

GREEN INDUSTRY POTENTIAL AND CURRENT PRACTICES IN
TÜRKİYE: A STUDY FOR ASSESSMENT OF CHALLENGES AND
OPPORTUNITIES OF NEW INDUSTRIES

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DENİZ EGE ALKAYA

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OPPORTUNITIES OF NEW INDUSTRIES**

submitted by **DENİZ EGE ALKAYA** in partial fulfillment of the requirements for
the degree of **Master of Science in Regional Planning in City and Regional
Planning, Middle East Technical University** by,

Prof. Dr. Naci Emre Altun

Dean, **Graduate School of Natural and Applied Sciences**

Prof. Dr. Emine Yetişkul Şenbil

Head of the Department, **City and Regional Planning**

Prof. Dr. Mehmet Melih Pınarcıoğlu

Supervisor, **City and Regional Planning, METU**

Examining Committee Members:

Prof. Dr. Anlı Ataöv Demirkan

City and Regional Planning, METU

Prof. Dr. Mehmet Melih Pınarcıoğlu

Supervisor, City and Regional Planning, METU

Prof. Dr. Kemal Mert Çubukçu

City and Regional Planning, Dokuz Eylül University

Date: 06.09.2024

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name Last name : Deniz Ege Alkaya

Signature :

ABSTRACT

GREEN INDUSTRY POTENTIAL AND CURRENT PRACTICES IN TÜRKİYE: A STUDY FOR ASSESSMENT OF CHALLENGES AND OPPORTUNITIES OF NEW INDUSTRIES

Alkaya, Deniz Ege
Master of Science, Regional Planning in City and Regional Planning
Supervisor : Prof. Dr. Mehmet Melih Pınarcıođlu

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As a European Union candidate country, Türkiye is in the process of harmonization with the new agenda of the European Union. Although this harmonization process is mainly evaluated with export concerns, it is important for Türkiye to produce value-added products and become a competitive economy. With the Green Deal, it is no longer possible to maintain the old industrial structure and old economic models. The physical structures of industrial areas are also changing. In this study, the predispositions of the regions in Türkiye to green transition in industry were tried to be determined, challenges and opportunities in current practices as well as examples of good practices were evaluated and action recommendations were developed to establish a holistic roadmap to accelerate the green transition in industry.

Keywords: Green Industries, Green Transition, European Union Policies, Circular Economy, Innovation

ÖZ

TÜRKİYE'DE YEŞİL SANAYİ POTANSİYELİ VE MEVCUT UYGULAMALAR: YENİ SANAYİLERİN ZORLUK VE FIRSATLARININ DEĞERLENDİRİLMESİNE YÖNELİK BİR ARAŞTIRMA

Alkaya, Deniz Ege
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Tez Yöneticisi: Prof. Dr. Mehmet Melih Pınarcıoğlu

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Türkiye bir Avrupa Birliği üye aday ülkesi olarak Avrupa Birliği'nin yeni ajandasına uyum süreci içerisinde. Bu uyum süreci temelde ihracat kaygısı ile değerlendirilse de Türkiye'nin katma değerli ürün üretimi ve rekabetçi bir ekonomi haline gelmesi açısından önemlidir. Yeşil Mutabakat ile birlikte artık eski sanayi yapısı ve eski ekonomik modellerin sürdürülmesi mümkün olmaktan çıkmıştır. Sanayi alanlarının fiziksel yapıları da değişkenliğe uğramaktadır. Bu çalışmada Türkiye'deki bölgelerin sanayide yeşil geçişe yatkınlıkları tespit edilmeye çalışılmış, güncel pratiklerdeki zorluklar ve fırsatlarla beraber iyi uygulama örnekleri değerlendirilerek sanayide yeşil geçişi hızlandıracak bütüncül bir yol haritası oluşturmak için eylem önerileri geliştirilmiştir.

Anahtar Kelimeler: Yeşil Sanayiler, Yeşil Geçiş, Avrupa Birliği Politikaları, Döngüsel Ekonomi, Yenilikçilik

To everyone who wants a more equal world

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LIST OF ABBREVIATIONS

ABBREVIATIONS

EU: European Union

NUTS: Nomenclature of Territorial Units for Statistics

UN: United Nations

UNDP: United Nations Development Programme

EIP: Eco-Industrial Parks

UN SDG: United Nations Sustainable Development Goals

OIZ: Organized Industrial Zone

GHG: Greenhouse Gas

CNCA: Carbon Neutral Cities Alliance

IPA: Instrument for Pre-Accession Assistance

UNEP: United Nations Environment Programme

EU CEAP: European Union Circular Economy Action Plan

R&D: Research and Development

SMEs: Small-Medium Enterprises

CHAPTER 1

INTRODUCTION

With its shortest definition, new generation industrial zones can be used to emphasize their distinctive features according to changing economic and political conditions. Major issues such as decarbonization, green finance, climate crisis, innovation, technology development race, economic crises, interregional development differences, which are among today's economic-political trends, can be listed as the reasons for the emergence of new generation industrial zones. Its main difference from traditional industrial structures is that it aims to develop ecological values while producing economic value. As a result of this, it brings with it many spatial and structural changes. The most common examples that have started to be seen in the world are called eco-industrial parks. There are targets and frameworks published by international organizations such as the World Bank and the European Union.

With the changes in the economic-political conjuncture over the years, industrial structures also change and these changes directly affect regional policies. Since the 1980s, especially large and developed economies have entered the process of de-industrialization and have been in search of cheap production markets and shifted their industrial production to Far East Asian countries. This de-industrialization process has caused the early industrializing regions to be left behind today and regional differences have emerged. However, it is seen that various steps have been taken regarding the problems experienced in the supply chain during the Covid-19 pandemic. In addition, it is quite natural that the structure of traditional industries will be affected by the fact that environmental problems have reached a more serious level today, and the climate crisis has become an area of action that is taken seriously

by states and where action is tried to be developed, unlike in the 1990s. Considering the sustainability goals of the European Union on climate and the Paris Agreement, it is expected that the new era world will have a new industrial structure.

Within this industrial structure, there should be concepts such as competitiveness, economic value generation, profitability and efficiency from the past, as well as new economic concepts such as innovation, technology development, patent, entrepreneurship ecosystem. When evaluated in this context, what we call the new generation industry should create economic value while at the same time mitigate the damage it causes to the environment. In terms of physical structure, instead of occupying polluted areas that are far from cities and life, and used only by employees, they should be transformed into places that are clean and attractive, intertwined with the city and its inhabitants. This transformation has two parts, physical and mental. The requirements for each are expensive or investments that require large amounts of mitigation strategies. At the same time, considering dense urban structures and economic problems, it is both difficult and expensive to create these areas from scratch in the city. In this context, the transformation of existing industrial zones within themselves becomes important.

Most common and one of the best examples of the new generation of industries are Eco-Industrial Parks. Although the history of Eco-Industrial Parks (EIP) dates back to the 70s, they have adapted and changed shape according to the changing economic and political conditions. In this regard, we will try to understand the structure of Eco-Industrial Parks according to the general framework drawn by the World Bank.

1.1 Aim, Scope and Methodology

The aim of the study is to reveal the potential of the regions in Türkiye in terms of socio-economic development and innovation and to reveal their positive and negative aspects in the transition to green industry. In addition, the gaps will be revealed by examining Türkiye's legislative efforts for green transition in industry and the general trend of the country will be revealed by examining Türkiye's statistics

under the title of Sustainable Development Goals. The study covers 26 regions determined by NUTS-2 boundaries.

In addition to the index study to understand Türkiye's potential, a case study will be conducted by interviewing Manisa OIZ and Yalva OIZ which are one of the OIZs included in the "Technology Development in OIZs Project", which is supported by the Presidential Strategy and Budget Presidency and carried out in cooperation with the Ministry of Industry and Technology and UNDP. Within the scope of the interview, 10 different open-ended questions were prepared and sent to the relevant parties such as Innovation Center and Department of Environment. The interview questions were replied by the concerned departments of the Manisa OIZ and Yalova OIZ which were defined above. Interview answers were obtained anonymously and no personal data of any participant was processed. This information was provided to the participants in writing at the beginning of the study. The interview questions and the form itself can be found in Appendix 2: Question Form.

Within the scope of the study, a pilot region was not preferred and studies were not carried out specifically in this region, and the reasons for this are explained in the following sections. The most important need here is to create a general road map and the conclusion section is devoted to this.

1.2 Conceptual Framework

In recent years, spatial development in the world has been shaped around policies on climate change, the digital/technological transition and a new global world in a new agenda. Climate change is undoubtedly one of the most important pillars for reducing the environmental impacts of industrial zones. However, digital transformation and the new globalization after the pandemic are two other important topics for the emergence of new industries, and the conceptual framework is shaped around these three pillars.

Table 1.1 Conceptual Framework

Climate Change/Green Transition	Sustainable Cities
	Global Cooperation and Financing for New Development Models
	Five main areas for carbon-neutral cities: Energy, Buildings, Industry, Transportation and Waste Management
	New Generation Industrial Zones
	Circular Economy
Digital Transition	Smart Cities
	Digital Participation
New Globalization after Pandemic	Problems in Logistics and Supply Chains and Production/Supply Security
	Formation of the city-regions

1.2.1 Climate Change/Green Transition

Nowadays, it is an indisputable fact that the negative effects of climate change are being experienced. Efforts to mitigate the negative impacts of climate change and/or to design appropriate spaces, production systems, international relations and societies continue with a series of international developments. These concepts will be evaluated in depth.

1.2.1.1 Sustainable Cities: Sustainable Development Models

Sustainable development models have inevitably become the development model of the 21st century. With the low carbon economy, it is to ensure the efficient and effective usage of natural resources by minimizing carbon emissions in industry, agriculture, transportation, construction and energy sectors. It is a green growth model in which minimizing environmental pressures arising from production does not negatively affect production and even positively affects it in general the framework.

Carbon-neutrality can be defined as the realization of projects that are expected to prevent or reduce the amount of GHGs emitted in the amount of greenhouse gases emitted in order to balance the GHGs emitted into the atmosphere as a result of an activity and to have net zero emissions. Energy efficiency is the first step for carbon-neutral economy, the second one is to make efforts to reduce fossil fuel consumption by expanding the use of renewable energy. Finally, it is expected to promote clean production and consumption and to develop technologies in this field of research. This is a model of economic growth and it should not be forgotten that all these clean production, clean consumption, innovation and energy efficiency activities are expected to provide an economic benefit.

There are simply three points:

- Increasing innovation activities, high value-added production in new sectors, increasing renewable energy investments can provide economic benefits by increasing employment as it will affect sectors other than its own.
- The development and implementation of projects for renewable energy, circular economy, sustainability, and green growth can attract national or international investments in both business development and operation periods.

- In particular, factors such as the production of durable products, the avoidance of planned obsolescence and the revision of income distribution models will have significant positive effects on overall economic welfare.

1.2.1.2 Global Cooperation and Financing for New Development Models

It can be said that carbon-neutrality for cities is a difficult goal. Global cooperation and knowledge exchange are necessary to achieve this difficult goal. The first reason is that every plan implemented, technology developed and related actions are generally experimental innovations. The second reason is the externality effects of carbon reduction actions that transcend the borders of cities and countries, and thus the global collective dimension of the process. It seems important for cities to aim to become carbon-neutral through general strategies and collaborations by coming together with cities from different countries with which they share these strategies and provide a collective learning process, as well as strategies to become carbon-neutral in their own way

There is a Carbon Neutral Cities Alliance (CNCA) in the world, which works on cooperation and financing for the transition of cities to a carbon-neutral economy. The initiative includes cities such as New York, Amsterdam, Copenhagen, London, Helsinki, Oslo, San Francisco, Stockholm, Sydney and Yokohama, and has published a strategy plan covering the years 2021-2023 for the dissemination of the carbon-neutral city concept (Web 1).

Another international cooperation and financing opportunity is the Instrument for Pre-Accession Assistance (IPA) funds provided by the European Union. The fact that Environment and Climate Action, Energy, Competitiveness and Innovation, Agricultural and Rural Development and Transport (Web 2) are among the sectors planned to be funded for the IPA II period reveals cooperation opportunities for carbon-neutral actions. **Window 3** – Green agenda and sustainable connectivity, **Window 4** – Competitiveness and inclusive growth, and **Window 5** – Territorial and

Cross-border cooperation (EC, 2021), which are among the windows identified for IPA III (2021-2027), emphasize that opportunities for international cooperation on sustainable growth will continue in the upcoming period.

In general, these financing opportunities are referred to as green finance and are expected to be used to mitigate high costs and other associated or independent downsides. A green economy, according to UNEP, is one that considerably lowers environmental dangers and ecological scarcities while simultaneously improving social fairness and human well-being. Changing fiscal policy, reforming and reducing environmentally harmful subsidies, implementing new market-based instruments, directing public investments toward important industries that are "green," greening public procurement, and enhancing environmental laws and regulations as well as their enforcement are a few examples of such enabling conditions at the national level. Enhancing trade and aid flows, building up market infrastructure, and promoting more international collaboration are all possible on a global scale (UNEP, 2011).

1.2.1.3 Five main areas for carbon-neutral cities: Energy, Buildings, Industry, Transportation and Waste Management

GHG emissions from energy production and consumption can be cited as one of the main causes of human-induced climate change. Energy efficiency is the foundation of a carbon-neutral city. It is imperative that energy efficiency is a concept adopted in all areas related to the city, especially in the other four topics. Methods such as saving energy efficiency through advanced technological building and vehicle designs, renewable smart energy networks consisting of different technologies and infrastructures, and innovative production components are the most prominent practices.

Buildings are seen as one of the fundamental spaces of urban life. In addition, making changes to the existing building stock stands out as a significant challenge due to their high construction and demolition costs and the fact that they are seen as

relatively long-lived parts of the city. The development and implementation of energy efficiency regulations for new buildings, especially those to be constructed through urban transformation, and pioneering green transformation movements in public buildings can be one of the methods to reduce emissions and energy efficiency problems from buildings.

Practices such as zero-emission Green Industrial Zones, clean technological transformation and the promotion of compliance and green financing of enterprises, the establishment of an energy efficiency certification system or rating and legislation in enterprises seem to be at the forefront. The effective and efficient use of not only energy but also all resources such as soil, water, raw materials, technology, human capital in production processes, minimizing waste and loss, is of great importance in terms of both achieving carbon reduction (hence sustainable development) targets and ensuring competitive advantage on a global scale. The efficient use of resources also contributes to the reduction of negative environmental externalities (environmental pollution, etc.) arising from production processes and to the sustainability of resources.

