities under the stated objectives of the plans. It makes possible to assess all the program elements to determine their overall worth or significance. Monitoring and Evaluation aim to improve feedback, learning and improvement (Puaschunder, 2021; ILO, n.d.).

There are two main types of evaluation as Performance and Impact evaluations.

Performance evaluations focus on the quality of short- and medium-term service delivery and the results achieved by the program. Impact evaluations focus on possible changes in outcomes. Determining causality distinguishes impact assessment from any other type of assessment. Monitoring and evaluation (M&E) systems often include information on the project's cost. This shows the benefits and highest rate of return of projects against the costs (ILO, n.d.).

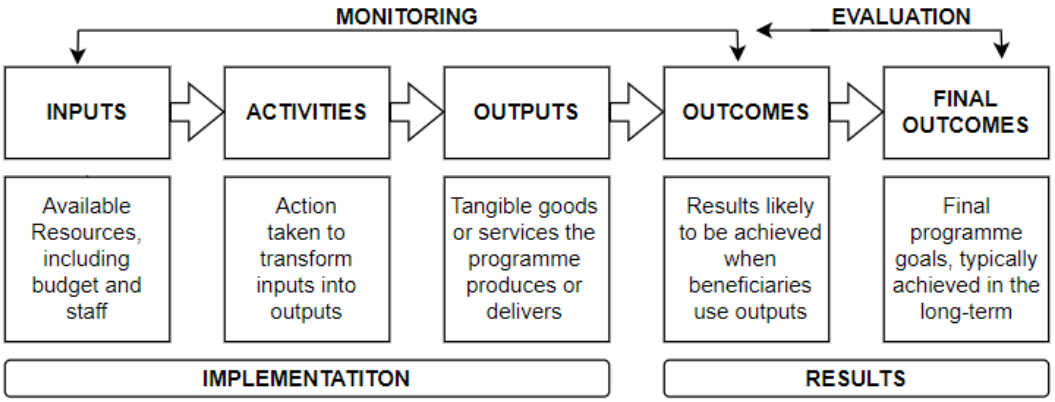

Figure 4. 1. Monitoring and Evaluation Framework (ILO, n.d.)

As shown in the framework (result chain) above, the monitoring system will continually monitor the following items: (i) resources invested in/used by the program; (ii) implementation of activities within the planned time; and (iii) delivery of goods and services. In addition, performance appraisal will show the input-output relationship and immediate results at a given point in time, while impact assessment will provide evidence as to whether the observed changes were due to the intervention (ILO, n.d.).

The relationship between M&E and planning is established as follows. The planning process before implementing the project or program should be based on a comprehensive plan of what the project or program aims to achieve. It is essential to have a plan that can address: (i) What activities will be operated as part of the development intervention?; (ii) What will change as a result?; and (iii) Why is this change important? (INTRAC, 2015).

Even after a project or program has begun until it is completed, it is still important that planning, monitoring and evaluation (PME) be closely linked (Bakewell et al., 2003). This is shown in the diagram below.

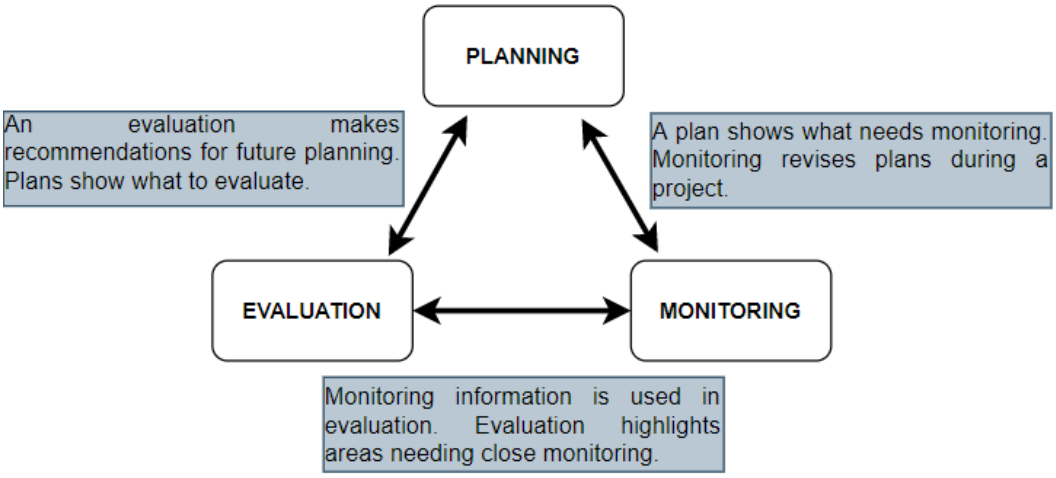

Figure 4. 2. Planning and M&E Relation (INTRAC, 2015).

The Carbon Emission Expert System (KAUS) is also a kind of monitoring and evaluation tool used within the scope of planning.

4.3 Monitoring and Evaluation in the case of KAUS

KAUS is a tool beyond the monitoring-evaluation system with its qualified features.

The first stage of KAUS determines carbon emissions in the construction, transportation, industry, agriculture, and waste sectors for the GAP provinces. Based on that, the project creation and the carbon emission calculation tool, the display of the carbon status on the atlas, and the development of the reporting system were created.

The second phase is about the central monitoring and evaluation of projects belonging to different sectors selected in line with the action plan, with their goals, durations, impact areas, and indicators in the transition to a carbon-neutral economy. Thanks to KAUS, a software platform based on carbon emission calculation, it is possible to manage projects, monitor performance, prioritize and establish external connections. The program has been developed as a platform that includes carbon emission expert components and can provide service at different levels of authority.

Besides these; It has been enriched with various calculation models and related reports such as data entry, viewing of input data, individual carbon footprint, and technological tools for carbon reduction.

It consists of four main screens: Graphic Screen, Atlas Screen, Project Manager Screen, and Data Entry Screen. It appeals to three primary users: project manager, Audience, and Data Entry Personnel. All these screens are interconnected in terms of data and support carbon-neutral projects' monitoring in different aspects such as carbon reduction, the target audience for the project, and project cost. Moreover, the home page consists of user-applicable information and calculation on personal carbon footprint and renewable energy tools' efficiency to reduce carbon emissions.

It is possible to draw a monitoring and evaluation framework for KAUS as in Figure 4.3.

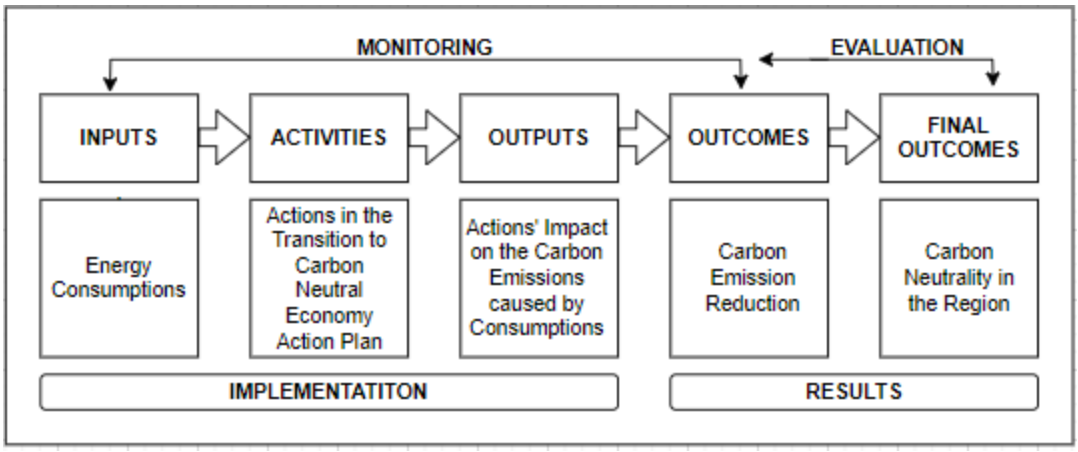

Figure 4. 3. Monitoring and Evaluation Framework for KAUS

KAUS measures the impact of the actions on carbon emissions by using the Transition to a Carbon Neutral Economy indicators in the GAP Region on the energy consumption input. As a result, a decrease in carbon emissions is observed, and it is aimed to reach carbon neutrality in the region within the period determined for actions. The actions in the plan aim to achieve decoupling to both reduce the carbon level and support the development level in the region. KAUS has a monitoring-

evaluation infrastructure that can be used in the green bond process, with features such as measuring the impact of projects created with various combinations of these actions, determining strategy, providing transparent process tracking and reporting. Detailed information about all the features of KAUS is in the continuation of the chapter.

4.4 Background of The Carbon Emission Expert System

An action plan and Carbon Emission Expert System Project were carried out in cooperation with the Ministry of Industry and Technology, GAP Regional Development Administration, and METU RICBED.

The general purpose of the Action Plan, which has been developed for the transition to a Carbon-Neutral Economy in the GAP Region, determining the priority applications during 2020-2025, is to implement a development model based on a low carbon footprint, with applications to be made in all sub-sectors in the case of the economic system and to use it to increase the competition between regions. The activities required by the action plan are based on developing KAUS software. The Action Plan has two inseparable primary objectives.

On the one hand, it attempts to reduce the carbon footprint by ensuring the most effective use of resources in all production and service areas of the GAP Region, especially in industry, agriculture, transportation, building, and waste.

On the other hand, it aims at sustainable business and production models to ensure that the local and regional economy is competitive. In summary, it includes actions to remove the negative impact on environmental resources while supporting economic development (Decoupling).

In the direction of the Action Plan, the Carbon Emission Expert System (KAUS) software platform was developed. Raising awareness and providing behavioral change by implementing the activities in the action plan and increasing renewable sourced technological tools are two different approaches to developing KAUS. As a

result of these approaches, it is aimed to reduce carbon emissions. It is foreseen that this software platform will support the carbon-based smart decision-making, monitoring and evaluation system and increase the data capacity of the region in the transition to a carbon-neutral economy. In this way, instant dynamic decision mechanisms can be established and the system can be integrated into new smart systems.

4.5 Modules of The Expert System

While creating the KAUS software platform, the actions included in the Carbon Neutral Economy Transition Action Plan report in the GAP Region and the implementation of the activities required by these actions were taken as a basis. While determining these activities, they were divided into Action-Based and Space-Based. While deciding the Space-Based parameters, variables such as a propensity for actions, the needs of actions and the current project background were taken into account. There are basically two different approaches: creating behavioral change by implementing these activities and increasing the use of renewable sourced technological tools. As a result of these approaches, it is aimed to reduce carbon emissions. In creating the software platform, three main modules have been defined under the headings of Web Frontend, Modeling/Simulation, and Expert System/Forecasting.

4.5.1 Web Frontend Module

The KAUS Web frontend module consists of 5 different screens: Main Page, Atlas, Project Manager Screen, Graphics Screen and Data Entry Screen. Three types of users were determined for the KAUS Web frontend module within the specified authority and limits: data entry personnel, project manager, and viewer.

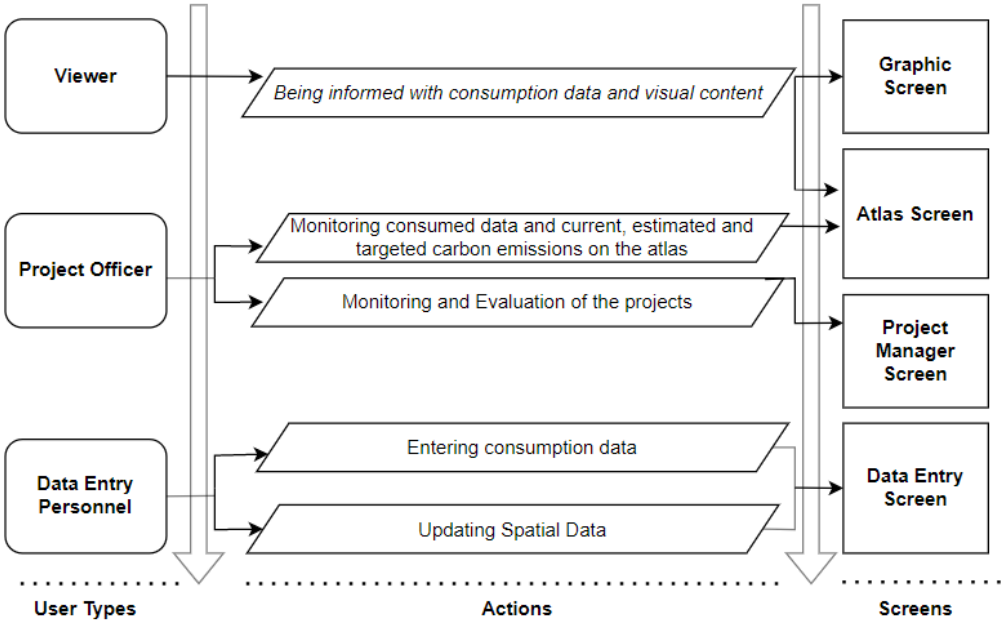

Figure 4. 4. The User Interface of Carbon Emission Expert System -KAUS (Adapted from METU-RICBED, 2020)

4.5.1.1 Screens of The Carbon Emission Expert System (KAUS)

Main Screen/Basic Tools Screen: This screen is accessible to all three user types: data entry personnel, project manager, and viewer. It includes a calculation window apart from the content, such as navigation buttons for transition to other screens, explanations with project coordinators and stakeholder information, texts containing the general description of the project methodology, carbon-neutral economy, and individual recommendations to reduce carbon emissions. Thanks to this calculation window, it is possible to calculate how much emission benefit can be achieved with the personal carbon footprint calculation and technological tools such as PV panels or heat pumps within the framework of the models prepared by the METU RICBED team.

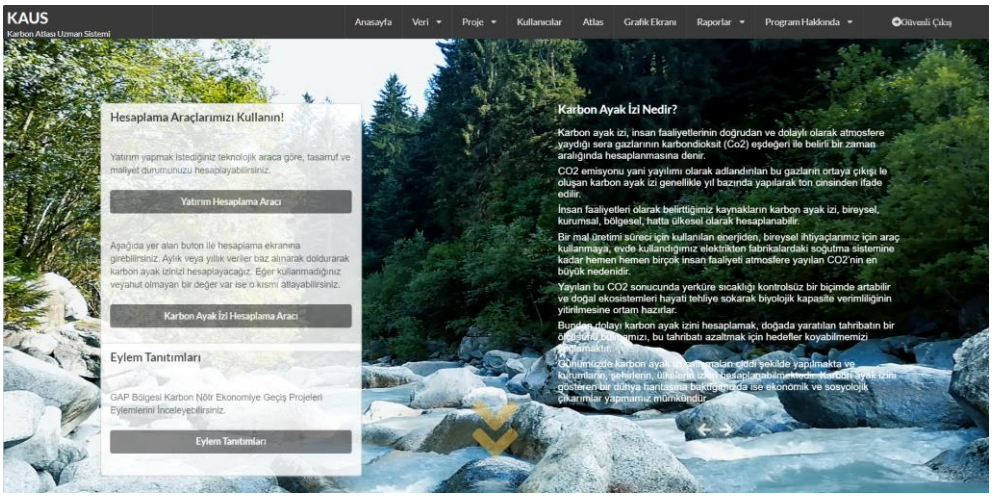

Figure 4. 5. The Mainpage of The Carbon Emission Expert System-KAUS

Source: http://kaus.gap.gov.tr/

Atlas Screen: The Atlas screen is accessible to all three types of users, namely data entry personnel, project manager and viewer. It consists of electricity (Lighting, residential, industry, agricultural irrigation, business categories), natural gas (Transformation-Cycle, energy, transportation, industry, service, residences, other categories), petroleum (Gasoline, diesel, fuel) -oil, aviation, marine, gas oil categories) consumptions in the GAP Region, at provincial and district scale, and emission information from these consumptions. This screen makes it possible to reach the current consumption and emission data from 2016 to 2018 and the estimated data until 2025 in annual and monthly periods. These consumption types are shown in MWh unit in the electricity category, Sm^3 unit in the natural gas category, and Ton unit in the oil category. There is an option to reflect these consumption values on the atlas. In addition to these, provinces and districts with maximum and minimum emission values or numerical information such as the regional average emission value on the atlas screen and the population of these provinces can be seen. This screen, which is open to everyone's access, is customized on a user basis. While consumption data can be seen on a single atlas screen for the viewer, two different atlas screens can be seen simultaneously for the project

manager and data entry personnel, including current and estimated consumptions and changes in project application areas.

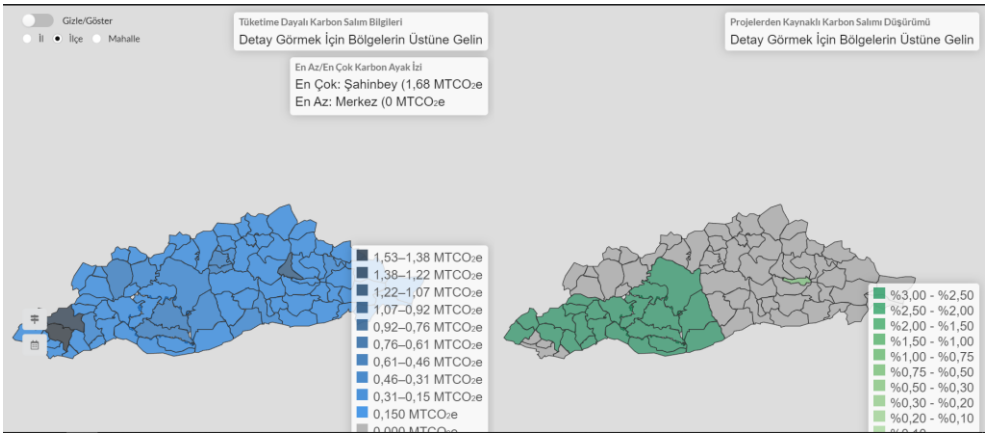

Figure 4. 6. The Current and Targeted Emissions on The Atlas Screen

Source: http://kaus.gap.gov.tr/atlas.html

Project Manager Screen: Only the project manager user type has access to the project manager screen. The project manager is expected to evaluate this screen about the implementation process of the actions required by the project every six months. These evaluations select and score the sector, implementation strategy, actions, and parameters specific to the province or district. As long as these evaluations progress as expected, the project manager will display the current emission and consumption amount (according to the selected consumption type), the target emission and consumption amount (according to the chosen consumption type), the estimated emission and consumption amount, the actions with the highest and lowest impact. Also, the screen can display the distribution of the reduction rate according to the consumption types, the temporal distribution of the contribution of the selected actions to the emission together with the consumptions, the number of people to be reached in line with the target emission reduction (for parameters such as meetings, promotions, etc.), the emission status when the action or actions are not implemented, and the project cost.