Within the framework of carbon neutrality, technological transformations such as the development of electric cars and public transport facilities, the development of V2G (vehicle to grid) applications that will ensure optimization between charging stations and users, autonomous vehicles and road development studies suitable for these vehicles are gaining importance to reduce emissions in transportation. In addition, social incentives are also at the forefront. These include encouraging the use of low-emission fossil fuel vehicles, promoting the use of bicycles and establishing sharing plans, integrating multi-modal transportation, and increasing the number of electric vehicle and bicycle charging points. Making transportation more efficient and reliable with bus lanes designated as priority roads and smart signaling systems have significant impacts on reducing GHG emissions.

There have been very positive developments in urban waste management around the world. Strong recycling policies in many parts of the world, composting programs

for residential waste and innovations in garbage collection systems can be seen as key practices. Increasing the reuse of commercial waste as heat energy and developing projects for its use in renewable energy processes, innovative recycling and organic separation technologies such as anaerobic digesters, and projects to support carbon-neutrality solutions for waste reuse are important to ultimately achieve zero waste targets.

1.2.1.4 New Industrial Zones

It will be discussed in more detail as Green Industrial Zones in the following sections. But they can simply be referred to as urban production zones that are based on the principle of not compromising economic growth while reducing the environmental impacts of production. While production relations within the city are being reshaped, the space of production is also taking on a new form according to the concepts of the new era. While traditional Organized Industrial Zones are based on productivity, the industrial structure of the new era includes innovative approaches, entrepreneurship ecosystem, digital technologies, carbon-neutral production model and an industrial zone integrated with the city (UNIDO, 2021).

1.2.1.5 Circular Economy

The transformations mentioned in the previous section are quite holistic and a circular economy model can be seen as a complementary part of this development model. One of the most important strategies to mitigate the negative impacts of climate change on cities is the circular economy model.

The circular economy is an economic model that is designed and managed as both processes and outcomes in planning, procurement, acquisition, production, and re-manufacturing to maximize ecosystem function and human well-being (Murray et al., 2017).

The circular economy model focuses on the life cycle of products and aims to preserve as much of their value as possible. It circularizes linear processes by changing the 'end-of-life' (Kircherr et al., 2017) approach of the product by reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. The circular economy promotes high-value material cycles rather than traditional recycling and develops systems approaches to the cooperation of producers, consumers and other social actors in sustainable development efforts (Korhonen et al., 2018)

A circular economy has the potential to provide win-win economic, environmental and social aspects of sustainable development. At present, a circular economy requires respecting natural ecological cycles and adapting economic circles to these circles (Korhonen et al., 2018).

1.2.2 Digital Transition

As digital technological transformation has changed all our life practices in recent years, it is also changing cities and, as a part of it, production and consumption relations, urban transportation and working life.

1.2.2.1 Smart Cities

Smart cities can simply be defined as the incorporation of technology into urban life by using advancing technology within urban elements. By using ICT to sense, analyze and integrate information from key systems in cities, a smart city system can also provide intelligent responses to different types of needs, including daily livelihood, environmental protection, public safety and urban services, industrial and commercial activities. A smart city is also a city that monitors and integrates the conditions of all critical infrastructure such as energy, roads, bridges, tunnels (Manville et al., 2014).

In a smart city model, in addition to facilitating urban mobility and governance mechanisms and increasing citizen participation, it is expected that new technology-oriented business models will be created, new solutions to environmental problems will be found, and people will adapt to this new smart life by increasing their awareness and consciousness levels.

1.2.2.2 Digital Participation

Active participation in urban governance is seen as an important part of democratic urbanization culture. The current reflection of this can be described as the active and digital participation of city residents in the smart city. It would not be wrong to say that urban residents are the main actors of cities and smart urbanization is not possible without their active participation (Zubizarreta; Seravalli; Arrizabalaga, 2016). In urban planning, especially in the globalizing world, democratic urban movements, changing production-consumption relations, and the strengthening of local governments, participation practices have had an important place in determining urban policy or development policies. In addition to these, the proliferation of developing technologies combines participatory processes with technological services to create the theme of digital participation. The United Nations defines digital participation as the key to e-municipality and online government practices. More specifically, digital participation refers to the process of involvement and active participation of the community in policy and decision-making processes through the use of modern ICT such as the Internet. This participation includes access to various online services and content (Seifert; Rössel, 2021).

1.2.3 New Globalization after Pandemic

One of the most important uncertainties the world has faced in recent years is the climate crisis. Both global and local policies are being developed to address this

issue. However, uncertainties are not limited to this; a series of uncertainties such as the emerging/ongoing wars in different parts of the world map, related social movements, the emerging wave of migration and the subsequent rise of far-right movements with anti-immigrant discourses in Europe and the US, and the global increase in income inequality stand in front of the global world. In addition to all these, the Covid-19 pandemic has a series of consequences such as the disruption of the global supply chain, abnormal increases in prices, economic crisis, border closures, and the formation of a perception in societies that these could happen. Even if risks are always at the basis of planning, it is inevitable that the understanding of planning will change accordingly when uncertainties cannot be calculated in advance.

1.2.3.1 Problems in Logistics and Supply Chains and Production/Supply Security

The vulnerabilities in the supply chain and logistics are a problem that has come to the agenda more and more, especially after the effects of the Covid-19 pandemic. Declines in the efficiency of the supply chain caused by the pandemic have revealed that the chain is quite fragile with sudden change (Aday, S.;Aday, M. S., 2020). While the closure of borders in line with the decisions taken during the pandemic period leads to interruptions in international trade, physical distancing and rotational working conditions cause disruption in the workforce, revealing many problems that need to be solved in this field.

In addition, reduced physical interaction and closed borders have created problems such as lack of information and communication in the supply chain. Increasing demand for basic necessities such as food and health and decreasing demand for other sectors such as entertainment due to restrictions and personal preferences have led to problems with product safety, overpricing, and delivery problems (Mollenkopf; Ozanne; Stolze, 2020).

After putting the pieces together, it can be assessed that while the weakening of physical trade has brought about new business models and digitalization, on the other hand, over-demanded products generate more waste than expected, problems related to the management of this waste, economic concerns come to the forefront and environmental and economic sustainability take a back seat.

1.2.3.2 Formation of the city-regions

Rural-urban migration is a phenomenon that has been at the center of urban life since the industrial revolution, and with this development, urban areas are gradually growing. According to TurkStat 2022 data, 93.4% of the population in Türkiye lives in provincial and district centers and 6.6% in towns and villages. However, this data should not be directly interpreted as a 6.6% rural population, because today, when the economic activities and spatial structures of cities are considered, it is seen that there are much more flexible transitions between urban and rural areas rather than a sharp distinction. Today, a settlement whose main source of income is agricultural activities can be spatially structured as an urban area, and with the presence of industrial areas, it can be defined as a transitional region between urban and rural areas. Cities have always been a center of attraction for their surrounding hinterland, but the spatial growth of cities has led to the formation of urban-regions that must be considered together with their hinterland.

With the right planning and development policy, this situation can be considered as an important opportunity in terms of economic and social relations. In the context of Türkiye, these urban regions should not only be considered as a province and its rural settlements, but also as economic regions that include more than one province and its hinterland. In this regard, it will be important to identify these cities-regions and establish economic relations in order to determine local policies in line with the impact areas and regional characteristics of the study.

1.3 General Overview of the Research

The general structure of the research will cover the transformation strategies of traditional industrial zones into new generation industrial zones. In this context, first of all, a literature study will be put forward to understand what new generation industrial zones are and how they differ from traditional industrial zones. Considering that the new generation industrial zones are a concept that belongs to the green economy and the new era of the world, it will also be examined in terms of carbon neutrality, competitiveness, innovation, sustainability, circular economy, environmental problems and climate crisis, green finance and regional backwardness, which brought us to this concept. In addition to the binding elements brought by the Paris Agreement, which was also signed by Türkiye, one of the conditions for being competitive in the current economic conjuncture is this transformation that must take place in the industrial structure. However, we all know that these investments and restrictions are quite expensive and require various mitigation strategies.

Considering the current economic conditions, it would be delusional to think that all these will spread and be adopted all over the country. In this context, short, medium and long-term strategies and policy recommendations should be developed. For this purpose, within the scope of this thesis, it is thought that the appropriate pilot areas should be determined in the first place and the strategies and policies for these areas should be determined. When evaluated from this framework, an index will be created on the innovation infrastructures of the industries in the regions according to the NUTS2 boundaries in Türkiye. At this point, the backwardness of the regions within themselves and in comparison with other regions and the strategies to reduce these differences will also have an important place. If deemed necessary in the further steps of the study, the scope of the index can be reduced to the innovation indices of the cities within the regions and elections will be made in this way.

In order to determine the necessary transformation strategies and policy recommendations for Türkiye, the industrial structure and sectoral dynamics of the

selected region will be revealed, and accordingly, regional-specific transformation strategies will be developed by evaluating international norms, world examples and local characteristics.

1.4 International Developments on Climate Change, Green Deal and Circular Economy

The European Union first published the First Circular Economy Action Plan in 2015, followed by the signing of the Green Deal in 2018, opening the door to many innovations in the production and industrial sector. Subsequently, in 2020, the Circular Economy Action Plan was revised within the framework of the Green Deal. In this section, these developments in Europe will be analyzed and their emphasis on industrial transformation will be highlighted. In addition, Green Deal Industrial Plan which is presented in February 2023 will also be assessed under this section.

1.4.1 The European Green Deal

The European Green Deal is a binding strategy document that brings together many policies to make Europe a modern, resource-efficient and competitive economy with net zero greenhouse gas emissions in the face of natural disruptions. The Green Deal is seen as a vital part of achieving the Sustainable Development Goals of the United Nations' 2030 agenda (EC, 2020).

In order to implement the Green Deal, existing policies need to be reviewed and/or changed to ensure clean energy supply across a wide range of sectors, from economy, industry, infrastructure, transportation, food and agriculture to construction and taxation. At the same time, these changes cannot be separated from digital transformation (EC, 2020).

It is clearly stated in the Green Deal section 2.1.3, it is certainly necessary to full mobilization of the industry for reaching a circular and climate neutral economy (EC,

2020). Industrial activities such as raw material extraction and material processing account for approximately half of the GHG emissions, and it is essential that industrial activities in this context are brought to a climate-neutral level (EC, 2020). One realistic proposal for change here is to move to a more circular economy model. A new circular economy action plan would help capitalize on the opportunities of the circular economy both domestically and globally. In addition to the circular economy, the European Green Deal highlights digital transformation, entrepreneurship and innovation, essentially stating that innovation, circular economy and carbon-neutral industries are three complementary pillars.

1.4.2 Green Deal Industrial Plan for The Net-Zero Age

The necessity to significantly accelerate technological advancement, production, installation, and manufacturing of net-zero products and energy supply in the upcoming ten years, as well as the value added of an EU-wide approach to jointly face this issue, serves as the foundation for the Plan. The Plan will support current initiatives for transforming industry under the EU Industrial Strategy, specifically the Circular Economy Action Plan, and the European Green Deal. Energy-intensive industry modernization and decarbonization, as well as facilitating job transitions and creating high-quality jobs through education and training, continue to be important priorities (EC, 2023). The objective of the Green Deal Industrial Plan is to maintain the competitiveness and allure of the European Union as an investment destination for the net-zero industry by streamlining, expediting, and aligning incentives. By working together, the EU and its member states can expedite the twin transitions and send a clear message to industry. The Plan emphasizes the importance of the technological development to reach the aims of itself. In addition, the plan emphasizes the importance of Europe-wide policies. It is stated that the Green Deal Industrial Plan will be based on openness, innovation, inclusiveness and sustainability in a way to bring out the strengths of the European Union. According to the plan, with the right policies and the right conditions, economic growth can be

achieved while combating climate change and environmental pollution. Four pillars support this outline for a new Green Deal Industrial Plan: open trade for robust supply chains, a predictable and simplified regulatory environment, quicker access to adequate funding, and skills (EC, 2023).

The Plan emphasizes the areas where policies need to address. It states that legislation and public regulation should be predictable, consistent and simplified. It also proposes different models for facilitating access to finance, such as different national funding, EU funding, private sector funding, investment funds.

Not only the green transition in industry but also the changing world economic order will demand the development of new jobs and new skill sets. In this context, the plan also includes measures and recommendations on skills development. Especially during and after the pandemic period, the necessity of flexible supply chains has been experienced and there are a number of actions under this heading in the plan.

1.4.3 EU Circular Economy Action Plan

The European Union's efforts on Circular Economy predate the Green Deal and the first step in this regard was the EU Circular Economy Action Plan, the version of which was published in 2015. The Plan was then revised in 2020 and entered into force by expanding its scope with current developments.

The Plan emphasizes a cleaner future and a more competitive European economy and highlights the critical importance of the transition to a circular economy. The European Commission states that the circular economy is one of the key formulas for the 2050 climate-neutral target (EU, 2020). In order to achieve this goal, the EU has to speed up the shift to a regenerative growth model, which gives back to the environment more than it takes, make progress in limiting its use of resources within the bounds of the planet, and, in the next ten years, work to cut its consumption footprint and double its rate of circular material use (EU, 2020).

Under the Plan, not only sectors but also citizens will be positively affected, and access to high quality, functional and safe products will be financially easy and efficient. A future-focused strategy for co-creating a cleaner and more competitive Europe with consumers, businesses, citizens, and civil society organizations is provided by the Circular Economy Action Plan (EU, 2020).

The Plan is basically an environmental policy document for the consumption of sustainable products. Up to 80% of the environmental impacts of industrial products are caused by the design phase (EC, 2012). In this context, CEAP both emphasizes eco-design and supports it with the Eco-Design Regulation.

The importance of green industries also emerges here. In order to make products more durable, resource efficient and circular, new production models should be implemented in industries and there should be a green transition in the industry.

Circularity is an important part of industry's transition to climate-neutrality and competitiveness. It can save resources, generate added value and support the emergence of new economic opportunities in identified value chains (EU, 2020). By establishing the EU Environmental Technology Verification scheme as an EU certification mark, it is crucial to promote the use of digital technologies for resource tracking, tracing, and mapping as well as to encourage the adoption of green technology through a system of solid verification (EU, 2020).

The sustainability problem provided by important value chains necessitates immediate, comprehensive, and coordinated action, which will be an essential component of the sustainable product policy framework. These activities will help to respond to the climate emergency and will feed into the EU Industrial Strategy, as well as the upcoming biodiversity, farm-to-fork, and forest plans. As part of the sectorial actions' governance, the Commission will work closely with stakeholders in important value chains to identify and address bottlenecks to the expansion of circular product markets. Within the scope of the Plan, 7 different product-value chains have been identified. These sectors are listed in the Table 1.2.