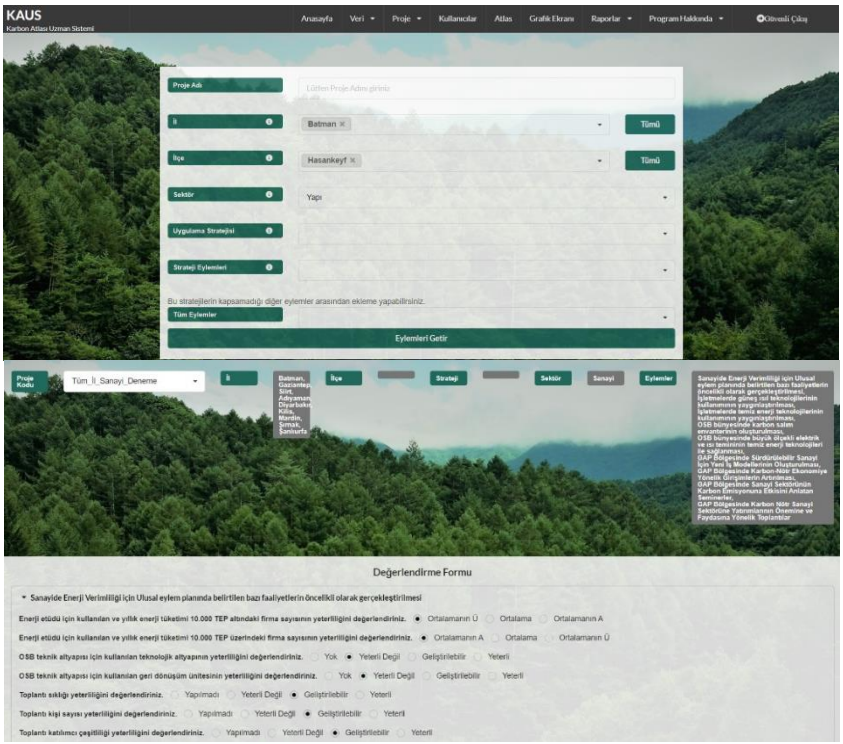

Figure 4. 7. The Project Entry-Evaluation Screens of The KAUS

Source: http://kaus.gap.gov.tr/projectview.html

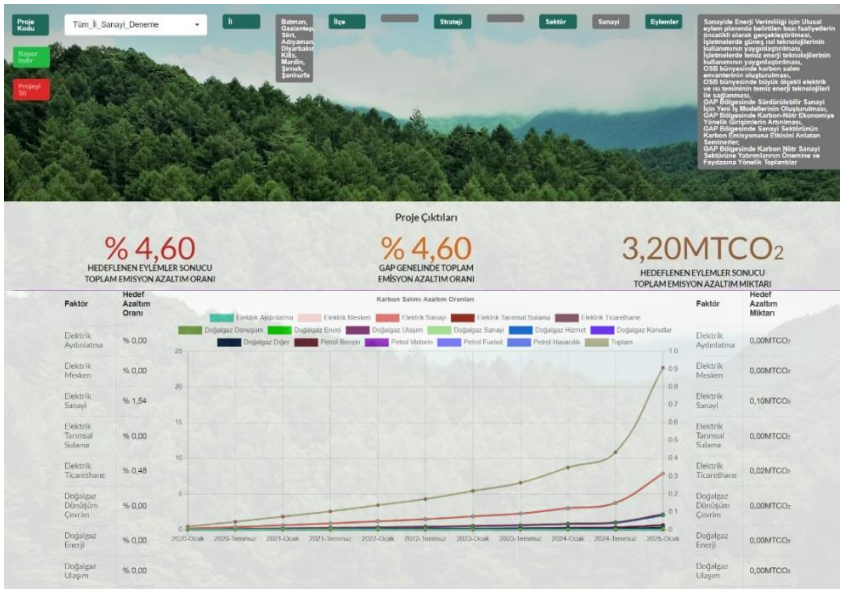

Figure 4. 8. The Project Display Screens of The KAUS

Source: http://kaus.gap.gov.tr/projectview.html

Graphics Screen: This screen is accessible to all three user types: data entry personnel, project supervisor and viewer. The graphs of carbon emission data in the entered period and the selected province or district are displayed on this screen.

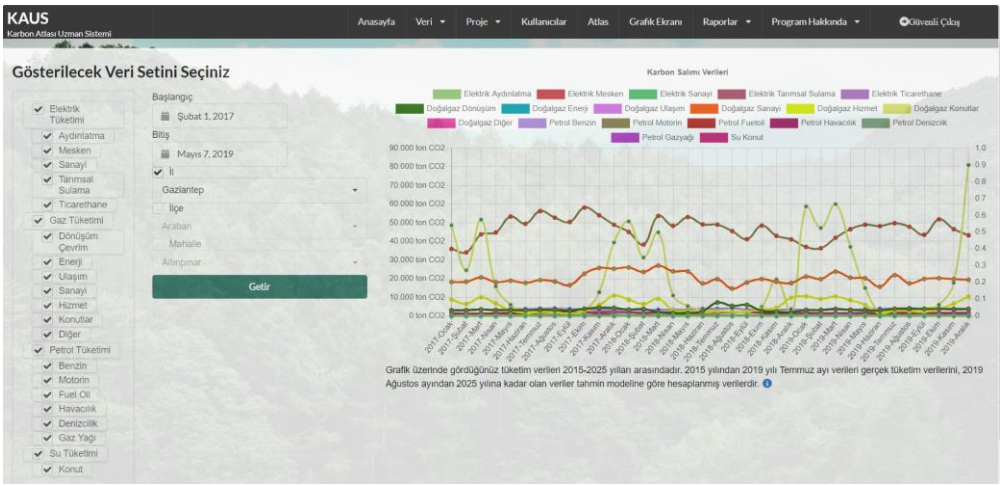

Figure 4. 9. The Graphic Screen of The Carbon Emission Expert System-KAUS

Source: http://kaus.gap.gov.tr/home.html

Data Screen: User types other than data entry personnel and project supervisor do not have access to the data entry screen. Data entry personnel are expected to enter the current consumption data required for the system in monthly periods on this screen. The data type can be spatial data such as electricity, natural gas, oil and water consumptions reflected on the atlas, and the number of buildings required to calculate action effects, floor heights, and the degree of air pollution.

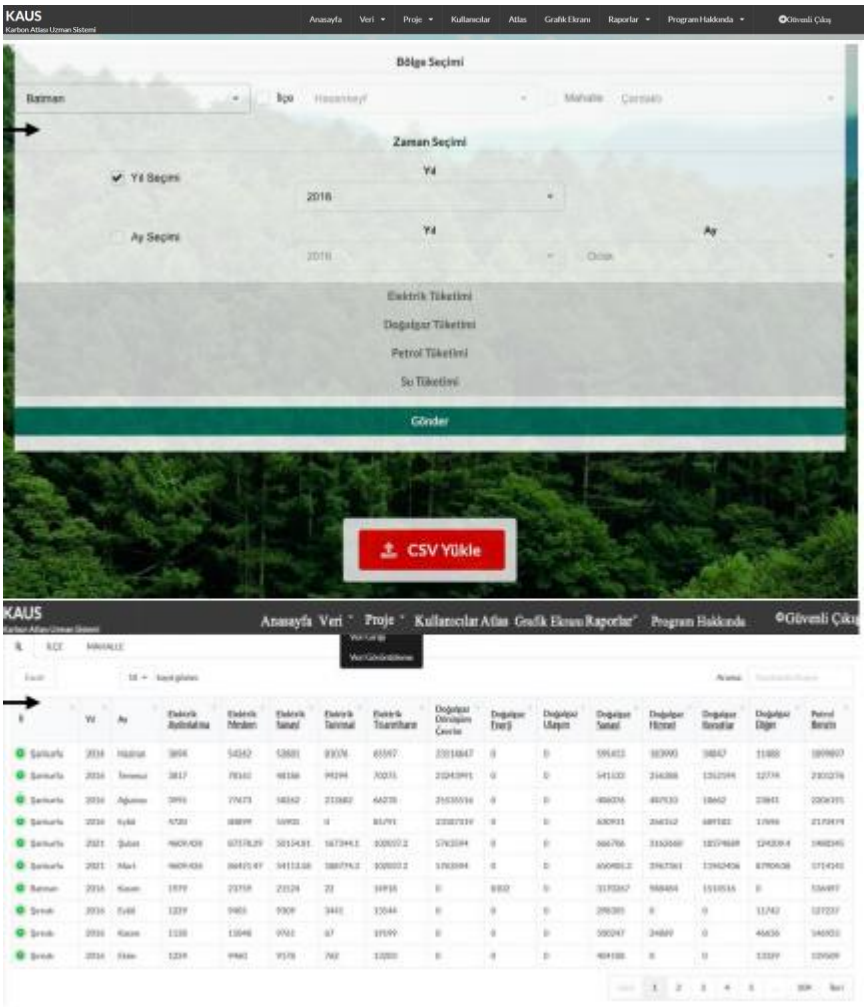

Figure 4. 10. The Data Entry and Data Display Screens of Carbon Emission Expert System-KAUS

Source: http://kaus.gap.gov.tr/dataentry.html , http://kaus.gap.gov.tr/dataview.html

4.5.1.2 User Types

Data Entry Personnel: It can access five types of screens: Main Page, Atlas, Graphic Screen and Data Screen. However, the responsibility of the data entry personnel is to enter the electricity, natural gas, oil and water consumption data specified in the data entry screen in monthly periods and to update the spatial data

such as the number of buildings, floor heights, air pollution degree required in the calculation of the action effects in case of a change.

Project manager: It can access five types of screens: Main Page, Atlas, Graphic Screen and Project Manager Screen. However, the responsibility of the user type for the project is to monitor and evaluate the processes required by the project actions every six months. After the evaluation of the project manager, the action impact rates and, therefore, the emission values will change.

Viewer: It can access four types of screens: Main Page, Atlas and Graphic Screen.

4.5.2 Modeling/Simulation Module

The simulation Module considers the electricity, natural gas and oil consumption at the provincial and district scales of the GAP Region and the emission data arising from this consumption for the last five years. With a calculation model established in this module, the expected emission increase rate in the coming years, the change in the emission rate for the selected place, and the actions applied can be calculated. With the foresight that the actions included in the action plan will be implemented within five years, sectoral emission reduction amounts have been determined for every six months between 2020 and 2025 to ensure project process control.

This model is designed to calculate the change rate in carbon emissions after implementing the actions. It is also possible to perform the following operations using the Simulation Module:

- The effects of action and success rates in all sectors can be seen with maps and graphics,
- Updating consumption data and carbon emission data,
- To see the spatial and action-based effects of actions,
- Seeing the change of action effects over time with maps and graphics,
- Controlling the scoring process of action effects,
- Comparing the impact of action according to the place,
- Observing the personal impact on carbon emissions,

● Analysis and reporting of action impacts,
● Viewing associated actions.

4.5.3 Expert System/Forecasting Module

Thanks to this module, 5-year forecasts were made for the variables that cause CO_2 emissions (Electricity, oil, and natural gas consumption variables) using monthly data on a provincial basis. The estimations were made in three stages.

- Detecting outliers in variables and using estimated values instead of these values (Seasonal and Trend decomposition using Loess).
- Determination of the best seasonal ARIMA model for each variable separately after outliers has been cleaned.
- Calculation of a 5-year forecast for each variable by using the coefficients of the selected ARIMA models.

4.5.4 Data Supply

The data and sources used in the Expert System calculation are listed in the table below.

Table 4. 1. The Dataset of The Carbon Emission Expert System-KAUS (Adapted from METU-RICBED, 2020)

Data Type	**Data Content**	**Data Source**
Consumption Data	Electricity Consumption	EPDK
	Natural Gas Consumption	
	Oil Consumption	

Table 4.1. (Continued)

Emission Factor Data	Electricity Emission Factor	TÜİK, IPCC
	Natural Gas Emission Factor	
	Oil Emission Factor	
Demographic Data	Population Household Size	TÜİK
	Population Density	
	Gross Domestic Product (GDP)	
	Population by Education Status	
	In-Migration and Out-Migration	
	Employment Rate	
	Number of Qualified Employee in Industry	
Spatial Data	Land Use	TÜİK
	Thresholds (Slope, Fault Lines, Flood Zones)	
	Type of Buildings (Public, Commercial, Housing)	
	Number of Buildings	
	Building Stores Height	
	Housing Property	

Table 4.1. (Continued)

	Agricultural Land Size	
Climate and Environmental Data	Annual Average Temperature	MGM
	Maximum Daily Wind	
	Annual Average Temperature Precipitation	
	Annual Average Hours of Sunshine	
	Air Quality	TÜİK
	Order of Priority in Water Pollution	ÇŞB
	Sources of Soil Pollution	

To measure the impact of actions on carbon emissions, first of all, the need to determine the parameters that the actions are affected by during the implementation process and the indicators of these parameters arose. Parameters and indicators in different categories have been determined by the RICBED team.

While creating these action effect parameters, it is divided into two different titles as Action Based Parameters and Space-Based Parameters. While the Action Based Parameters are determined for the measurability of the technical and social situation required by the action, the Spatial Parameters consist of the parameters that can cause the change of the action effect due to spatial characteristics.

In addition, Action-Based Parameters are divided into two. On the one hand, these parameters are the parameters that can be manipulated on human behavior and decisions to increase the applicability of the action and the others. Therefore, these parameters' scores will be higher than other parameters due to the snowball effect.

On the other hand, the Location-Based Parameters consist of Fixed Location-Based Parameters that do not require a subjective interpretation and will automatically affect the scoring due to the user choosing the venue and other parameters where the user makes site-specific scoring by following the instruction. Three different variables were considered while determining the parameters that the user scored. The headings are Susceptibility /Tendency to Actions, Needs of Actions, and Current Project Backlog. While there are parameters that can change spatially and affect the tendency towards the implementation of the action under the heading of susceptibility to actions, there are parameters that question the existence of the tools or environment required for the implementation of actions under the heading of Actions Needs, and parameters that question the existence of action-related projects under the heading Existing Project Backlog.

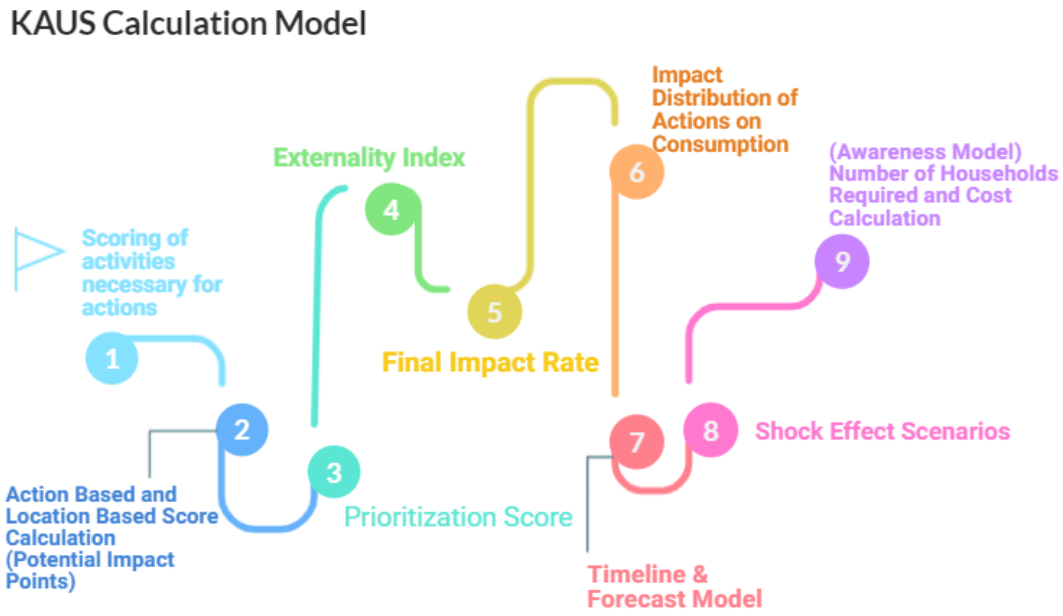

Figure 4. 11. The Calculation Model of The Carbon Emisson Expert System-KAUS (Adapted from METU-RICBED, 2020)

The Potential Impact Score of the actions was obtained by adding the action-based and location-based parameter scores with each other.

Following the determination of the Potential Impact Score, an action relationship table was created considering the mutually supportive effects of the actions in all sectors. This table contains numerical data of how many actions are affected by the other actions, creating an externality. The Externality Index was calculated by completing the maximum number of relationships to 100.

Following the previous stage, in the Action Plan Report of the Transition to Carbon Neutral Economy in the GAP Region, the Uncertainty, Development Impact, Difficulty/Cost, Easy Adaptation, Future Discount, and Time Coefficient values in the Action Priority Table are multiplied with sum of the Potential Impact and Externality scores, considering that the effects will be reduced due to the difficulty of action implementation.

The value of the total annual carbon emission amount in the GAP Region (using long-term data from previous years) has been calculated as 39,047 Thousand Tons and 44,977 Thousand Tons of equivalent CO_2 for 2020 and 2025, respectively. These numbers correspond to an equivalent CO_2 increase of 5,930 Thousand Tons in 5 years (Matpum, 2020). Therefore, to neutralize the possible rise in carbon emissions in these five years under consideration, it is necessary to target a 13,185% emission reduction compared to 2025. In this way, the total carbon emission value in 2025 will be the same as in 2020. This target is 4.6% in the industry sector, 3.1% in the construction sector, 2.4% in the agriculture sector, 2.3% in the transportation sector and 0.4% in the waste sector. These rates are distributed according to the provinces in direct proportion to the number of households.

METU RICBED team aimed emission change at these rates by scoring the parameters. Therefore, the calculation was made assuming that the target rate was reached with the target parameter scores and the final effect rate of the actions was found. In order to see how the actions will create a consumption-based change for each sector, the distribution of the effects on consumption has been determined with a scoring system developed by RICBED Team.

The target emission change that will be reflected in these consumptions, an Emission Change Rate Timeline, has been prepared by using the action implementation phases specified in the Action Plan. According to this calculation model, there are four different phases: Preparation, Implementation, Dissemination, and Routinization, covering different periods for each action. While the action will not affect emissions proportionally during the preliminary preparation phase, the action will affect the emission change by 1 fold, in the implementation phase by 2 fold, in the dissemination and routinization phase by 3 fold.

4.6 Research Study Findings

The primary purpose of this research is to develop a general framework for green finance by investigating the green bond financial instrument and its complements, revealing the need for integration into the planning process. This research also aims at discussing how decoupling projects can be systematically integrated into the monitoring and evaluation process. For this purpose, two different perspectives were examined. The first represents the views of the KAUS users and system developers; the second is of financial experts. Thereby, the first part of this chapter presents the potential problems encountered in this integration process, and the second part consists of the opinions of finance experts about the ways for integrating decoupling projects and green finance through monitoring-evaluation systems.

4.6.1 Problems of the monitoring-evaluation tool in which decoupling projects and green finance will be integrated

This section presents the Carbon Emission Expert System (KAUS) and introduces the requirements for monitoring-evaluation on the basis of a definition of problems and criterias in response to the need for meeting the green finance integration fully.

As shown in Table 4.2, the results acquired from the meetings indicate that more than half of all mentions (54%) refers to the 'Available Data'. This is almost equally followed by 'Project Management' (15%), 'Social Impact' (13%), and 'Unavailable Data' (13%). The rest of all mentions comprises the issues about the 'Institutional Capacity and Governance' (4%).

Table 4. 2. Research Findings Categorisation

Main Categorisation		Sub-Categorisation	Frequency	%
Available Data		Renewable energy/ Consumption data	7	25%
		Spatial Data	7	25%
		Transportation Data	6	21%
		Smart Apps/Platforms	4	14%
		Data Frequency	2	7%
		Illegal Energy Use Problem	2	7%
		Total	**28**	**54%**
Project Management	**Funding**	Funding appeal of the project/Proactivity	3	38%
		Payment Failure	1	13%
	Data Sufficiency and Management	Data Gathering	3	38%
		Central data archiving	1	13%
		Total	**8**	**15%**
Social Impact		Impact / Sensitivity	3	43%
		Dissemination	2	29%
		Behavior Change	2	29%
		Total	**7**	**13%**
Unavailable Data		Data Entry and Lack of Digital Data	3	43%
		Data Reliability	3	6%
		Data Sharing problem	1	2%
		Total	**7**	**13%**
Institutional Capacity and Governance		**Total**	**2**	**4%**

Respondents mentioned six issues when they referred to the availability of data in using KAUS. Half of the mentions (‘terms’ yerine ‘mention’ kullanılıyor) in this category includes 'Renewable energy/Consumption data' and 'Spatial Data' with the same frequency of 25%. The remaining issues refer to 'Transportation Data' (21%), 'Smart Apps/Platforms' (14%), 'Data Frequency' (7%), and 'Illegal Energy Use Problems' (7%).

With respect to renewable energy consumption, Şanlıurfa Metropolitan Municipality (I2) asserts that solar energy panels data, transformer and natural gas data at neighborhood scale can be obtained from DEDAŞ and AKSAY institutions. Regarding carbon emission calculation methods, while the Odunpazarı Municipality has pilot studies, in Şanlıurfa, there is no such study.

Within the scope of smart applications and platforms, another sub-category, the Şanlıurfa Metropolitan Municipality (I2) stated that they can provide detailed information such as route and traffic load from the smart card for Şanlıurfa public transportation. It has also been added that there is a smart numbering system and a web platform (“web.gis.Şanlıurfa”) for buildings.