Table 1.2 Key Product Value Chains

Electronics and ICT
Batteries and Vehicles
Packaging
Plastics
Textiles
Construction and Buildings
Food, water and nutrients

As a reflection of these international developments in Türkiye, the Green Deal Action Plan was first prepared by the Ministry of Trade, while the work on the National Circular Economy Strategy and Action Plan is currently being carried out by the Ministry of Environment, Urbanization and Climate Change. The impact of the Green Deal Action Plan and other international developments on Türkiye's strategical documents and legal framework will be assessed in the Chapter 3.

To summarize the introduction, mitigating the environmental impacts of industrial zones is not a new issue; in fact, it can be traced back to the first emergence of industrial zones. Although different studies have been conducted in this context, the new generation of industrial zones is seen as a result of a more comprehensive change in agenda. Changing world politics and conditions, as well as climate change and the green transformation agenda, have a significant impact here. New generation industries/green industries are read as a result of an international paradigm shift, and in the following sections, Türkiye's efforts and current practices will be discussed in line with this context.

CHAPTER 2

LITERATURE REVIEW

In this part of the study, green industrial zones will be defined as new production spaces and the fundamentals of green industries will be outlined by evaluating the connection between green industrial zones and developments on global scale.

2.1 Green Industries

Firstly, it is better to understand Industrial Park concept in terms of economic, social and environmental. The main thing is about all industrial parks that they provide economic growth and developments in social infrastructure. However at the same time we can observe they could cause negative impacts on environmental and social issues such as, climate change, pollution, resource reduction, problems about labor (World Bank, 2021). These negative impacts have become serious issues that local or central governments have to mitigate later.

The thought of mitigating these negative outcomes led to Eco-Industrial Park concept. The idea of EIPs are based on both resource efficiency and cleaner production according to World Bank's Framework. The reason for that, these two notions are highly related with the newest concerns of World's climate change, pollution, social disparities, improved risk and reduced resources management (World Bank, 2021). Briefly, an Industrial Park is concerns more than a one field, such as city planning, economics, sociology, environment. Thus, there is a necessary for planning and managing these areas in cities.

It is possible to mention about certain number of definition of Eco-Industrial Parks. Largely, an EIP can be defined as a dedicated industrial area on a convenient sitethat supports sustainability by integrating social, economic and environmental quality

aspects into site selection, planning, management and operations (World Bank, 2021).

Eco-Industrial Parks, New Generation of Industrial Parks or Green Industrial Zones/Parks are the terms that refer same concept. From now on, the term “Green Industry” will be used in the remaining part of the study.

United Nations published Sustainable Development Goals (SDGs) firstly in 2015. There are seventeen goals for transforming the World according to 2030 agenda (United Nations, 2015). These new agenda cannot be thought apart from the paradigm shift that is ongoing in World nowadays. New generation of Industrial Parks are also a part of this agenda as well. Six sustainable development goals that are listed below are on of the driving forces for new industry (World Bank, 2021):

- Clean Water and Sanitation
- Decent Work and Economic Growth
- Industry, Innovation and Infrastructure
- Sustainable Cities and Communities
- Responsible Consumption and Production
- Climate Action

According to World Bank’s framework, these changes in the industrial structure are available and applicable for certain types of economies around the World (World Bank, 2021). Since, this is a global agenda we can assume that these changes is going to spread all over the World. In fact, it is possible to observe these agenda is ongoing all over the World in these times. In addition, there are binding agreements to force the countries to change their industrial structure.

To summarize, industrial zones that placed in cities and try to ensure the universal goals above, can be defined as a Green Industrial Zone. In addition, there are four main distinguishing features for GIZs according to World Bank, which are:

- Integrated with city,
- Innovative, focused on developing technology,
- Aim both environmental and economic development,
- High-level digital production technologies

It is clear that these changes in the industrial structure are part of a global agenda. However, at this point, it would be correct to mention the benefits of new generation industrial parks. It is expected to have significant environmental, social and economic benefits by definition. Table 2.1 indicates the benefits of new generation of industrial parks in these three dimension according to World Bank.

Table 2.1 Benefits of the Green Industrial Zones

Economic Benefits	Social Benefits	Environmental Benefits
Improve competitiveness	New Employment Opportunities, Enhanced Education and Training Programs	Reduce the ecological footprint
Improve the opportunity of reaching new financial and technical support	Develop Social Adaptation	Reduce waste, resources and energy consumption
Reduce the costs by increasing efficiency	Increase Quality of Life of Local Communities	

2.2 Global Practices

As mentioned above, various examples of green industries can be seen around the world with different names such as, Environment Park, Technology Park, Eco-industrial Park, research parks, innovation zones, smart industrial parks, and special economic zones. New generation industry can be understood an inclusive term for all of the above. There are different parks around the world. There are certain number of policy documents, academic researches on going for the subject from Europe to China.

The EU has set a goal of achieving climate neutrality by 2050. This means that all industries, including so-called 'hard to reduce' industries such as steel, chemicals and cement, must become quasi-carbon neutral for the next 30 years (Agora Energiewende and Wuppertal Institute, 2020). The European Union (EU) has committed itself to tackling environmental challenges as well as to creating a carbon-neutral and pollution-free continent by 2050 by accepting the Paris Agreement and its own long-term policy (Arsova et al., 2021).

Climate neutrality is quickly becoming the new paradigm, not just in the EU but also globally. China has set a strategy to become carbon neutral by 2060. China is the world's greatest emitter of greenhouse emissions and a manufacturer of energy-intensive basic materials. Both the third-largest economy in the world, Japan, and the Republic of Korea, a powerhouse in energy-intensive industries, have set net-zero ambitions for 2050 (Agora Energiewende and Wuppertal Institute, 2020). One of the main target of the new industry structure is to reduce carbon emissions and to help for achieving climate neutrality. Thus, various studies can be observed in this context.

China has its own green transformation road map and they choose industrial transformation as the main vehicle for this. The reason for that, numerous industrial zones not only offer a better environment for industrial development, but they also take the lead in putting innovative economic, industrial, and environmental

regulations into practice (Zeng et al., 2020). Their impact areas are genuinely wide and this helps the industrial areas to spearhead the transformation.

The major restructuring of the Special Economic Zones in the 1980s and 1990s was primarily aimed at bringing about changes in the management and operational structure. Since 2000, green transformation has dominated China's policy towards greener, more efficient and more value-added production (Zeng et al., 2020). As observing there have been a paradigm shift in China's own transformation period. It can be said that policies and agendas might change but, industrial areas are always a key factor for adapting a new agenda. According to the research of Zeng et al., 2020, results indicate that regions have a new generation industry can be more competitive. This outcome is clearly essential especially for the developing regions/countries.

Industrial parks not only generate huge economic returns, but also cause massive resource consumption and pollution. The industrial park is an important test bed for China's future transition to sustainable development and new industrialization (Wang et al., 2021). This point of view stands that the idea of becoming the main indicator of green transformation. Main strategy behind that is decoupling strategies. Decoupling strategies is one of the main characteristics of green development. However, given the continued consumption of resources and energy, a true separation of economic growth, resource consumption, and environmental impacts is still insufficient (Geng et al., 2016). In addition to this, circular economy which is one of the main part of the green development has been determined as a national development strategy in China (Geng et al., 2016).

The idea of research, innovation, and digitization is harnessed through the circular economy. It produces new, sustainable services, jobs that are innovative and creative, upgraded knowledge and skills, and high-quality, safe products that are effective and economical, last longer, and are made to be reused, repaired, and recycled (European Union, 2022).

Circular economy has a tremendous importance in the idea of new industry. At this point, relationship between the city and local communities has a key role. Urban

infrastructure has a critical point as they are providing certain amount of waste that can be useful for industries energy production and re-usage activities (European Union, 2022). The circular economy is the evaluation of materials in closed systems aimed at reducing consumption of natural resources and thereby reducing pollution or limiting resource use, thus promoting sustainable economic growth. (Winans et al., 2017). Furthermore, industrial zones might have a contribution role for pilot implementations that citizens need to adapt to. This exchange between cities (including communities) and industrial zones can create new employment opportunities or a synergy that can cause co-benefit (European Union, 2022).

One of the important phenomena leading this change in the world is green finance. Environmental protection and efficient resource use activities are seen as an important measurement and evaluation criterion of green finance. In this context, research carried out in China reveals that the green transformation movement, which is planned within the framework of national policies, increases access to green finance (Lv et al, 2021). In fact, there was a green finance policy system has been established in China in 2015 (Lv et al., 2021). Results of Lv's research indicates that ability to reach green finance is something leading reducing to regional gaps between different economic regions. Regions are showing converging performance after the green finance system established according to the researches in China (Lv et al., 2021).

These experiences in the World clarifies that this is a whole package with greener industry, carbon-neutral production, green finance, innovation and technological development, research and development activities. Thus it is necessary to take action with the national level policies and strategies to build a sustainable industrial environment with all these actors or indicators.

2.2.1 Establishment of Green Industrial Zones

Regions and cities are often identified by practitioners as pioneers in the transition to sustainability and often initiate change before national policies are formulated.

Main reason for this, its scale and relatively to controllable economic, environmental, social and economic problems and its ability to tap into the local experience of relevant stakeholders. Moreover, they are well-positioned to identify and address key challenges that often require inter-agency policy responses at all levels. (Arsova et al., 2021). In this context, the EU has made efforts to reduce its CO₂ emissions for the period 2014-2020. These efforts will be intensified over the next 2021-2027 period, with the adjustment of RIS3 (Research and Innovation Strategy for Smart Specialization) in some regions to gradually reduce the EU through significant reductions in carbon emissions. try to be environmentally friendly. As such, the EU is backing structural funding for innovation policies that align its goals towards innovation and address sustainability challenges. (Oliveira et al., 2021).

There are two simple way to build a new generation industrial park. One of them is building a whole site from scratch or transforming an existing traditional industrial park into a new generation. There are various studies in the literature indicate that transformation of an IP is more efficient and has a lower cost. Especially thinking of economic struggles in Türkiye, resources must be used in most efficient way. One of the most famous transition examples in the world, France's Salais-Sablou case.

In the Salais-Sablou case, the transformation was not only spatial but in mindset as well. Which means, spatial transformation is supported by the policies and plans. In addition to industrial symbiosis, sustainable planning policies for people and goods movement as well as spatial articulation with nearby urban and natural systems are recognized as contributing factors to a park's environmental efficiency. For planners and developers active in converting industrial parks into EIPs by adopting an original concept based on the connections between the park and the surrounding area, the discussion of this method offers helpful lessons and direction (Riberiro et al., 2017). Obviously this is not the only project, there are certain projects about industrial symbiosis and industrial transformation on going in several countries in Europe such as, UK, Germany, Sweden, Italy and France (Ribeiro et al., 2017).

Since innovation, R&D activities and high technology are essential parts of the new generation industries, smart solutions cannot be thought apart from the new industry zones. Smart solutions can be observed in the area of renewable energy production, low-carbon transformation and planning and management of the site (Wang et al., 2019). It should not be forgotten that new generation industrial zones are one of the piece of smart cities. Therefore, it is expected to be seen most of the smart city applications in these areas (parks). Emerging smart solutions into a park can be co-beneficial both for the industrial parks and cities. In this context, industrial parks become a testbed for the city and this applications strengthen the relations between the city and industrial parks. It is mentioned before, industrial parks are not defined polluting areas apart from the cities and this is a good collaboration to build this kind of environment in the cities.

Several researches indicate that if the sustainability practices adapts to the industrial parks with low heterogeneity, weak governmental support, and low collaboration with different actors, this will lead a less successful environment (Bellantuono et al., 2017). Co-benefit, collaboration, networks, are key factors for success in this context. Building a successful new generation industrial park environment can positively affect people's behavior. Behavioral change is something that this new agenda targets to create permanent sustainable world. It should not be forgotten that these industrial parks includes many type of people from different socioeconomic groups. Every day, people come these places to work either a CEO or a factory worker. This heterogeneity allows that new implementations such as recycling, reusing or any smart city application is going to be reachable from different people. This also reflects their daily life, theoretically. This is an assumption but a reasonable one. Thus, smart and green solutions are essential not only for production lines or management also for the social dynamics.

The other indicator to measure new industries is competitiveness. Necessities for competition has been also changing with the economic and political atmosphere. Recent years, it is necessary to produce in high value-added sectors is a key for become competitive. Especially less advanced countries or regions can be

competitive at the international level by shifting high value-added sectors. This also includes the hi-tech production techniques such as positive incomes of the modernization of the agricultural sector in Central and East European countries (Capello and Cerisola, 2022). The long-term sectoral composition of countries and regions make sectoral transition a challenging endeavor, and job-specific skills are not easily transferable from one industry to another (Capello and Cerisola, 2022). This is one of the most challenging issues. Although, there is a transition from less to more productive sectors can be observed in CEE countries and there are some good results for their competitiveness, it seems that is impossible to change whole sectoral dynamics in these countries (Capello and Cerisola, 2022). However, observing positive outcomes without changing whole dynamics is also important and can be turned to applicable strategies for less-developed regions.

The literature on EIP places a lot of emphasis on recycling and reusing wastes and other products. Recent research, however, highlights the drawbacks of this strategy and suggests broadening the concept of EIP to include managerial and spatial concerns. A comparative study developed by Vermeulen and Walle (2004) indicates that, only physical changes are not enough to build an EIP (Ribeiro et al, 2017).

2.2.2 Role of the International Financing

Policies, strategies, pilot studies and regional networks at the national level gain importance because transformation or change in the industrial structure is not mentioned only in the transformation or change of physical space. In this context, when the studies in the world are examined, it is seen that the studies supported by sustainable and applicable policies and in which the additional costs are mitigated are considered successful.

In this context, the way to use all these tools effectively can be seen as developing national systems and strengthening regional networks. Regional Innovation Systems have an important place in the regional development literature in the 1990s. As can be seen in Chung's (2002) research, the interaction of effective regional innovation

systems with each other and effective studies bring a national innovation system to the agenda. By creating competitive Sectoral Innovation Systems in their respective regions, effective Regional Innovation Systems create a competent National Innovation System. We further contend that a RIS should include an acceptable number of relevant innovation actors from the academic community, the public research sector, and the private sector (Chung, 2002). Actors of the regional innovation system is defined as universities, public institutions, industry, central government and regional government in this research (Chung, 2002). In Turkish context, we can use local governments instead of regional government. However, the idea of national innovation systems based on collaboration of the regional innovation systems. This will only be possible by bringing together a sustainable planning approach and the aforementioned development tools.