Within the scope of smart applications and platforms, the Şanlıurfa Metropolitan Municipality (I2) states that they can provide detailed information such as route and traffic load from the smart card for the Şanlıurfa public transportation. There is also a smart numbering system and a web platform (“web.gis.Şanlıurfa”) for buildings that can be integrated to the smart system.

The spatial data includes annual risk map, building material map, household consumption data with geographical coordinates, noise map, building permit data. The Şanlıurfa Metropolitan Municipality (I2) states that the annual risk map and noise map of the fire brigade are available.Additionally, the Karaköprü District/County Municipality (I3) stated that buildings, number of building-licenses, construction material status can be obtained from the District municipality or the surrounding urban planning branch. DEDAŞ - Electricity Distribution Company

(I4), on the other hand, climas that in addition to these, there is electricity consumption data on the basis of households in the places with OSOS and that 150-200 households connected to a transformer can be shared with the geographical coordinates of the transformer.

With respect to transportation data, the Şanlıurfa Municipality mentions daily/monthly number of vehicles, type and fuel consumption data of public transportation, and billing information paid to parking and road junctions. The municipality also (I2) asserts that daily and monthly vehicle availability and consumption data regarding public transportation are available. Moreover, vehicle type data can be obtained from the police department. However, since fuel-oil usage is not in the region, no data about it is available. The Karaköprü District/County Municipality (I3) provides information about the means of transportation and the park and road separation belonging to the Karaköprü Municipality and that there is kw information on the invoices they pay.

With respect to data frequency, information about data collection intervals, monthly and annual, has been compiled. Some data are available monthly, the others annually. The Karaköprü District/County Municipality (I3) states that:

> "It is easier to obtain monthly data on a district basis or more detailed data can be obtained in an area not as large as Karaköprü. For example, 350-400 electrical transformer data for Karaköprü can be shared monthly."

The issue of illegal usage data concerns with the problem of illegal energy consumption, a popular problem in the region, and the inability to collect or share real data accordingly. DEDAŞ - Electricity Distribution Company (I4) says:

> "Data sharing can be done in parts in some regions, especially in regions where illegal use is intense. There are crimes related to illegal use. Roof transformers can prevent illegal use and energy waste."

Although the availability of these data was stated in the interviews during the process, when KAUS was put into use hypothetically, coordination with these institutions could not be carried out and data could not be provided. Therefore, the data in the "Available Data" category could not be reached.

The second most frequently mentioned issue refers to 'Project Management'. It is composed of 'Funding' and 'Data Sufficiency and Management'. Half of the mentions about ‘Funding’ includes ‘funding appeal of the project and proactivity’ (38%) and ‘payment failure’ (13%). Regarding ‘Data Sufficiency and Management’, respondents mentioned the issues of ‘data gathering’ (38%) and ‘central data archiving’ (13%).

With respect to the funding issue, the GAP RDA (I5) stated that the KAUS project was carried out with the aim of developing technology, reducing the current account deficit and increasing exports. Therefore, it required financial inputs. Also, the GAP RDA (I5) added that:

> “The transition to a carbon-neutral economy is very important for development and funding. It would be very beneficial to develop the expert system by making it more attractive. Maybe in this way it will be able to fund itself and the grievances due to the expectation of allowance will be eliminated.”

The Şanlıurfa Provincial Directorates for Environment and Urbanization (I1), the Şanlıurfa Metropolitan Municipality (I2), and the Karaköprü District/County Municipality (I3) also develop consensus on this issue and state that:

> “We do not have any integration on green finance nor use any instrument of green bond. It is very important that an action should be included in the investment plan and specified in the action plan, even if thematically. In other words, it is salient to include financial potentials in this expert system as an extension of the GAP Region Transition to Carbon Neutral Economy Action Plan”.

In addition, with reference to the urban mobility issue the Şanlıurfa Metropolitan Municipality (I2), mentioned that:

> "Due to the immense increase in the urban population, transportation investments take a large share of the municipality's expenditure. Therefore,

additional studies such as awareness cannot be produced. Additional investment channels should be created in mobility and public transport".

The involved research institution (I6)) commented on this issue as follows:

> “Because of the necessity of spatial development projects to be compatible with the market and the transformation of the new financial system into green finance, an additional financial module is needed for this expert system. KAUS has not completely ignored this issue with its development within the framework of finance-development-environment. However, it is fair to claim that this development is insufficient since it uses criteria including “the level of financial adequacy” similar to other parameters and provides project and social cost calculation. However, it does not have a mechanism that produces concrete results, especially in the subject of green finance, which it is directly related to.”

The reflections obtained from the institutions reveal the need for the financial integration of KAUS and the institutions’ motivation for this integration. In more detail, it would be beneficial to provide a financial output since the purpose of KAUS is to improve development, reduce current account deficit and increase exports. Additionally, this financial output providing the infrastructure to be included in investment and action plans with the reporting system of KAUS can be seen as a significant advantage. Also, the fact that KAUS is a project attracting investment by increasing opportunities can also motivate involved institutions with the potential of finding sufficient funds for their work.

Regarding the 'Data Sufficiency and Management', alternative methods that can operate with insufficient data in the carbon emission atlas are emphasized. The Şanlıurfa Metropolitan Municipality (I2) gives the following as an example:

> “ Carbon measurements are made around the world with eddy covariance towers. Thus, the entire system from the atmosphere connected to the ground is displayed. The installation of these towers is the most reliable source of

data for species prioritization on agricultural emissions. Methods like this could be explored."

The Şanlıurfa Metropolitan Municipality (I2) also stated:

> " A platform will be established in the GAP Region in order to collect all the data in the region, but the studies have not started yet".

The third most frequently mentioned issue refers to 'Social Impact'. 'Impact/Sensitivity' emerges as the most prominent sub-category by having the highest frequency among all sub-categories of Social Impact with 43%. The other two 'Dissemination' and 'Behaviour Change' follow it with the same frequency rate of 29%.

The GAP RDA (I5) stated that they see the awareness part of KAUS as impact notation-dissemination and exploitation. The awareness issue has been addressed in the expert system with specific parameters (Meetings, training, and the participants' information in these activities) to provide these impact assessment, dissemination and exploitation.

During the research process, it was learned that the Şanlıurfa Metropolitan Municipality (I2) is working on public awareness, urban mobility and transport. It has been stated that a social sensitivity analysis is necessary in this regard with the sentences:

> "Applications with long-term returns, such as solar energy, do not work in Şanlıurfa. For the people to adopt this practice, they need to be convinced of a serious financial return."

From this speech, it is understood that both decision-making institutions approach these practices with prejudice and a financial integration is needed in this regard.

Also, the researcher (I6) working in the KAUS project from the METU RICBED stated that:

> "There were studies to integrate an awareness module into the monitoring-evaluation system by organizing workshops during the project formation process, but this did not happen. The workshop was held during the project

> process, but not for raising awareness, but for promotion and exchange of ideas."

Although it was decided to organize workshops for awareness during the expert system creation, this part proceeds with subjective interpretation as a result of not planning a workshop for this in the process and not being able to integrate with the scoring system. A workshop was held during the formation process of the expert system. However, this workshop was for promotion and information, it is not related to system integration. In addition, awareness activities in institutions remained at the scale of public transportation applications and could not be advanced. This can be cited as one of the reasons why this issue has not been adequately reflected in the expert system.

'Unavailable Data', which is the fourth category of the study, incorporates the sub-categories 'Data Entry and Lack of Digital Data' (43%), 'Data Reliability' (43%) and 'Data Sharing Problem' (13%).

The problem of the lack of data or not being in the digital environment arises from problems such as the data not being up-to-date, not being in the desired scale and subject.

As the METU RICBED (I6) stated;

> "KAUS is a tool that includes the emission results and the impact of projects consisting of various actions on this emission at regular intervals, the content of which can be changed according to these results and the predicted scenarios. Therefore, the data entered into the calculation system is not up-to-date, which may lead to the selection of actions and the wrong evaluation of the projects to be created. If the data is as up-to-date as possible, tool will enable the most accurate decisions".

However, the interviewed institutions "The Şanlıurfa Provincial Directorates for Environment and Urbanization (I1), the Şanlıurfa Metropolitan Municipality (I2), the Karaköprü District/County Municipality (I3) stated that:

> “Sufficient infrastructure and technology such as building-scale smart systems to obtain real-time data in the region do not exist".

As a result, the data required for the Carbon Emission Expert System to provide more up-to-date results are not collected in the region due to infrastructural inadequacies.

In the light of the interviews, there are deficiencies in the desired data scale. While the researcher touched on the data related problems of KAUS, the METU RICBED(I6) stated the following about the data scale:

> "The sectors covered by KAUS are construction, transportation, industry, agriculture and waste. While energy consumption data is needed for macro-scale areas from these sectors, for example, for industry and agriculture, the impact of the actions included in the construction, transportation and waste sectors is calculated with the consumption data of the individual or household. Therefore, data only at the regional scale, thus, province, or district will not be sufficient. More accurate results can be obtained with micro-data at the scale of neighborhoods and even buildings and streets".

Additionally, DEDAŞ - Electricity Distribution Company (I4) said:

> "The data can be found most easily as monthly data on a district basis, or more detailed data can be reached in an area not as large as Karaköprü".

Similarly, the Karaköprü District/County Municipality (I3) stated that:

> "We cannot provide data at the building scale. We have the number of licenses, but we do not have the number of blocks, and building-based data cannot be accessed because some buildings are recorded as a single block".

As a result of the interviews, there is not sufficient infrastructure or mechanism to collect data on this scale in the region. Therefore, the results obtained on this scale are estimated values in the expert system. This is a factor that negatively affects the consideration of the expert system at all scales.

As to mention why different data subjects are important for KAUS, the METU RICBED (I6) stated that:

> "KAUS may include various combinations of projects with actions specific to each sector. Therefore, to process these sectors and different actions with sufficient data and give emission impact results, it is necessary to deal with environmental and climate issues such as consumption types and energy consumption. However, these data are mostly not collected in the region or the desired data titles are not available".

The Şanlıurfa Metropolitan Municipality (I2) has stated in support of the researcher that:

> "We know that Eskişehir-Odunpazarı Municipality calculates carbon emissions by taking each house's natural gas data and making comments on the neighborhood scale, so it has carbon status and fuel consumption data. In other words, municipalities are conducting such studies, but we have not done such a study yet".