One of the key factors influencing economic growth in contemporary societies is innovation. The available data indicate growing territorial disparities in innovation in Europe (Zabala-Iturriagoitia et al., 2021). Innovation should be a key factor for reducing disparities but as we have been observing, creating innovative and hi-tech production is not a realistic scenario for every region or city. However, in a systematic approach and planning might be a solution for this. The numerous innovation scoreboards that are published each year show that there is no significant convergence of innovation among European nations. These scoreboards show that there are growing territorial differences in Europe between countries that are leading and those that are lagging in terms of innovation (Zabala-Iturriagoitia et al., 2021). This innovation scoreboard claims that Sweden, Finland, Denmark and the Netherlands are leading innovators while, Bulgaria and Romania are the modest innovators (European Union, 2019). It can be seen that there are some countries are falling behind as a result of lack of innovative activities. Which shows us, innovation have to be one the main factor that should take place in the new industries. However, not every region in the same country has a chance to create innovative investments in very same amount. There are some indicators to calculate the innovativeness such as public R&D investments, business R&D investments, techno parks, technological

development zones, number of patents, new doctoral graduates, medium and hi-tech product exports, venture capital ((Zabala-Iturriagoitia et al., 2021), and it is not possible to expect these numbers and investments every region in the country. In this sense, pilot zones and networks become important.

For example, Chinese experience claims that, “Innovation Pilot Zones” and “Green Finance Reform” have an important role for spreading the new implementations around the whole country (Wang et al., 2021). These two are the strategies that used while Chinese economy has been shifting to the situation of high-quality development from the situation of rapid growth (Wang et al., 2021). This is actually a simple method that combines regulations and implementations. There were three different result of this study (Wang et al., 2021) claims us that;

- Defining a pilot zone promotes regional green development,
- According to the policies and regulations, developing industrial structure, technology and innovation investments in the provinces of pilot region, is lead to regional green development,
- Since pilot zone became an attraction point, firms and companies can have an opportunity to reach more financial options, especially green finance.

Considering the necessity of new generation industries to cover both green finance and innovation activities, this method seems to be quite efficient for creating a center of attraction.

It is hard to think entrepreneurship apart from new industries. The entrepreneurial ecosystem is relevant to economic policy in many countries, especially in Europe. The entrepreneurial ecosystem concept offers a new perspective on the geographical clustering of economic activity. In addition to regional development strategies in Europe (EU), entrepreneurship and ecosystems build by continuous technological development are topics of interest to researchers (Oliveira et al., 2021). An attraction center such as a new generation industrial park, starts to attract entrepreneurs as well. This is a part of the concept itself. It is important to establish the relationship between

the entrepreneurial ecosystem and everyday ecological practices in society. This can be achieved through global and regional environmental initiatives aimed at recognizing the importance of waste management, recycling, reuse and sustainable development (Hsieh et al., 2017). Integration of the entrepreneurship activities, smart solutions, regional relations and green finance into industry is key of new industries' sustainability.

Relations between regions, development of technology is gaining importance to become competitive. In the context of Türkiye, it is mentioned that there are differences in the level of development between regions for various reasons over the years. At the same time, regions in Türkiye have different sectoral, demographic and geographical characters. This should be seen as a potential in terms of specialization in different fields and the relation of these specializations to each other. There is a heterogeneity between regions. In this context, there are studies showing that interregional diversity, knowledge differences and relationships will lead to more growth (Karahasan, 2020):. Three important results of the study on the regions in Türkiye are expressed as follows (Karahasan, 2020):

- There are inequalities between regions in Türkiye, but inequality between western regions tends to decrease.
- The number of patent applications is spreading to the regions in Anatolia, the variety of patents produced is increasing,
- Regional Information Complexity is increasing and the network of technological relations is intensifying.

New generation industrial zones adopt these relationships as an advantage. As a concept, new generation industrial areas have an important place both within themselves, in the region where they are located, and in national and international networks. Similar to the relations developed with the entrepreneurship ecosystem, universities, research and development centers, and innovation centers, it should be established with local potentials and knowledge specific to the region, and in this

context, it should be at a point where it can contribute to regional development. As a center of attraction, new generation industrial zones should contribute to the development of the city and region where this attraction is located.

As revealed in Erdem's study, regional relational networks tend to increase continuously between 2004 and 2016 and reached its peak in 2016 (Erdem, 2022). Another important effect of the increase in the number of these ties is that although the relational networks are still high in the western regions, these networks also spread geographically. However, less frequent networks are observed in the eastern regions (Erdem, 2022).

The positive effects of such collective relations and symbiotic relations of different regions in terms of growth and the convergence of the growth of the regions are revealed in various studies. Technology and knowledge development and innovation activities should be considered as an integral part of new generation industrial zones. Therefore, the developments revealed that Türkiye has developed an important base in terms of adaptation to the new industrial model. The OIZs and innovative practices developed in provinces such as Manisa, Ankara Başkent), Yaloca and İstanbul (Çerkezköy) show that the trends are also spreading geographically. In this context, the presence of nationally developed strategies indicates a potential for improvement.

To summarize this section, one of the most important findings for Türkiye is the uneven development of regions in Türkiye. This has the potential to increase inequalities between regions, in other words, to increase uneven development, as well as being an important opportunity for economic development.

It is quite possible to expect new generation industrial zones to generate growth through green and circular economy policies, both in terms of business models, employment and technology development. In this context, technology development and innovation can facilitate adaptation for some regions. At the same time, these innovations and the new agenda are also directly related to socio-economic development as they require social harmonization. In this context, in the following

sections, the development and current state of the legal framework in Türkiye will be evaluated, while the socio-economic development and innovation status of the regions will be assessed. Although the aim here is not a location study, it is important for the elaboration of policies.

CHAPTER 3

ASSESSMENT OF LEGAL FRAME WORK AND GREEN TRANSITION POTENTIAL OF ORGANIZED INDUSTRIAL ZONES IN TÜRKİYE

This chapter consists of two separate sub-studies. First, the legal framework in Türkiye will be examined and assessed. Then, two indices will be established to reveal the potential for green transition in Türkiye. These two studies will form an important basis for the policy recommendations in the next chapter.

3.1 Legal Framework in Türkiye

Since 2015, with a series of developments in the world such as EU CEAP 2015, EU CEAP 2020, Green Deal and Paris Agreement, the structure of the production sector and its spatial projection, Industrial Zones, has had to change. Türkiye has been affected by these developments. Türkiye's experience with the new developing agenda of the EU is highly related with the Green Deal and Paris Agreement. In this section, we hereby examine the actions of Türkiye after signing Green Deal. Ministry of Trade has developed a National Green Deal Action Plan in 2021 which overlaps Türkiye's long-term goals to develop trade with EU countries.

There are national plans and strategies that propose a series of changes in the industrial structure in the changing world conditions in Türkiye. But before coming to these, it is useful to understand the concept of Organized Industrial Zone in Türkiye. OIZs are production of planning development period of Türkiye. Mainly, the targets of the OIZs are raising industrial development, reducing regional unevenness, balancing development of industry and urban areas. This is roughly sixty years of a period (Dursun et al., 2019). However, it is hard to say that these goals are accomplished.

Due to the economic, social and environmental problems that have developed in recent years, there are national studies on the change in the industrial structure in Türkiye. Although the methods and concepts vary in these studies, the objectives are more or less the same as those mentioned above.

Various studies shows that there are national or regional level strategies and policies in the world. Their names or levels could be change but their target is same. Türkiye has its own studies and policies as well. Ministry of Industry and Technology announced Türkiye Organized Industrial Zones Project Financed by the World Bank in 2021. According to these project activities below can be funded by a credit (Turkish Republic Ministry of Industry and Technology, 2021).

- *“OIZ basic infrastructure investments by using green solutions as much as possible (road, water, rain water, sewer lines, telecommunication and internet networks; natural gas networks; power lines; OIZ buildings; waste water treatment plants; environmental laboratories and logistics facilities)”*
- *“Green infrastructure investments in the OIZ (advanced infrastructure investments, among others, in energy supply from renewable sources; LED street lighting; improved wastewater treatment; improved energy efficiency of administrative buildings; and recycling and/or reuse of waste materials for production inputs) use)”*
- *“OIZ innovation centers investments”*

The project also includes training documents and determined standarts for the Green OIZ.¹ Thus, it can be said that this is one of the most inclusive documents regarding new industrial in Türkiye at the national level. On the other hand, Ministry of Industry and Technology have published Strategy Plan for the term of 2020-2024.

1 Green OIZ is one of the common use word for describing New Generation of Industrial Parks in Türkiye.

Hi-tech, competitive, sustainable and national industry is the main mission of this strategy plan. According to this plan “A powerful industry and national technology” is the vision of this plan (Turkish Republic Ministry of Industry and Technology, 2019). These aims indicates that there is a raising awareness for current developments in industrial sectors. In addition, again in this strategy plan, there are some strategies suggest that a greener, eco-friendly industrial zones (Strategy: 322.19., page: 19). Under the heading of the environmental factors, plan mentions about the European Green Deal, de-carbonization, reuse and recycle of the materials, renewable energy sources and generally raising awareness of the people about all these subjects (Turkish Republic Ministry of Industry and Technology, 2019). Therefore, it can be said that, strategy plan shows that a perspective of new generation of industries.

In addition, four actions are defined under the greener industries precaution. The list below indicates them (Turkish Republic Ministry of Industry and Technology, 2019).

- Works on the transformation of industrial sites within the city will be continued.
- Recycling industrial zones will be established, and waste separation and reintroduction to industry will be accelerated.
- Treatment plant investments will continue to be supported.
- Negotiations will be held for local governments to work more effectively on waste collection.

As it is seen, these actions shows same interest with the new generation of industries. Plan also includes actions and strategies for raising capacity of innovation, especially in the less-developed regions in order to reduce regional gap between different regions. There are some incentives defined under the heading of R&D activities such as, Technological Development Zones, R&D and Design Centers, innovation and

entrepreneurship activities, university and industry collaborations (Turkish Ministry of Industry and Technology, 2019).

In order to better understand Türkiye's perspective on Green Industries, the following national official documents were reviewed.

3.1.1 Law on Organized Industrial Zones

The Law on Organized Industrial Zones regulates the principles of establishment, construction and operation of organized industrial zones in Türkiye. One of the most important changes made in the context of the green transition was the inclusion of the definition of Green OIZ within the scope of the law through an amendment to this law.

With the addition made to the law on 4/4/2023, Green OIZs are defined as "*OIZs that stand out with their resource and energy efficiency, lean production, industrial waste cooperation and environmentally friendly practices and are certified by the Turkish Standards Institute within the framework of the criteria determined by the Ministry in terms of environmental, economic, social and managerial aspects.*" (OG, 2000 Law Number: 4562, Art. 3).

With the addition made to Article 7 of the mentioned law, it is stated that the projects prepared by OIZs to meet the Green OIZ criteria will be evaluated by the Ministry of Industry and Technology (OG, 2000 Law Number: 4562 Art. 7).

A certification system was developed by the Ministry of Industry and Technology and Turkish Standards Institution regarding Green OIZ (TSI, 2024)

3.1.2 Green OIZ Application Guideline

Preliminary criteria and performance indicators have been defined for inclusion in the Green OIZ application under this guidelines. These indicators serve different purposes. These are defined below.

- To improve the managerial and monitoring performance of OIZs,
- Improving the environmental performance of industrial zones by developing sustainable ways to manage water, wastewater, waste and resources,
- Improving social performance by improving workers' rights and working conditions and ensuring all forms of equality,
- Improving economic performance.

There are six different preliminary criteria defined under this guideline. Preliminary criteria can be shown in the Table 3.1.

Table 3.1 Preliminary Criteria for Green OIZ Infrastructure

Number	Criteria
1	At least 1 company in production in the OIZ.
2	All wastewater in the OIZ is treated.
3	Lack of coal use as a source of energy production in OIZ.
4	OIZ is certified by TSE for TS EN ISO 14001 and TS EN ISO 50001 standards.
5	Establishing a unit in the organizational structure to monitor and manage issues related to Climate Change and Sustainability and employing at least one competent staff member.
6	OIZ to have at least basic level Zero Waste Certificate.

Under these preliminary criteria ten economic, six social, five governance and seventeen environmental performance indicators were developed for the assessment. Another important yearly improvement reports become mandatory for OIZs that gained this certificate. Organized Industrial Zones will be evaluated according to their score on these indicators and will be categorized according to platinum, gold, silver or bronze level. To reach the bronze level, it is necessary to collect at least 40

points. Applicants with 55-69 points will be categorized as silver level, 70-84 points as gold level and over 85 points as platinum level (TSI, 2024).

Table 3.2 Performance Indicators

Indicator No.	Indicator Name	Indicator Source	Indicator
1	Increase in Total Income at OIZ Level (%)	Firm	Annual Net Sales (\$)/m ²
2	Increase in Total Export Income at OIZ Level (%)	Firm	Annual Export (\$)/m ²
3	Increase in Total Employment at OIZ Level	Firm	Annual employment growth (%)
4	Share of Firms Receiving Investment Incentive Certificates in Total Number of Firms (%)	Firm	Number of companies receiving investment incentive certificates/number of all companies
5	OIZ occupancy rate	OIZ Management	Parcel data
6	Average Spatial Growth Rate of OIZ	OIZ Management	Location selection and zoning plans
7	OIZ's distance to main arterial transportation	OIZ Management	MEYDİP (Spatial Management and

	networks is below 50 km		Digitalization Project)
8	Availability of Technology Infrastructure <ul style="list-style-type: none"> • Having at least one R&D Center 	OIZ Management & Firm	-
	Availability of Technology Infrastructure <ul style="list-style-type: none"> • Having at least one Model Factory 		
	Availability of Technology Infrastructure <ul style="list-style-type: none"> • Having at least one Design Center 		
	Availability of Technology Infrastructure <ul style="list-style-type: none"> • Presence of a Technology Development 		

	Zone within the OIZ		
9	Share of Investment Expenditures in Total Expenditures in OIZ Management (%)	OIZ Management	Certified public accountant report
10	Total Employment Increase in OIZ Management (%)	OIZ Management	Social Security Institution Transcript
11	Female Employment Rate at OIZ Level (%)	Firm	Share of the female employment (%)
12	OIZ's Establishment of a Complaint Resolution Mechanism and Finalization Rate of Received Complaints (%)	OIZ Management	Finalized complaint / total complaints
13	Share of companies with more than 50 employees in the OIZ that have determined the principles of the "Company Code of Conduct" and inform their employees (%)	Firm	Share of firms that set a policy

14	Ratio of Companies with TS ISO 45001 Certificate to the Total Number of Companies in OIZ with more than 50 Employees (%)	Firm	Number of companies with occupational health and safety experts or receiving services/all companies
15	Existence of Social Infrastructure <ul style="list-style-type: none"> • Nursery/Kinder garten/Elderly Care Center 	OIZ Management	-
Existence of Social Infrastructure <ul style="list-style-type: none"> • Security* 			
Existence of Social Infrastructure <ul style="list-style-type: none"> • Education Facility 			
Existence of Social Infrastructure <ul style="list-style-type: none"> • Public Transportation 			

	<p>Existence of Social Infrastructure</p> <ul style="list-style-type: none"> • Social Facility (Restaurant, Sports Center etc.) 		
16	<p>Public Relations</p> <ul style="list-style-type: none"> • Website* 	OIZ Management	-
	<p>Public Relations</p> <ul style="list-style-type: none"> • Social Media Account 		
	<p>Public Relations</p> <ul style="list-style-type: none"> • PR Specialist 		
	<p>Public Relations</p> <ul style="list-style-type: none"> • Promotional Materials 		
	<p>Public Relations</p> <ul style="list-style-type: none"> • Social Responsibility Projects 		
17	<p>Human Resources Capacity</p> <p>Technical team should consist;</p>	OIZ Management	-

	<ul style="list-style-type: none"> • At least one City Planner, Architect, Surveyor, Civil Engineer, Mechanical Engineer, Electrical Engineer 		
	<p>Human Resources Capacity</p> <p>Environment and social management team should consist;</p> <ul style="list-style-type: none"> • At least one Environmental Expert, Social Expert, Occupational Health and Safety Expert 		
	<p>Human Resources Capacity-</p> <p>Administrative team should consist;</p> <ul style="list-style-type: none"> • At least one Finance 		

	Specialist, Procurement Specialist		
18	OIZ management employees receive at least one training to improve their professional capacity	OIZ Management	-
19	Carrying out informative activities for companies in line with Green OIZ performance indicators and targets*	OIZ Management & Firm	Share of companies that have been informed
20	Conducting an assessment of Green OIZ performance indicators minimum every 6 months	OIZ Management	-
21	Preparation of an implementation plan with goals and targets in line with Green OIZ performance indicators*	OIZ Management	-

22	Reduction in the total amount of water consumed per annual income generated at the OIZ Level (%)	Firm	Water amount (m ³) / annual net increase (\$)
23	Reduction in total electricity consumption per annual income generated at the OIZ Level (%)	Firm	Electricity consumed (kWh) / annual net increase (\$)
24	Reduction in total natural gas consumption per annual income generated at the OIZ Level (%)	Firm	Natural gas consumed (m ³) / annual net increase (\$)
25	Share of Companies Working on TS EN ISO 14064, TS EN ISO 14067 or Other Internationally Recognized Standards in OIZ	Firm	Number of companies with emission report / total number of companies
26	Ratio of Wastewater Recovered at OIZ Level to Total Wastewater Generated	OIZ Management	Amount of wastewater reused (m ³) / total wastewater

27	Ratio of renewable energy production to energy consumption at OIZ level (%)	OIZ Management & Firm	Renewable energy electricity generation / total electricity consumption
28	Ratio of companies with at least basic level Zero Waste Certificate to total companies in OIZ	Firm	Number of companies with Zero Waste Certificate / total number of companies
29	Ratio of the number of companies participating in industrial symbiosis to the total number of companies	Firm	Number of firms involved in industrial symbiosis / total number of firms
30	Ratio of Companies with TS EN ISO 50001 Energy Management System Certificate to Total Number of Companies	Firm	Number of certified companies / total number of companies
31	Ratio of Companies with TS EN ISO 14001 Environmental Management System	Firm	Number of certified companies / total number of companies

	Certificate to Total Number of Companies		
32	Environmental Infrastructure Status: <ul style="list-style-type: none"> • Presence of parking space (5%) 	OIZ Management	-
	Environmental Infrastructure Status: <ul style="list-style-type: none"> • Existence of wastewater information system 		
33	Including climate change and sustainability issues in procurement processes	OIZ Management	-
34	Training: <ul style="list-style-type: none"> • Providing training on water management and water efficiency to at least 25% of existing 	OIZ Management	Ratio of companies trained

	companies by OIZ.		
35	<p>Training:</p> <ul style="list-style-type: none"> • Providing training on GHG emissions and GHG reduction to at least 25% of existing companies by OIZ. 	OIZ Management	Ratio of companies trained
36	<p>Training:</p> <ul style="list-style-type: none"> • Providing training on energy management and energy efficiency to at least 25% of existing companies by OIZ. 	OIZ Management	Ratio of companies trained
37	OIZ management buildings have TSI Secure Green Building Certificate	OIZ Management	-

38	Greenhouse gas reporting within the OIZ according to TS EN ISO 14064 and verification by TSI.*	OIZ Management	-
39	Improvement Report	OIZ Management	-
40	Green OIZ Design Document	OIZ Management	-

Symbol of the “*” in the Table 3.2 refers as mandatory indicators. As it can be seen on the Table 3.2 there is a list of indicators in four different titles, only four of them are mandatory for the applicant.

These two documents evaluated title 3.1.1, 3.1.2 and Table 3.2 mainly represents the legal framework of the Turkish context. Besides that Green Industries and green transition is one of the major targets for Türkiye in different contexts. Other relevant governmental documents will be evaluated below.

3.1.3 11th Development Plan

This development plan covers the period between 2019 and 2023. In fact, while green industrial zones are not directly mentioned in the content of the plan, it includes some important points in terms of supporting the country's development vision and future studies and following current trends. The items listed below emphasize the need for green and innovative transformation in industry and strategies for this (Official Gazette, 2019).

- Tackling climate change in greenhouse gas emitting sectors (714, page: 169)
- Controlling emissions from production, heating and traffic (715, page: 169)

- Industry, R&D, innovation, renewable energy and digitalization (826.5, page: 187)
- Ensuring technological transformation in industry (206, page 34)
- Stating that improvements in landscaping and social facilities should be made in the design of new OIZs and the transformation of existing ones (322.8, page: 66)
- Institutionalizing the digital transformation platform in industry (344.1, page: 75)
- Identifying the objective of increasing R&D investments in industry (347, 348, page: 76)
- University-industry collaborations (349.3, page: 77)
- Industry innovation network mechanism (351.1, page: 77)

It can be stated that the 11th Development Plan is a foundational document that has important points in terms of following current trends in development policies at the global level and triggering changes in the legal framework for industrial transformation.

3.1.4 12th Development Plan

This development plan covers the period between 2024 and 2028. One of the main axes of this plan is defined as "*Competitive Production with Green and Digital Transformation*" (Official Gazette, 2023 No. 32356)

The objectives and policies of the 12th Development Plan include supporting green transformation in the manufacturing industry and increasing circular and sustainable production practices (Article 427, Page: 82). The importance of R&D activities for sustainable production and green transformation and the adoption of green transformation technologies is emphasized (Article 427.1, Page: 82). Article 427.2 of the Plan is directly based on the dissemination of green industrial practices. In the same article, it is stated that green transformation in industry should not be limited

to organized industrial zones and that green practices will also be expanded in small industrial estates and industrial zones.

It is underlined that sectoral assessments will be made and transformation strategies will be implemented (Article 427.6). In addition to the certification of green transformation in the industry, the establishment of an infrastructure for monitoring developments is also among the objectives and policies of the plan (Articles 427.9 & 427.10). This plan aims to increase the awareness of SMEs as well as large-scale production areas towards green transformation (Article 427.5). One of the key policy areas of the Plan is to support high-tech investments (Article 427.7).

Green transformation in the manufacturing industry and digital transformation are related (Article 428). It is stated that model factories, one of the indicators in the Green Industry Application Guide, will be expanded and re-functionalized with the mission of leading digital transformation on a regional basis (Article 428.4). It is aimed to improve the capacity of the public and private sectors for the green transformation of the industry (Article 432.4). The Plan emphasizes the improvement of the international competitiveness of industry (Article 433).

The 12th Development Plan emphasizes the importance of ensuring the sustainability of sectors through R&D investments, digital and green transformation for the priority sectors identified in the plan (Chemistry, Pharmaceuticals and Medical Devices, Electronics, Machinery, Electrical Equipment, Automotive and Rail System Vehicles).

When the areas emphasized by the plan are examined, it can be said that it covers different points in an inclusive manner. In particular, the target of supporting high technology investments in the investment costs of transformation, a problem frequently encountered in the literature research, should be underlined. In addition, it is noteworthy that green transformation is also addressed at the level of small industrial zones and SMEs. In addition to the dissemination of green OIZs, the objectives of documenting green transformation and monitoring progress are important for the work during and after the plan period.

The 12th Development Plan lays the foundations but does not set precise boundaries and definitions. In this context, it is expected to be the basis for many different projects and investments that can accelerate the green and digital transformation of the Turkish industry as it should be.

It was already recognized from the literature that the entrepreneurship ecosystem is an important part of new generation industrial zones. In this context, it is useful to examine the specific policies of the plan related to entrepreneurship and the SME sector. It is aimed to cover entrepreneurship, digital technologies and financial literacy in education and to expand entrepreneurship trainings (Article 559.2). Prioritization of OIZs in site selection within the scope of OIZ-Vocational High School collaborations, which is a common, albeit controversial, practice, is one of the policies included in the plan (Article 559.3). Innovation, R&D and digital investments will be supported for entrepreneurs (Article 563).

One of the important points here is the combination of entrepreneurship and human resource training. The increase in innovative practices such as green transformation, digitalization and circular economy in industry will create new business lines and new business areas. If the necessary development is not achieved here, there may be disruptions in the healthy functioning of the system. In this context, both a strong entrepreneurship ecosystem and human resources suitable for transformation are very important goals.

3.1.5 Green Deal Action Plan

The Green Deal Action Plan was published by the Ministry of Trade in 2021 and includes important target actions and policies for Türkiye's alignment with the EU Green Deal. As Green OIZs are an important part of the green transition and green growth, the targets include the completion of work on the realization of Green OIZs and Green Industrial Zones (Ministry of Trade, 2021). The action plan also underlines that strengthening the technological infrastructure for green transformation is a priority. Within the scope of this goal, an R&D and innovation-

oriented approach is emphasized. In line with the establishment of a green and circular economy, efforts will be made to implement the Green OIZ and Green Industrial Zone certification system (Ministry of Trade, 2021).

Action 2.1.3 of the action plan is directly stated as “Completion of technical and administrative studies for the implementation of the Green OIZ and Green Industrial Zone Certification system” and provides the basis for the expansion of Green OIZs in Türkiye (Ministry of Trade, 2021).

Action 2.2.1 includes the action of “identifying the prominent technologies that will support green production through technology needs analysis and conducting studies for the development / dissemination / transfer of the identified technologies”. The responsible organizations for both actions are the Ministry of Industry and Technology and TÜBİTAK (Ministry of Trade, 2021).

3.1.6 Ministry of Industry and Technology’s Strategy Plans

Strategy Plan for 2020-2024

It is stated that efforts will be made to make industrial areas more environmentally friendly and to transform them into a green industrial ecosystem. In this context, it is stated that in addition to the studies for the transformation of the industry in the inner city, recycling industrial zones will be established and it will be aimed to bring the wastes back into the system and the treatment plant investments will continue to be supported (Ministry of Industry and Technology, 2020 Article 322.19.).

Strategy Plan for 2024-2028

Under Target 2.4, it is stated that support programs will be implemented to ensure green transformation in industry. Under Target 4.4, by referring to the Competitive Sector Program, it is stated that the green transformation of the industry will be ensured under the headings of private sector development, trade, research and innovation. Under Target 5.1, it is stated that the number and effectiveness of

industrial zones will be increased for green transformation. Quantitative targets have also been set in this context. In 2028, the end of the period of the Strategy Plan, it is targeted to support 200 companies within the scope of the Green Transformation Support Program. Within the scope of this strategy plan, it is mentioned that the Türkiye Green Industry Project will be carried out (Ministry of Industry and Technology, 2024).

3.1.7 Türkiye Green Industry Project (TGIP)

The objective of the initiative is to facilitate a streamlined transition to eco-friendly practices within Turkish industrial firms, fostering an expedited shift towards sustainability, heightened decarbonization endeavors, and enhanced technical capabilities. With a budget totaling 450 million USD, the project will be overseen by key implementing bodies including the Ministry of Industry and Technology (MoIT), the Small and Medium Enterprises Development Organization (KOSGEB), and the Scientific and Technological Research Council of Türkiye (TÜBİTAK). This endeavor is slated to span a duration of six years and covers the period of 2023 and 2029 (TGIP, 2023).

In the second part of this chapter, the regions in Türkiye will be assessed with quantitative data in terms of their socio-economic development and innovation potential. The most important reason for choosing these two categories is that cities, regions or city-regions with strong social capital as well as economic development are less resistant to such innovations and initiatives, and that investments generated under the free market naturally gravitate towards these areas. Secondly, innovation and entrepreneurship activities are one of the pillars of the new generation industry concept. For this reason, it is considered that regions with high R&D investments and regions with both developed human resources and entrepreneurial activities will have higher potential and green transition in industry can be achieved more smoothly. On the other hand, there is no certainty that a region that lags behind both in terms of socio-economic development and innovation potential cannot achieve

green transition in industry, but it is expected that there will be different challenging processes such as more public investment, incentives, transfer of human resources, awareness and awareness-raising activities. For this reason, two different indices have been created in sections 3.2 and 3.3. The assessments in the following sections will be evaluated according to the facts mentioned above.

Open-source data were used to construct the indices, raw versions of the statistical data will be presented in the appendices. The following formulation was used to construct the indices.

$$\text{Index (a)} = \frac{a(i)-a(\text{TR-Min})}{a(\text{TR-Max}) - a(\text{TR-Min})}$$

Two separate indices will be created in total. The indices and other variables will be evaluated together with the world examples to create a roadmap of recommended actions for Türkiye's green transition in the industry.

3.2 Socio-Economic Development

All policies for the applicability or implementation of the pillars of a green and sustainable industry such as innovation, economic growth, value added production, budget allocated to R&D investments, technological infrastructure are directly linked to the socio-economic development of countries or regions. Before moving on to direct indices related to green industry, it is important to first see the regional distribution of socio-economic development in order to ensure that the policy recommendations in the conclusion phase vary according to local conditions. Therefore, a general socio-economic development index was created using different data sets. Indicators used in the Socio-Economic Development Index and resources listed below.