Likewise, the Şanlıurfa Provincial Directorates for Environment and Urbanization (I6) stated:

> "We know that energy identity data is very related to this expert system. However, we do not have such data now, but when we move to the new building of our institution, we will have created this data for that building".

As a result, institutions do not have all the data to support this issue, but they are also aware on this subject.

The data-sharing problem, which is another sub-category, is expressed by two main issues. The first is the refrain from sharing data due to region-specific problems, and the second is that the data is not in an area that can be easily shared like digital media. The researcher (I6) in the expert system expressed the data sharing problems of the institutions during the project formation process as follows:

> "KAUS also shows the current and estimated emission values on the atlas. Macro and micro scale spatial data are required for this atlas, but institutions

are hesitant to share the data due to some region-specific problems or the data do not reflect the truth. For example, since unlicensed construction cannot be prevented, the data on the building scale do not fully reflect the truth. At the same time, sharing the consumption data that the institution can share with geographical coordinates is avoided due to illegal consumption in the Region".

DEDAŞ - Electricity Distribution Company (I4) has stated in support of this situation that:

"We can share data in parts, especially in regions where illegal use is intense. Crimes are committed due to illegal use and cannot be intervened."

Although GIS-based programs such as NetCAD and ArcGIS are used in all institutions, the second data-sharing problem is the lack of data in the digital environment. Şanlıurfa Provincial Directorates for Environment and Urbanization (I1) expressed this issue as follows:

"There is no digital data within the scope of public buildings. All public institutions related to waste and transportation will now be carbon neutral, therefore, a GIS system has been produced for this, but no data has been entered until now".

Likewise, the Şanlıurfa Metropolitan Municipality (I2) gave an example in this regard:

"There is a smart numbering system for buildings and the "web.gis.Şanlıurfa" system. We can share some of the data on this site, but we do not share some of them for security reasons such as the building floor numbers".

As a result, data required for KAUS cannot be shared in a large extent due to the region-specific reasons and that the data has not been digitized yet.

The least mentioned category by the interviewers is Institutional Capacity and Governance (4%).

The users' understanding and adoption of the monitoring and evaluation modules is important for the fulfillment of the system requirements. First of all, the METU RICBED (I6) summarized this issue as follows:

> “In order for KAUS to be a usable tool and to get accurate results for its purpose, user orientation is critical. While some of the local decision-making institutions using it gave excited and supportive reactions during the project, some found it incomprehensible and did not accept its use by showing a very negative reaction. Even if these adverse reactions are neutralized, additional work will be needed to routinize KAUS use".

Supporting this interpretation, DEDAŞ - Electricity Distribution Company (I4) stated that:

> "It takes labor to collect data based on household and building, but there is no human power to allocate it".

None of the Şanlıurfa Provincial Directorates for Environment and Urbanization (I1), the Şanlıurfa Metropolitan Municipality (I2), the Karaköprü District/County Municipality (I3) and DEDAŞ - Electricity Distribution Company (I4) use monitoring and evaluation or a similar expert system. Based on these comments and information, the institutions do not have data collection, stacking, archiving habits and they are not familiar with monitoring and evaluation systems.

Another issue is the lack of clear definition of internal responsibilities. The Şanlıurfa Metropolitan Municipality (I2) gave an example of this situation:

> "The climate change report of Şanlıurfa is being prepared. However, the responsible person is unknown because a coordinator has not been appointed. Therefore, some decisions are disrupted".

Based on this interpretation, it can be said that not determining a coordinator for the studies is important for monitoring-evaluation systems that need to progress in a controlled manner.

It was stated that all the necessary data for KAUS were not available in the institutions discussed and that the necessary data should be collected from different institutions. For example, DEDAŞ - Electricity Distribution Company (I4) stated that

> "Electricity transformer data can be matched with the data to be obtained from the civil registration office",

while the Karaköprü District/County Municipality (I3) said that

> "The only authority to share building-license number data is the Metropolitan Municipality".

The Şanlıurfa Metropolitan Municipality (I2) stated:

> " A platform will be established in the GAP Region to collect all the data, but the studies have not started yet".

As a result, an institutional center for the data has not been determined and the data is scattered in the institutions. This is an indication of the weakness of inter-institutional organization and connection.

4.6.2 The need and requirements of integrating decoupling projects and green finance through monitoring-evaluation tool

This section shows how the green finance module can be integrated into the monitoring and evaluation tool used for decoupling projects. The Carbon Emission Expert System (KAUS) was selected as a case study. This system was developed to support the transition to a carbon-neutral economy in the Southeastern part of Turkey and was carried out in cooperation with the officials of the Ministry of Industry and Technology and the Southeastern Anatolia Project (GAP) Regional Development Administration. In this direction, qualitative semi-structured questionnaires were conducted to gather the opinions of the financial experts on the need for this integration via the Carbon Emission Expert System as a monitoring and evaluation tool and the requirements for its design.

Finance experts agreed on three points regarding the integration of green finance with a monitoring and evaluation tool. These include; (i) The need for the integration of a financial component in a monitoring and evaluation tool, (ii) the design of such a system to serve a specific purpose, to include analytical data, and to support corporate governance, and (iii) the promoting means to facilitate the use such as governmanet incentives.

First, the need for a consideration of green finance is frequently highlighted. In this regard, they particularly mentioned the lack of such a system and why it is necessary to construct it. The following statement exemplifies this:

> "There is no system that explicitly measures the carbon impact. There are systems in which money-related issues are evaluated. However, comprehensive research and evaluation is carried out for financial systems. When giving credit ratings, besides the financial issues, a sustainable environment is also considered. Especially nowadays, this is a very hot topic.The grades in the financing instrument are evaluated with the consideration of all factors. Expert opinion is also taken when needed, but there is no such a system in which financial evaluation and environmental impact evaluation are considered together. It would be great to close this gap. "

Previous work also supports this. There is no tool available that is used to measure the carbon impact, apart from financial evaluations. However, there are some developments in this regard. Financial experts (I7) express this as in the following statement:

> "There are studies such as a sustainability guidebook published for banks. It is updated this year. In this guidebook, the folowing principle has been added. Respectively, the banks should determine the main performance indicators (APG) specific to institutions in order to measure and follow up their

sustainability performance, to see periodic progress and to meet their communication with their stakeholders."

This new sustainability guidebook proposes measuring and controlling the sustainability performance with a monitoring and evaluation system. Furthermore, Environmental and Social Due Diligence Analysis similarly recommends the same lines. Finance experts (I7) describe this study in the following statement:

> "It is necessary to systematically identify, measure, and evaluate the potential environmental and social risks that may originate from the projects while considering local legislation or international standards. It will be necessary to see this effect for additional investments."

These requirements can be interpreted as the fact that the funding of sustainable projects will be on the agenda, and thus, a systematic development for this process is required. The suitability of the current financial evaluation criteria for this process does not seem adequate. The financial experts (I7) claim that although a technical or expert support regarding the project content is provided in project funding processes, this support is only related to the part of the project feasibility. They also suggest a monitoring-evaluation system design that can make project impact assessment on the basis of a financial selection criteria. They express that:

> "Currently, there are parameters such as project structure, completion risk, operation and technology risk, and market risk in the credit evaluation process. However, it would be excellent to collect the financial information about the loans given in the past. So many loans were allocated on a sector basis such as solar energy. This data can be used for balanced crediting and sample evaluation. It is not difficult to collect this data. However, a separate specific method should also be used. If necessary, an algorithm should be written. This is needed because it is important for investors to see the effect and return of their investment, to become aware of the possibilities, and to make the right investment. "

Second, the experts highlighted three aspects to be considered in the design of this monitoring-evaluation system: (i) serving a specific purpose, (ii) including analytical data, (iii) supporting corporate governance. Experts suggest that the system can be designed to serve a specific purpose, particularly for credit rating, and add:

> "Currently, some factors as the project criteria are being determined and discussed. It would be beneficial to standardize this, but green finance has a unique dynamic, so it needs to be worked on as a separate module in the financial order. There is a great need for these uses, especially for credit rating."

Features such as analytical data and corporate governance were also emphasized in the design of this monitoring-evaluation tool, while the impact of external factors such as government incentives was also mentioned. The important points regarding the formation of the system were expressed by the experts (I7) as follows:

> "For these systems to be usable, analytical data are required. Even if a qualitative data is complementary, it would be beneficial to quantify it. In terms of authorities, financial evaluations are mainly carried out by committees, not by a single expert. Therefore, the topic of corporate governance is also of great importance. Corporate governance is the case in credit evaluations. It includes parameters such as attempts to be held accountable for business transactions, employee welfare, and relations with investors. It would be good to develop these parameters further by relating the project. "

Experts also referred to the analytical data usage and corporate governance issues for "The Sustainability Guide for the Banking Sector":

> "The updated guideline defined some basic principles for the sustainability approach in the banking and finance sector. Some include Evaluation and Management of Environmental and Social Risks Arising from Banking

Activities, Contribution to Sustainable Development Goals, Institutional Capacity Building and Monitoring and Reporting."

Third, the involved experts proposed government incentives as an external promoter for the use of finance-integrated monitoring and evaluation tool. This is exemplified as follows:

> "For example, the government may encourage the use of this tool, which also considers environmental and social values in certain sectors, to promote these projects and applications' dissemination. Bank loan policies can also provide these incentives. To illustrate, when this application is used as an evaluation system, bank reserve ratios can be reduced as an incentive method."

In the light of the interview information, there is no significant information about green bonds because it is a new concept. However, it's definition and workflow have been tried to be understood by developing guides, workshops and conferences. Experts (I7) made the following explanations in this respect:

> "There are developments in financial instruments such as green bonds, but we are not a country that has been able to keep up with this and set up this system yet. There are studies at the level of sustainability guides in banks yet. However, workshops and conferences are held to understand this issue. There are sustainability-related policies following corporate governance principles for instruments such as green bonds. Standardizations with the help of monitoring and evaluation would be very appropriate for green bonds.Also, the green bond use guideline in monitoring and evaluation would be necessary because it is a new concept."

As a result of the interviews with financial experts, the integration of decoupling projects with green finance is seen very positively through monitoring and evaluation systems. This integration is even seen as a necessity. This integration process highlighted the significance of analytical data use and corporate governance

elements. In addition to these, government incentives and expansion of newly emerging sustainable standards have been proposed.