- GDP Per Capita, 2022 (TurkStat)

- Export Performance of the Exporters, 2023 (Turkish Exporters Assembly)
- Share of the Registered Unemployed between the age of 15-64, 2022), (TurkStat)
- Net Migration (Age 15-64) by population, 2022 (TurkStat)
- Average Electricity Consumption per Capita (kWh), 2021 (TurkStat)
- Average Secondary School Enrollment Rate (women), 2022, (TurkStat)
- Ratio of Municipal Population Served by Waste Services to Total Municipal Population (%), 2022 (TurkStat)
- Ratio of Municipal Population Served by Wastewater Treatment to Total Municipal Population (%), 2022 (TurkStat)
- Ratio of Municipal Population Served by Drinking and Potable Water Treatment Plants to Total Municipal Population (%), 2022 (TurkStat)
- Ratio of Municipal Population Served by Drinking and Potable Water Network to Total Municipal Population (%), 2022 (TurkStat)
- Ratio of Municipal Population Served by Sewerage Network to Total Municipal Population (%), 2022 (TurkStat)
- Total Cash Loans by Population, 2022 (TurkStat)
- Total Deposits by Population, 2022 (TurkStat)

All scores are ranked between 0 and 1. When calculating the average index, no weighting was applied and the arithmetic average of all indicators was taken. Minimum value is equal to 0,141 and maximum value is equal to 0,832. Arithmetic mean of the index serie is equal to 0,477 and median of the serie is equal to 0,483. Standart deviation of the serie is equal to 0,187.

The scores are listed in 5 different categories. TR10 region is in the most developed category. TR42, TR51, TR31, TR41, TR21 and TR61 regions are in the developed category respectively. TR32, TR22, TR52, TR33, TR33, TR81, TRC1 and TR62 regions are above average. TR72, TR63, TR83 and TR71 regions are in the below average category. TR82, TRB1, TR90 and TRA1 regions are in the least developed

category, while TRC3, TRA2, TRC2 and TRB2 regions are in the least developed category.

A visualized version of the Socio-Economic Development index on a map is shown in Figure 3.1. Raw data for all indicators and sub-indicators related to the Socio-Economic Development Index are available in the Appendix 1: Raw Data. Raw data for all indicators and sub-indicators related to the Socio-Economic Development Index are available in the Appendix 1: Raw Data section.

While the indices were developed, there was no weighting among the indicators and all indicators were considered at the same level of importance and scores were calculated.

Provinces in the Marmara region, where Türkiye's industry is strong, and provinces in its hinterland are in the high and above average category. As shown in the map, there is a clear development gap between the regions, which necessitates different policies. Different options here should be shaped around the idea of maximizing the potential of regions that already have significant potential and are suitable in terms of infrastructure, while raising the development level of those regions with policies specific to regions with low development levels.

Raw data for all indicators and sub-indicators related to the Socio-Economic Development Index are available in the Appendix 1: Raw Data section.

While the indices were developed, there was no weighting among the indicators and all indicators were considered at the same level of importance and scores were calculated.

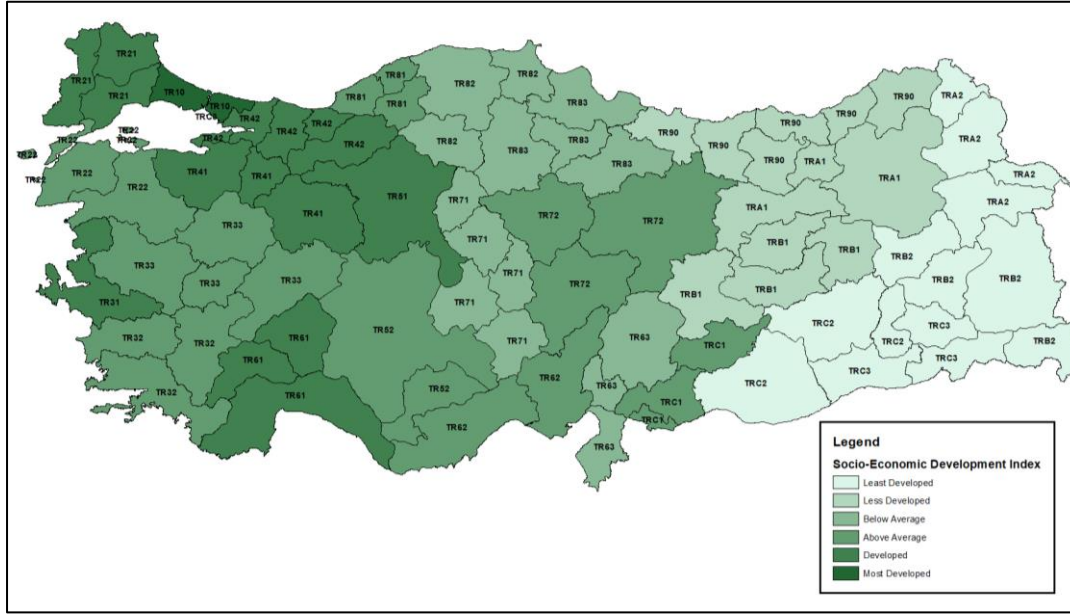


Figure 3.1 Socio-Economic Development Index

The full performance scores for the Socio-Economic Development Index are also presented in Table 3.3.

Table 3.3 Socio-Economic Index Score for Regions

Regional Code	Provinces	Total Index Score
TR10	İstanbul	0,832
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	0,771
TR51	Ankara	0,719
TR31	İzmir	0,716
TR41	Bursa, Eskişehir, Bilecik	0,712
TR21	Tekirdağ, Edirne, Kırklareli	0,600
TR61	Antalya, Isparta, Burdur	0,595
TR32	Aydın, Denizli, Muğla	0,563
TR22	Balıkesir, Çanakkale	0,555
TR52	Konya, Karaman	0,539
TR33	Manisa, Afyonkarahisar, Kütahya, Uşak	0,539
TR81	Zonguldak, Karabük, Bartın	0,531
TRC1	Gaziantep, Adıyaman, Kilis	0,495
TR62	Adana, Mersin	0,470
TR72	Kayseri, Sivas, Yozgat	0,468
TR63	Hatay, Kahramanmaraş, Osmaniye	0,432
TR83	Samsun, Tokat, Çorum, Amasya	0,432
TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	0,417
TR82	Kastamonu, Çankırı, Sinop	0,397

TRB1	Malatya, Elazığ, Bingöl, Tunceli	0,323
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	0,316
TRA1	Erzurum, Erzincan, Bayburt	0,276
TRC3	Mardin, Batman, Şırnak, Siirt	0,222
TRA2	Ağrı, Kars, Iğdır, Ardahan	0,205
TRC2	Şanlıurfa, Diyarbakır	0,161
TRB2	Van, Muş, Bitlis, Hakkari	0,114

3.3 Innovation Index

The Innovation Index was established to understand the potential of regions in Türkiye to move towards innovative practices. Since the index is based on industrial practices, the population of the regions working in industry was used. Indicators used for the innovation index are listed below.

- R&D Expenditures (1000 TL), 2022 (TurkStat)
- R&D Personal, 2022 (TurkStat)
- Employment in Industry (%), 2023, (TurkStat)
- Amount of exports in the information and communication sector (\$1000), 2022 (TurkStat)
- Total Number of Patents, 2023 (Turkish Patent Institution)
- Total Number of Technology Development Zones, 2024 (Ministry of Industry and Technology)
- Total Number of R&D Centers, 2024 (Ministry of Industry and Technology)
- Number of Entrepreneurship by Population of 15-64, 2022 (TurkStat)
- Information and Communications Sector in GDP, 2022 (TurkStat)
- Total Registered Trademarks, 2023 (Turkish Patent Institution)
- Total Registered Designs, 2023 (Turkish Patent Institution)
- Total Registered Design Centers, 2023 (Turkish Patent Institution)
- Total Number of Registered Utility Models, 2023 (Turkish Patent Institution)

For all indicators, values are ranked between 0-1. When calculating the average index score, no weighting was applied and a direct arithmetic mean was calculated. The maximum value of the index is equal to 0.961 and the minimum value is equal to 0.036. The median value is equal to 0.137, the arithmetic mean to 0.189 and the standard deviation to 0.188.

Regions are ranked according to 6 different levels according to the total score created according to the indicators used. It is demonstrating in the Figure 3.2 Innovation Index. As expected, there are clear regional differences in this index as well. The TR10 Istanbul region stands out as the region with the highest potential by far according to the index scores. TR51 and TR41 regions are in the second category. The other two regions with above average potential are TR42 and TR31, respectively. TR21, TR52, TR32, TRC1, TR72, TR33, TR61 regions are in the average category. TR62, TR22, TR63, TR71, TR81, TR82, TR82, TR83, TR90 regions are ranked as low potential regions. TRB1, TRC2, TRC3, TRB2, TRA1, TRA2 regions are categorized as regions with the lowest potential respectively.²

² Innovation Index contains data from TURKSTAT, Ministry of Industry and Technology, Turkish Patent Institution

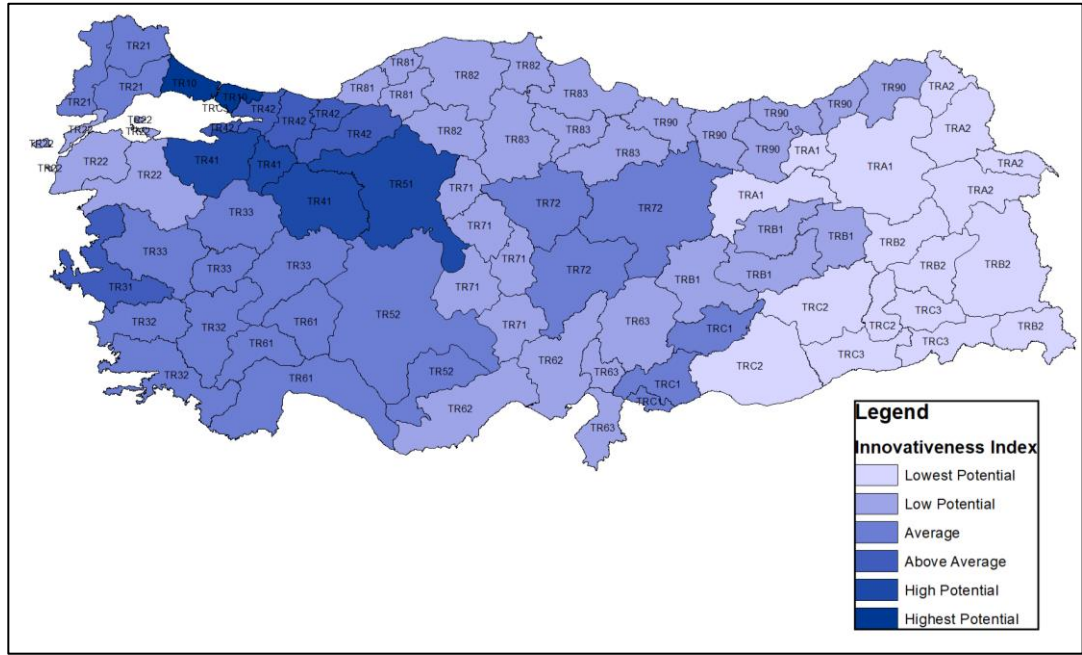


Figure 3.2 Innovation Index

Full scores for the index is shown below in the Table 3.4.

Table 3.4 Innovation Index Score for Regions

Regional Code	Provinces	Total Score
TR10	İstanbul	0,958033
TR51	Ankara	0,485669
TR41	Bursa, Eskişehir, Bilecik	0,398562
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	0,35582
TR31	İzmir	0,334507
TR21	Tekirdağ, Edirne, Kırklareli	0,243872
TR52	Konya, Karaman	0,218964
TR32	Aydın, Denizli, Muğla	0,190631
TRC1	Gaziantep, Adıyaman, Kilis	0,190024
TR72	Kayseri, Sivas, Yozgat	0,175588
TR33	Manisa, Afyonkarahisar, Kütahya, Uşak	0,168628
TR61	Antalya, Isparta, Burdur	0,1674
TR62	Adana, Mersin	0,156562
TR22	Balıkesir, Çanakkale	0,140329
TR63	Hatay, Kahramanmaraş, Osmaniye	0,133023
TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	0,130643
TR81	Zonguldak, Karabük, Bartın	0,130415

TR82	Kastamonu, Çankırı, Sinop	0,115365
TR83	Samsun, Tokat, Çorum, Amasya	0,115265
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	0,112424
TRB1	Malatya, Elazığ, Bingöl, Tunceli	0,102731
TRC2	Şanlıurfa, Diyarbakır	0,073505
TRC3	Mardin, Batman, Şırnak, Siirt	0,039663
TRB2	Van, Muş, Bitlis, Hakkari	0,030191
TRA1	Erzurum, Erzincan, Bayburt	0,027992
TRA2	Ağrı, Kars, Iğdır, Ardahan	0,007138

There are two important findings from the index scores of the regions in Türkiye. First, when the performances of regions in Türkiye are evaluated, there are inequalities in terms of both socio-economic development and innovation scores. The second is that these inequalities have similar patterns. It is assessed that these scores and patterns indicate a potential for green industries. It is expected to be a basis for the privatization of regional policies.

3.4 Türkiye's Current Situation on UN's Sustainable Development Goals

The objectives of Sustainable Development Goal (SDG) 9 are to develop innovative solutions, encourage sustainable industrialization, and create resilient infrastructure. This and all other SDGs can only be accomplished in large part through industrial development (UNIDO, 2023).

In this section, Türkiye's general situation in terms of Industry, Innovation and Infrastructure, which is one of the United Nations Sustainable Development Goal 9, will be examined. There are 12 sub-indicators in total under Goal 9.

Indicator 9.b.1 indicates that although the share of manufacturing industry sectors producing high and medium-high technology value-added in total value-added increased by 10% in the 11 years after 2010, the rate calculated for 2021 lagged behind 2019 and 2020, as it is indicated in the Figure 3.3 (TURKSTAT, 2022). One of the important reasons for this is probably the negative economic impacts of the

Covid-19 pandemic. The fact that a similar decline was experienced in developed economies such as Germany, France and the U.S.A. supports this assumption (UN SDG, 2022). Since the last published data on the relevant indicator is from 2021, there is no opinion on whether the negative effects of the pandemic have been overcome in the meantime.