CHAPTER 5

CONCLUSION

This research aimed at developing a general framework in terms of planning for green finance, understanding the green bond financial instrument and its complements, revealing the need for its integration into the planning process, and discussing how decoupling projects can be systematically integrated into green finance via the monitoring and evaluation process. In this direction, after a literature review on the theories, a qualitative research was conducted about a case study on the GAP Region Carbon Emission Expert System. Based on the findings of this research, a conceptual framework in the triangle of green finance, decoupling projects and monitoring and evaluation was developed. The generated conceptual framework led to the construction of suggestions on how the monitoring and evaluation tools of decoupling projects can be developed in order to adapt to green finance.

The following section of this chapter discusses the findings of this research and offers suggestions for the improvement of M&E tool for decoupling projects integrated with green bond.

5.1 Discussion of the Findings

Today, the most important challenge facing the profession of planning is how to replace the existing resource-consuming and environmentally deteriorating interventions with sustainable development activities. This is certainly in the agenda of public and private authorities as well which intend to adopt various strategies and implement projects enhancing sustainable development (Næss, 2001). Chapter 2 presents how decouplig can be a way for displacing economic activities related to

resource consumption with sustainable development, and how such a change process can be facilitated through the planning and management of public authorities.

Various projects and plans are implemented within the scope of sustainable development, which is on the agenda of planners and planning. The overall aim of these projects is to remove the carbon emission pressure on the environment while maintaining development. This thesis sees that planners have the responsibility to point out the possible outcomes of different proposed solutions seen in the light of the criteria for sustainable development. Drawing on their own professional knowledge, they should try to formulate and evaluate alternatives to plans as compatible as possible with sustainable development and to invite different sectors and authorities to discuss these alternatives. Moreover, planners should assess and monitor the results of strategic-level plans requiring the influence of local authorities to counter the suppression of information about the environmental and social implications of the alternative plans (Næss, 2001). This further adds more responsibility to planners for the monitoring and evaluation of plans and projects within the framework of sustainable development.

According to the classical economic theory, it is unrealistic to hope that sustainable urban development will emerge due to uncontrollable market forces (Næss, 2001). The transition to a low-carbon future will require fundamental changes across industries. Significant financing and investments are needed to support these changes. In many countries, particularly in developing countries, the public sector cannot fill the investment gap for the projects required for this transition and the private sector does not show sufficient interest. The main reasons why the private sector is not very interested in long-term financing of these projects are the low return rate and the associated risks. It is necessary to increase the financing of investments with environmental benefits through new financial instruments and policies such as green bonds, carbon market instruments to achieve sustainable development (Sachs et al.,2019). Green finance is an important facilitator for the transition to a sustainable future because it can simultaneously monitor economic growth,

environmental improvement and financial sector development, ensuring that sufficient funds are flowing to the target. Thus, the financial sector can be a catalyst for change by financing transition activities and channeling capital into environmental-friendly projects and technologies (Menon,2021; Soundarrajan and Vivek, 2016). Green bond, one of the green finance instruments, is chosen for this study because it is compatible with planning actors. There is a bond type that includes city projects and the bond market is growing rapidly. There are currently three fundamental challenges facing a strategy that combines these concepts: (i) identifying the right projects; (ii) developing complex plans involving both public and private sectors; and (iii) financial system structure (Sachs et al.,2019).

This thesis takes the green bond as a catalyst to help realize the plans and projects through funding mechanisms. In line with this, Figure 5.1 draws the conceptual framework reflecting how the whole system operates in integration with green bond, environmental projects and sustainable development.

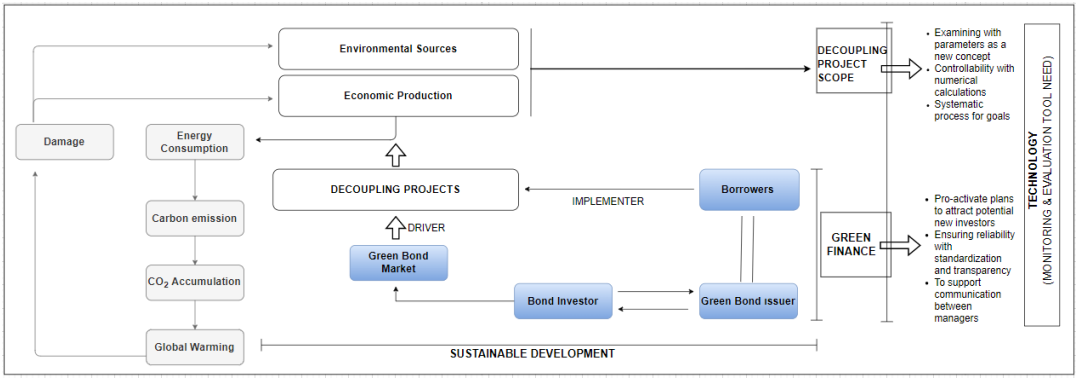

Figure 5. 1. Conceptual Framework of The Research

This framework, in general terms, describes the negative impact on environmental resources as a result of carbon emissions resulting from economic activities. It also integrates decoupling projects that can prevent this impact and the green bond process that fund these projects. The aim of decoupling projects is to catalyse the removal of the economy's negative impact on the environment. It is the growing green bond market that, in fact, drive these projects. The green bond process occurs

with the borrower's project implementation and the issuer who financially supports the borrower. The borrower and the issuer can be the same institution. Therefore, the institution providing the funding and the institution implementing the project cn be the same. In that case, systems such as monitoring and evaluation that can make the process transparent and open to an auditing possibility are needed.

This study revealed that both decoupling projects and green finance instruments such as green bonds need a monitoring and evaluation system. One main reason for the need of decoupling is that decoupling itself is new concept and needs to be understood. This, in turn, calls for a system that can be measured on the basis of defined parameters, that necessitates a controlled operation with numerical data in order to achieve the goal, and that operates through a systematic process. In terms of green finance, the reasons for needing a monitoring and evaluation system are to attract new investors by showing the impact of plans and projects, increasing reliability by making the process transparent and standardizing, and managing inter-institutional coordination well throughout the process.

Taking these as a point of departure, this study used The Carbon Emission Atlas Expert System, a monitoring and evaluation tool, to assess its usability in planning processes and the possibilities for integrating of green finance as part of it. In order for this monitoring and evaluation system to support planning processes while integrating finance and decoupling projects, this study revealed that it is necessary to eliminate its deficiencies and solve its related problems. These problems are related to the inadequacy for providing analytical and qualitative data for various reasons, , the low tendency of institutions to use this and the lack of a specific finance module.

In the continuation of this chapter, suggestions are presented on how to solve these problems. The first of these solution proposals is the integration of a finance module into the M&E system. Although various solutions are offered to other problems, it is seen that the finance module will proactively make plans and projects in the M&E

content and drive the resolution of other issues. This driver role of the module comes from the needs of the finance module to continue effectively. These needs are “3D”s – data, definition, disclosure, must be provided clearly (Menon, 2021). This trio is to improve the quality, usability, and comparability of data, develop coherent definitions or classifications of green transition activities, and apply a consistent set of global standards for reporting. Therefore, M&E systems such as KAUS can ensure the functionality of this financial module by showing and reporting the effect of green transition actions on consumption data.

Solving the problems of the monitoring and evaluation system will be encouraging and activating as it will make the projects funded.

The problems faced by the monitoring and evaluation tool serving the system, whose framework was drawn in response to the research questions of this study, are the issues to be considered in the planning process. These are the problems with qualitative and quantitative data, the lack of institutional integration, and the finance module. In terms of planning, concepts that affect development, such as green finance, should be understood in detail in order to be used in the planning process.

Finance is a driver in the planning process, as it plays a crucial role in implementing the projects and plans. Together with the monitoring and evaluation tool, the two concepts can create a robust system framework by making up for each other's shortcomings. This integration will support transparency, standardization, and corporate communication in green finance, while supporting the funding of planning projects. The selection of these projects to be funded will also be an incentive to produce even better projects, thanks to the funding of the project with the best criteria in terms of environmental, social, and economic effect.

5.2 Recommendations for Further Monitoring and Evaluation Tools

Due to the monitoring and evaluation capability of the KAUS system, it is possible to integrate the implementation processes of green finance and decoupling projects. This provides advantages both financially and in terms of the project management process. These advantages are understanding the project requirements from the project perspective, advancing to the goal with analytical data in a systematic way, while making the plans proactive in terms of finance, increasing the reliability of investments and increasing corporate communication. In this direction, which problems of KAUS, which is a monitoring-evaluation system that can be used by municipalities, energy providers and development agencies in the GAP Region, should be resolved in the face of this integration were determined through in-depth interviews. Monitoring and evaluation systems need improvements to support the planning process in terms of timeliness and usability. In this context, the suggestions developed over the KAUS software are as follows:

Integration of Finance Module into M&E System

In particular, in-depth interviews with finance experts emphasized that a financial part should be specifically studied and added to the monitoring-evaluation system. As mentioned in the findings explained in Chapter 4, financial content to be integrated is not known enough by institutions or investors. Therefore, the first step to be taken will be the promotion of green finance, especially green bonds, to institutions, investors, and citizens.

The next step is to work on this finance module specifically, as financial experts have stated, and it should be produced from scratch as separate software. It is essential to create a guideline for the content of this delivered software. Only in this way, institutions can quickly adapt and use this system.

This software must contain two analyzes as, decoupling and ESG. One of these fundamental analyzes, the decoupling analysis, is to see whether or to what extent

the project effect supports sustainable development tangibly. Although KAUS, which is the case study, shows the project's impact on carbon emissions, it is not to show the situation of minimizing environmental damage while maintaining economic development, which will define the impact on sustainable development. For this reason, a decoupling analysis, the formula described in Chapter 2, can be added to the monitoring-evaluation process. The projects can be compared according to the decoupling rates on the atlas, contributing to the project selection process.

The decoupling rate was calculated using GDP and CO_2 data for the case of all the suggested actions in KAUS were applied in Şanlıurfa.