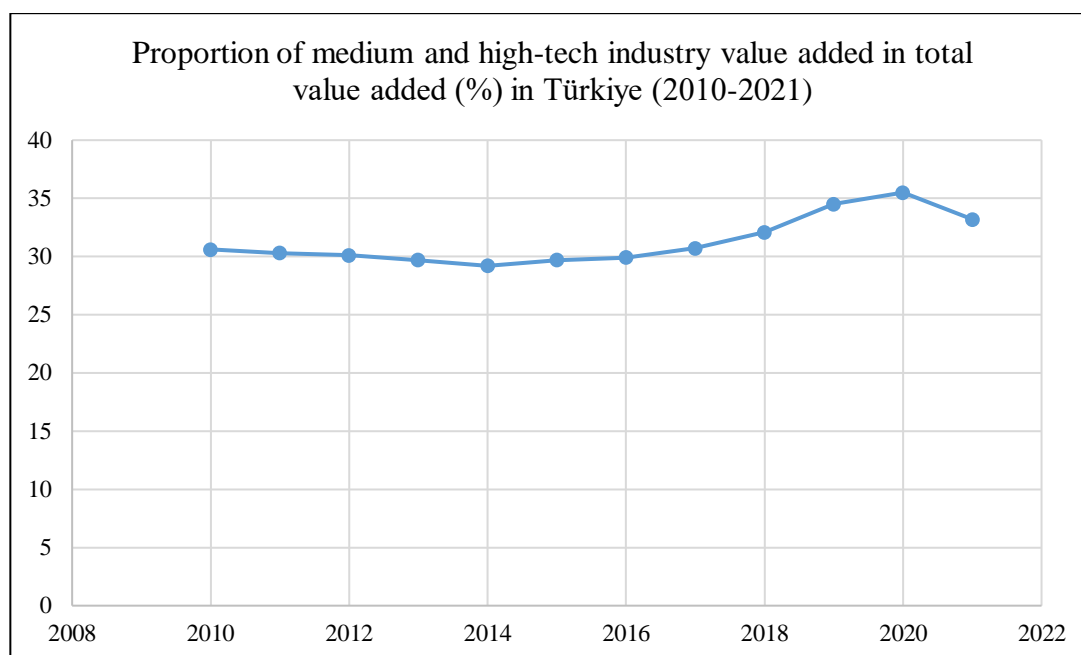


Figure 3.3 Proportion of medium and high-tech industry value added in total value added (%) in Türkiye (2010-2021)

There are three sub-indicators under indicator 9.4.1. These indicators are listed below.

- CO₂ emissions per unit of value added
- CO₂ emissions from combustion
- Manufacturing industry CO₂ emissions per manufacturing industry value added

Figure 3.4, Figure 3.5, Figure 3.6 and indicate the data for these sub-indicators respectively (TurkStat, 2024).

When the data in the graphs are analyzed, it is seen that the carbon emission produced per value added has been in a steady downward trend in recent years. Contrary to the downward trend that started in 2017, CO2 emissions from combustion reached the highest level of the last 11 years in 2021, which can be described as worrying.

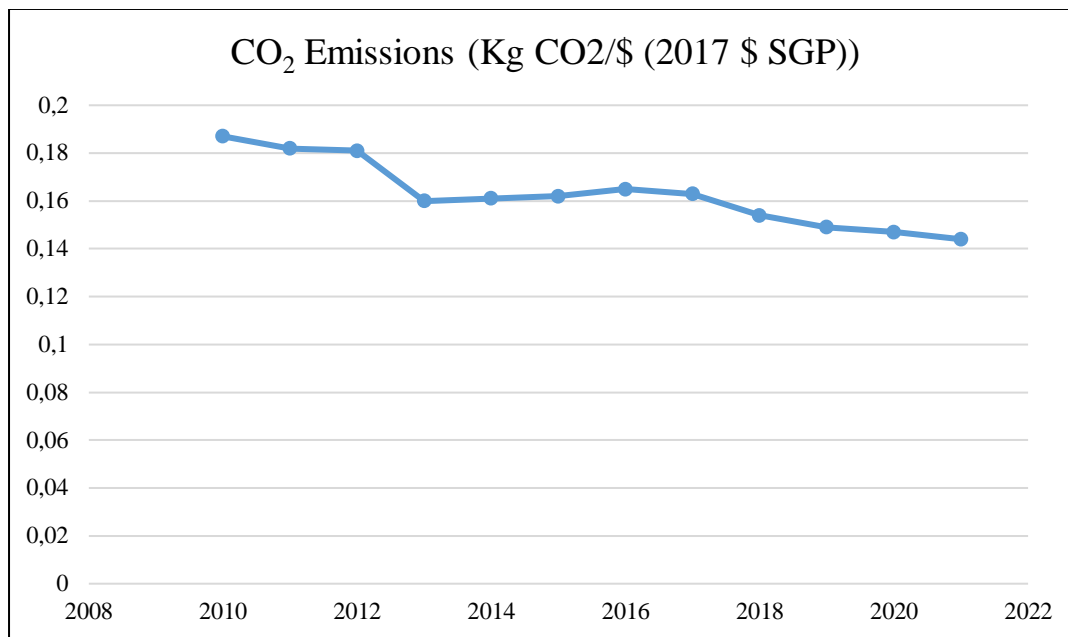


Figure 3.4 CO2 Emissions per unit of value added

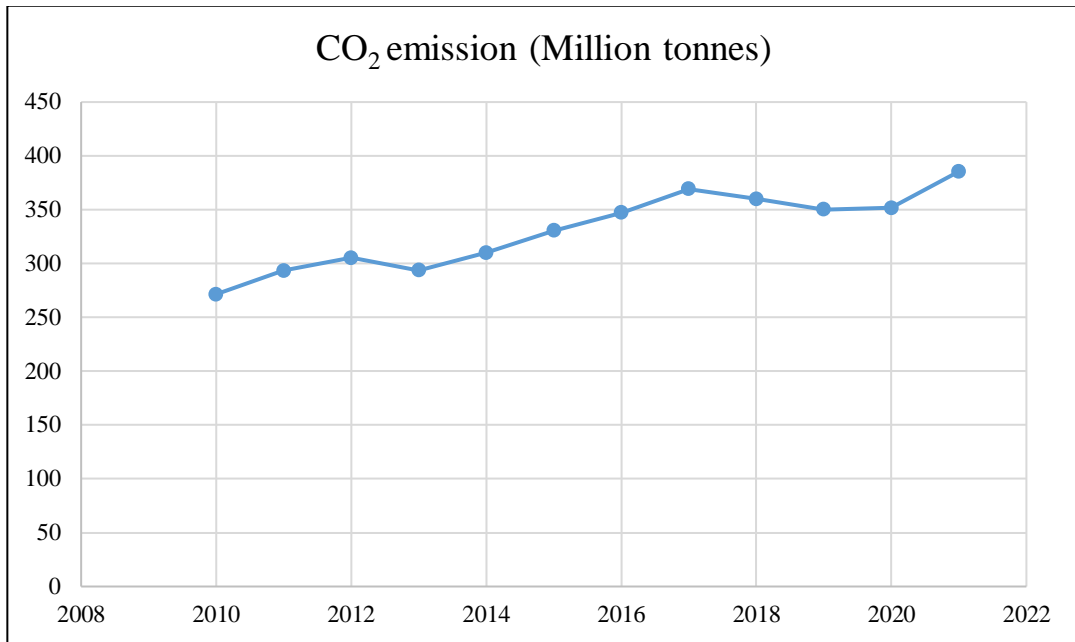


Figure 3.5 CO₂ emissions from combustion

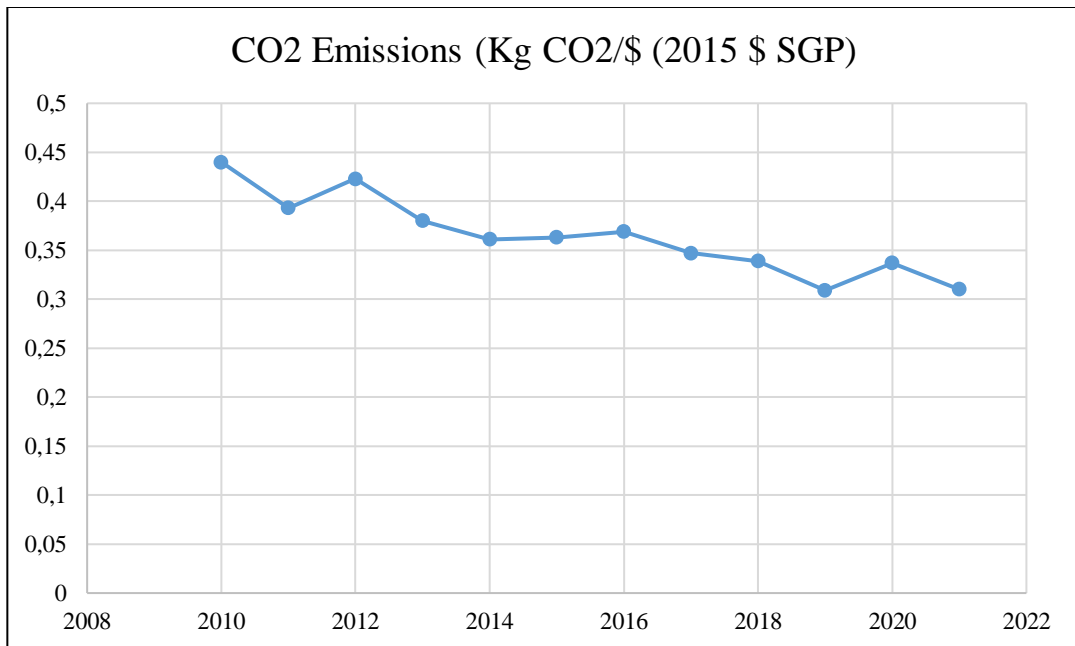


Figure 3.6 Manufacturing industry CO₂ emissions per manufacturing industry value added

In addition, the distribution of GHG emissions by sectors according to 2022 TurkStat data is shown in Figure 3.7. Accordingly, the energy sector emerges as responsible

for the majority of GHG emissions. Industrial activities and product use and agricultural activities cause GHG emissions at very close rates, and waste-related activities are responsible for about 3% of the GHG emissions produced. In this context, one of the most important reasons for the increase in CO₂ emissions from combustion shown in Figure 3.5 is the generation of electrical energy. In this context, it is considered that the change in energy generation activities will be an important milestone for the transition to a carbon-neutral economy.

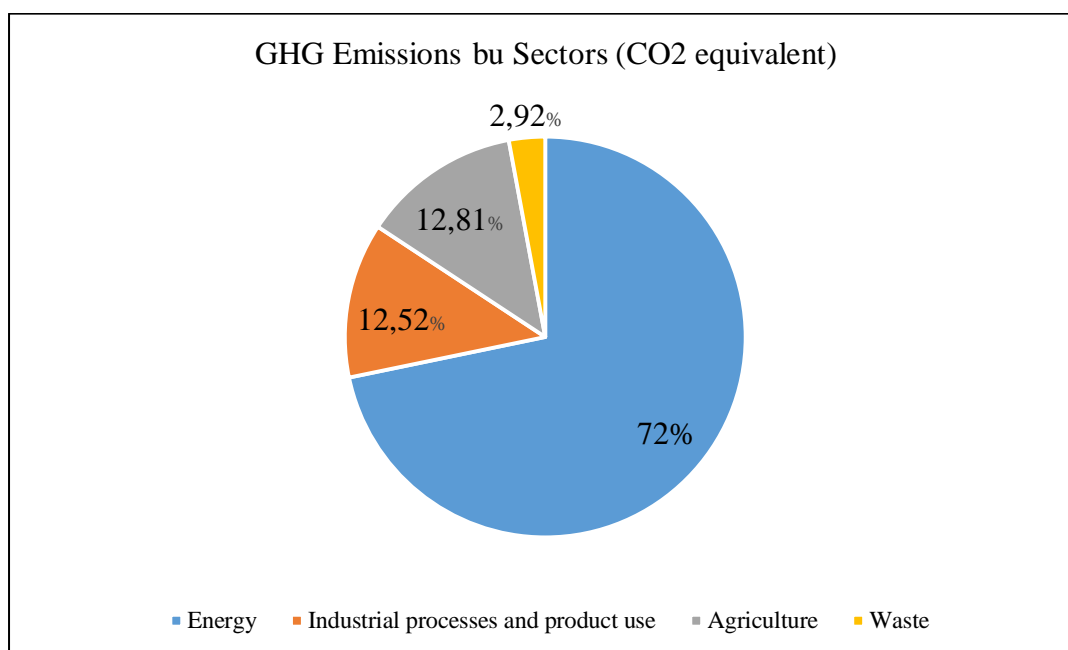


Figure 3.7 GHG Emissions bu Sectors (CO₂ equivalent)

Goals 9.5.1 and 9.5.2 refer to R&D expenditures and the number of researchers per million inhabitants. Regional expenditure on R&D and the number of R&D personnel were two of the indicators used to calculate the innovation index. As shown in Figure 3.8, the share of R&D expenditures in GDP has been increasing over the years. Figure 3.9 shows the distribution of R&D expenditures by source of finance. When these data are evaluated, while the public sector's R&D investments are on a downward trend, the share of the private sector is on an upward trend. The share of higher education institutions decreased after peaking in 2017. At this point, it can be noted that the share of universities should increase. Figure 3.10 shows the

distribution of R&D expenditures by sector. The share of the private sector is 61.3%, the share of universities is 34.2% and the share of general public spending is 4.5%. The fact that the private sector's R&D expenditure ranks first is promising for the transformation of the industry along the innovation axis.