Table 5. 1. Decoupling Rate Evaluation of The Sectors in KAUS

Şanlıurfa Province			
Sectors	**D_{rate}**	**0-1**	**>1**
Construction	0.387954	Absolute Decoupling	
Industry	0.249399	Absolute Decoupling	
Agriculture	0.129318	Absolute Decoupling	
Waste	0.055422	Absolute Decoupling	
Transportation	1.302419		Relative Decoupling

If $0 < DI < 1$; The increase in energy consumption is less than the increase in economic growth, indicating relative discretization. If $DI \geq 1$; The increase in energy consumption is more than the increase in economic growth. This indicates that there is no absolute decoupling (OECD, 2002; Xiong et al., 2015; An, 2017)

In this case, when all the actions of the Carbon Neutral Economy Transition Action Plan in the GAP Region are implemented in Şanlıurfa, the increase in energy consumption in the construction, industry, agriculture, and waste sectors is less than the increase in economic growth. The rise in transportation sector energy consumption is more or progressing in harmony with the rise in economic growth. Since regional carbon neutrality is aimed at the KAUS project, it is possible that absolute decoupling will not be achieved in all sectors on a regional basis. Adding

such an analysis evaluating the development and the action impact, will make the project selection process more comprehensive.

In the case of green bonds, besides the green bond principles and its complementary Use of Proceeds, Project Evaluation and Selection Process, Management of Proceeds, Reporting, and the ESG score used for evaluation purposes in the green bond process in Chapter 2 should be considered. In this way, ESG integration, which is one of the Socially responsible investment criteria, is also realized.

The example of KAUS covers the use of proceeds of the green bond, that is, the net environmental benefit and feasibility studies, by showing the amount of carbon emissions and the cost. Also, with the help of KAUS, the Green Bond issuer can clearly determine how the projects fit within the eligible Green Projects categories and relevant eligibility criteria for identifying environmental and social risks. It is also possible to automatically perform the reporting process, which is also a Green Bond Principle, with KAUS.

As a result, developing a selection process design for the project selection process at the regional scale for low-carbon urban projects among the GBP will ensure that the projects are selected through a more detailed and appropriate filter. In this way, more relevant and effective projects will be implemented.

Considering the Environmental-Social-Governance criteria, the competencies that KAUS provides and cannot provide are listed below.

Table 5. 2. KAUS Abilites and ESG Criterias

ESG Criteria			**KAUS Abilities**
ENVIRONMENTAL	Resource Usage Score	Firm's performance and capacity to reduce material, energy or water use and to find more eco-efficient solutions by advancing supply chain management.	The presence of resource providers in the region was evaluated within the KAUS action impact parameters.
	Emissions Score	Firm's commitment and effectiveness in reducing environmental emissions in production and operational processes.	x
	Innovation score	Firm’s capacity to reduce its burden for customers.	Within the KAUS action impact parameters, the qualified employees and capacities of the resource providers in the region were evaluated.
SOCIAL	Labor Score	Firm's effectiveness against job satisfaction, a healthy and safe workplace, protection of diversity and equality of opportunity, and development opportunities for the workforce.	x

Table 5.2. (Continued)

	Human Rights Score	Firm's effectiveness in respecting fundamental human rights conventions.	x
	Community Score	Firm's commitment to being a good citizen and respecting business ethics.	x
	Product Responsibility Score	Firm's capacity to produce quality goods and services, taking into account the factors of data security and integrity.	Within the KAUS action impact parameters, the competencies of the resource providers and products in the region were evaluated.
CORPORATE GOVERNANCE	Management Score	Firm's commitment and effectiveness in following the best corporate governance principles.	x
	Shareholder's score	Firm's effectiveness in treating its shareholders equally and using anti-takeover tools.	x

Table 5.2. (Continued)

	CSR (Corporate Social Responsibility) Strategy score	Practices that report that a firm integrates its economic (financial), social and environmental dimensions into its daily decision-making processes.	x

In order to base sustainable development, that is, the continuation of development while minimizing environmental damage, there is a need for a M&E system module proposal in which the green bond can perform the evaluation process with numerical data in the project selection process for certification, taking into account the deficiencies of the ESG criteria.

As stated under the KAUS Suitability for financial integration heading, the parameters that KAUS does not have should be included in accordance with the calculation method.

Project managers can evaluate emissions score under environmental criteria; Labor Score, Human Rights Score and Community Score under social criteria; and Management Score, Shareholders score, and CSR Strategy score under the governance criteria, by scoring as sufficient, less sufficient and not sufficient, such as KAUS impact parameters.

All this evaluation process should be encouraged by the state with certification or various exemptions, and the use of this system should be disseminated, and the project funding process should be carried out in a more systematic and controlled manner.

Suggestions for Solutions to M&E Problems encountered in financing integration

- **Not providing/sharing sufficient and necessary data for M&E**

  The first step that needs to be taken to keep this system moving forward is to solve data-related problems. Data problems arise as a result of in-depth interviews, as data currency, data scale, data subject, and data sharing. Some technological tools are needed to collect up-to-date, specific to the relevant subject and on a scale required for the system. These tools are smart meters or sensors that measure energy consumption or the Internet of Things devices that measure carbon emission and pollution levels directly at the source and in real-time (Menon,2021). These tools require a budget for their operation and dissemination. Therefore, financial activation of actions will be beneficial for developing data collection tools. As the determination of the data subjects to be collected requires additional expertise, capacity-building of the relevant personnel may be needed. In terms of data sharing, providing this sharing through a platform in the region, as planned by the institutions, will benefit data archiving. In this way, a data stacking scheme that will support inter-institutional interaction in the region can be maintained.

- **Measuring Qualitative Data such as Social Awareness**

  The measurability of qualitative data poses a problem for the M&E system because, as financial experts have pointed out in in-depth interviews, financial processes are driven by analytical data. In terms of project impact, quantitative changes can express the transition to sustainability in environmental and socio-economic indicators. However, more critical and challenging to articulate are the qualitative ones, context-specific aspects of transitions such as changes in values, beliefs and norms, related processes, durations, and relevant actors (social groups, economic sectors, and institutions). Qualitative indicators are not developed sufficiently since

quantitative indicators are generally prioritized (Briassoulis, 2001). Therefore, it is essential to quantify qualitative data to adapt to financial evaluations and obtain a more accurate result. Although this attempted to be solved with the scoring system in the KAUS, there may be ways to reflect in more detail. In the monitoring and evaluation process, the level of awareness and subject tendency can be measurable with the participation of those affected by the process. With the increasing emphasis on participatory approaches to development, inclusive and consultative monitoring and evaluation can be promoted as a shared process by which stakeholders at various levels are involved in monitoring and evaluating a particular project, program, activity, or policy to take or identify corrective actions (Mutimba, 2019). In addition, workshops and similar activities can provide input to this system will be effective in the result evaluations. In addition, in this way, the civil society will integrate into this process, adopt the procedures of green bonds and sustainable development projects, see itself as a part of this group and increase its contributions.

- **Institutional Tendency**

  Even if the M&E tool is designed perfectly, the effect of the system will not be seen unless it is used correctly by the user institutions. The incentives, institutional communication, and control should be strengthened to maintain this use. One way is to provide financial input to the institution, and the second way is to supervise the use of this tool. As the control mechanism expands and most institutions use this tool, the use of this system will also become widespread. However, to increase the tendency of the personnel in the user institutions, they should have training on the benefits, correct use, and needs of this system.

5.3 Limitations of the Study

In this study, how green bonds and decoupling projects can be integrated in the planning process through the monitoring-evaluation system and the problems in front of this integration have been investigated. Decoupling, which is considered one of the main concepts in this research, is criticized for containing various uncertainties. These uncertainties are sourced at relative decoupling, which may not mean absolute and sustainable. Since the dimensions of the relative decoupling cannot be seen clearly, decoupling may appear to exist but may be negligible. For this reason, although decoupling analysis is beneficial, supporting it with additional parameters will also eliminate possible uncertainties.

Also, it may be possible for the findings to vary from region to region since this research was examined through the Carbon Emission Expert System in the GAP Region. However, as KAUS is a flexible tool that can adapt to spatial analysis as long as the input is provided, this research can be done in various regions, and concrete results can be obtained.

Finally, it was not possible to test the suggested financial module of KAUS. Designing this system and testing it on a project will help solve potential unnoticed problems and enable the identification of needs in the process.

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APPENDICES

A. Interview Questions

a) Interview Questions for Institutions

Questions Regarding External Factors Affecting the Use of Monitoring-Evaluation

1. Have you used spatial-non-spatial digital monitoring-evaluation systems in your planning process before? What level of knowledge do you have about these systems?

2. Do you think that there are sufficient number of experienced and knowledgeable personnel in your unit about monitoring-evaluation studies or similar studies, and personnel who can coordinate?

3. How would you evaluate your communication and cooperation with other units within your institution and other planning institutions (other municipalities and development agencies in the region)?

4. What are the most common problems you encounter in data collection, analysis and processing?

5. Does your current data archive contain all scales and up-to-date data?

Questions Regarding Technical Factors Affecting the Use of Monitoring-Evaluation

1. What is required for the funding process of the proposed projects?

2. Do you think that awareness studies specific to green projects and studies that will produce other qualitative data are sufficient?

b) Interview Questions for the KAUS Project Researcher/ METU RICBED Institution

Questions Regarding ExternalFactors Affecting the Use of Monitoring-Evaluation

1. During the KAUS project process, did you encounter difficulties such as lack of data or not finding suitable data during the data selection and collection stages?

2. According to your observations during the project process, do you think institutions will adopt and use this practice?

Questions Regarding Technical Factors Affecting the Use of Monitoring-Evaluation

1. Do you find the evaluation method of qualitative data such as awareness studies within the KAUS sufficient?

2. Do you find the financial outputs sufficient within the KAUS study? Do you have any suggestions?

c) Interview Questions for Finance Experts

1. Is a monitoring-evaluation tool used in financial evaluations? Do you think it should be used?

2. Do you receive technical support regarding the project content during the funding processes of the projects? (For example; getting expert opinion to learn about the impact of projects on carbon emissions.)

3. Can it be integrated with a monitoring-evaluation system in determining the selection criteria of the projects that will provide financial input? How?

4. What issues should be taken into account while providing this finance-project selection integration?

5. Do the answers to the above questions differ in terms of green bonds?