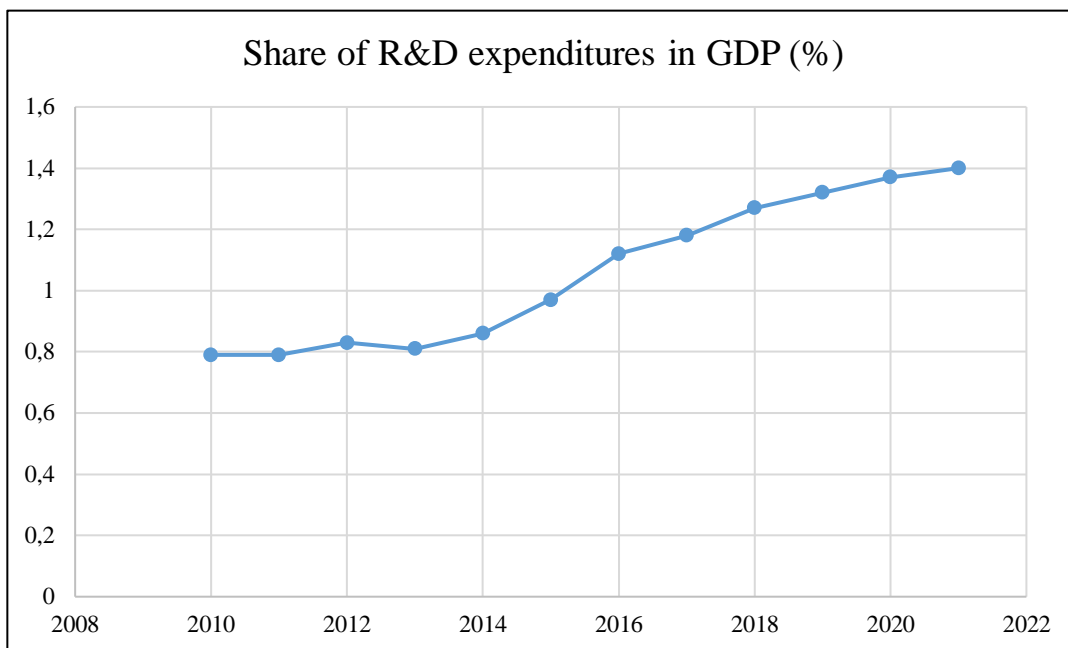


Figure 3.8 Share of R&D expenditures in GDP (%)

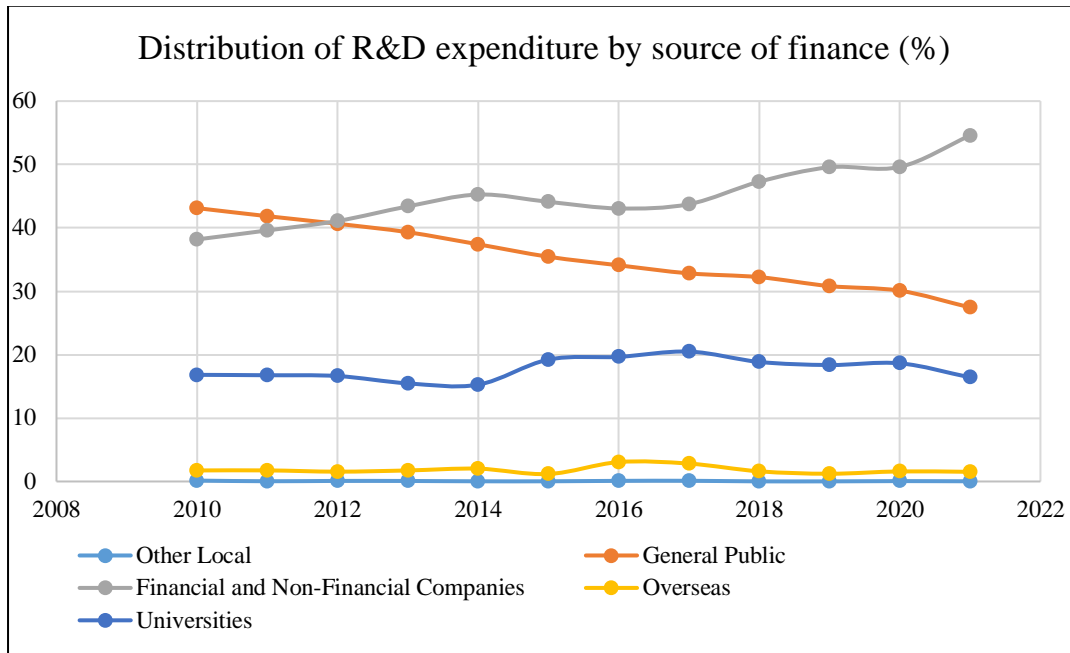


Figure 3.9 Distribution of R&D Expenditure by Source of Finance (%)

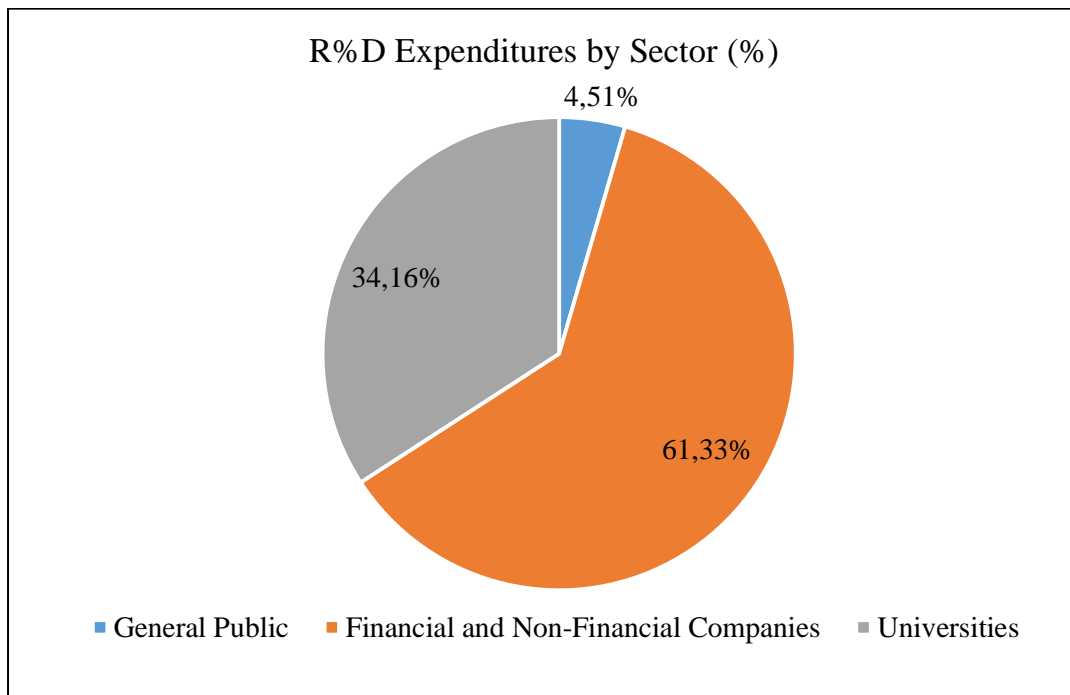


Figure 3.10 R&D Expenditures by Sector (%)

On the other hand, indicator 9.5.2, the number of researchers per 1 million inhabitants, has been on a steady upward trend. The upward trend is shown in Figure 3.11.

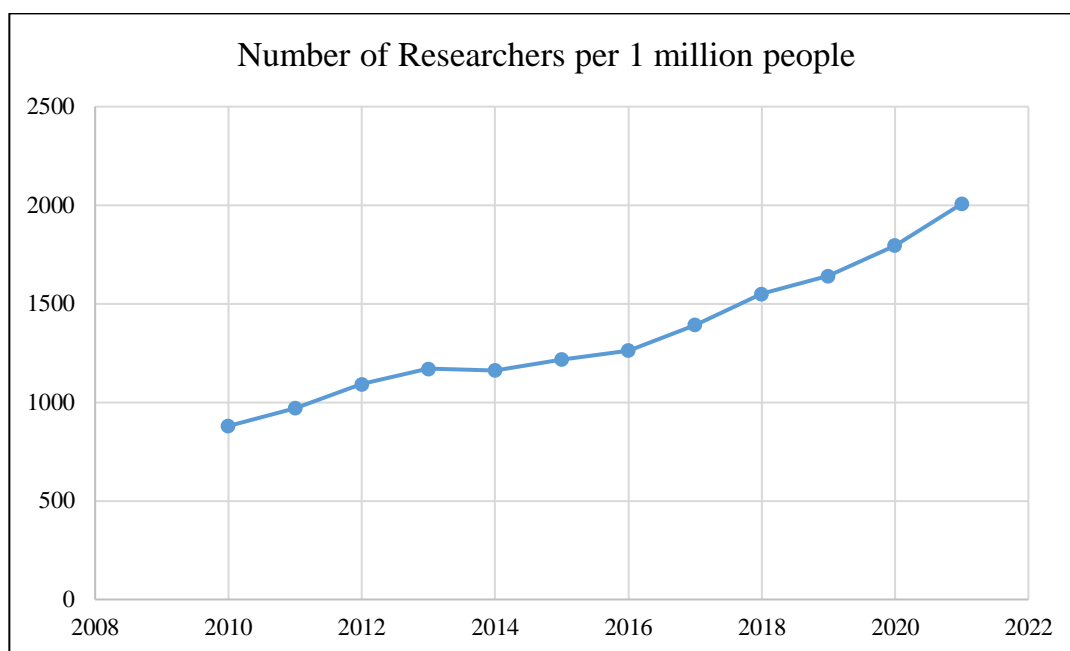


Figure 3.11 Number of Researchers per 1 million people

Figure 3.12 illustrates the number of researchers by sector. The upward trend in the private sector is particularly striking. When the data are evaluated, the number of researchers in the private sector in 2021 has approximately doubled compared to 2016. In this country, it can be stated that the private sector shapes its human resources according to current developments. Again, the number of researchers in universities continues to increase, with the exception of the year 2016.

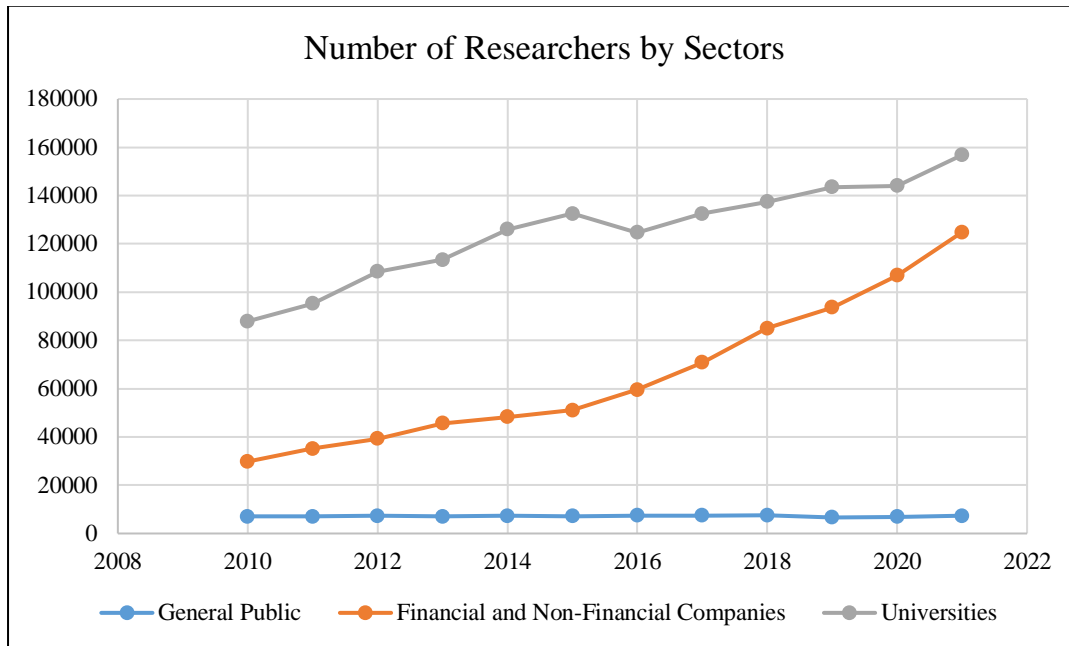


Figure 3.12 Number of Researchers by Sectors

The per capita ratio of the value added of the manufacturing industry calculated on the basis of purchasing power parity is one of the sub-indicators under SDG 9.2.1. As seen in Figure 3.13, Türkiye has been on an upward trend in this indicator in recent years. After a one-year downward trend in 2018, the rate of increase according to 2021 data is approximately 25% in a two-year period.

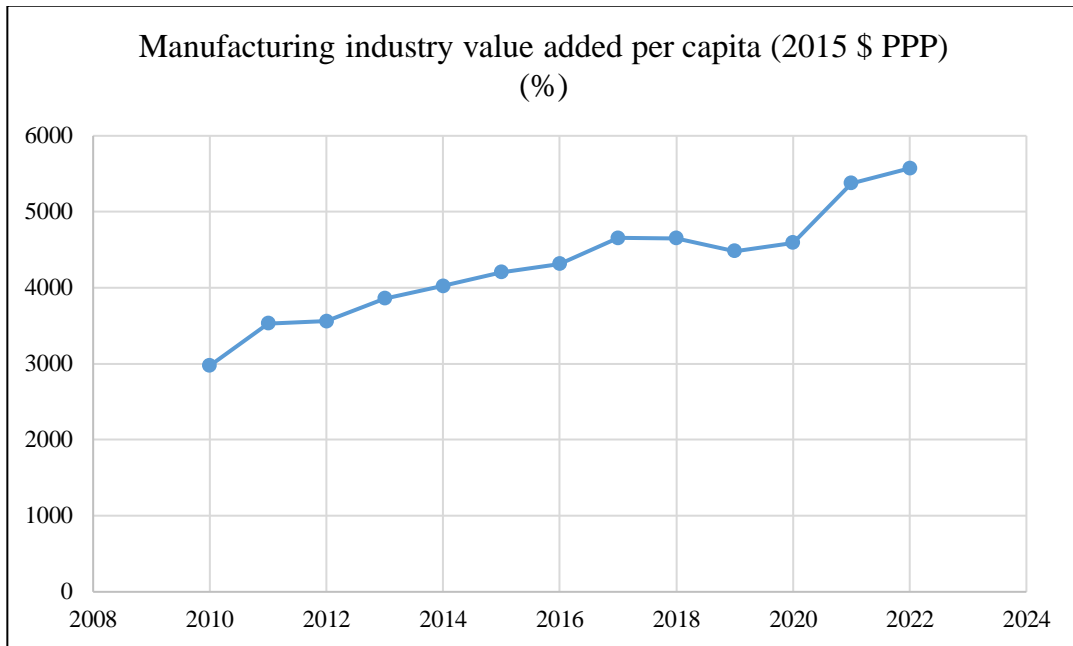


Figure 3.13 Manufacturing industry value added per capita (2015 \$ PPP) (%)

Goal 9.3 specifically emphasizes increasing the access of small industrial enterprises to finance and their integration into value chains and markets. This is highly important for increasing the number of innovative enterprises in industry, and directly for innovative and green industries in industry. In this context, the share of micro-scale enterprises in total manufacturing industry value added has been on a sharp downward trend. From 4.1% in 2019, this share dropped to 2.4% in 2021. In the 11-year period since 2010, there has been an increase in this indicator only in 2012 and 2018 (TurkStat, 2024). The share of micro-scale industries with a cash or non-cash loan debt was 40.7% in 2021 and has remained around 40% for the last 5 years. In this context, it can be inferred that a significant portion of micro-scale industries have easier access to finance, while others have difficulty in accessing finance (TurkStat, 2024).

As a result of the assessments conducted, it is seen that Türkiye's sustainability efforts are reflected in the indicators of the UN SDG targets. In particular, the upward trend in private sector R&D expenditures can be considered promising for the industry to adapt to new international agenda. On the other hand, public sector R&D

expenditures continue to decline. Considering the direct relationship between new generation industrial zones and innovation and technology development and the examples from abroad where new generation industrial zones are supported by financing instruments in line with a national strategy rather than individual initiatives, the downward trend in public expenditures is evaluated as a negative outcome.

On the other hand, the increasing trends in the manufacturing industry value added per capita and the number of researchers in the private sector are considered promising. The private sector needs to allocate resources for topics that are not yet regulated in Türkiye, especially when the export situation with the EU is considered. R&D activities are one of these topics. In this context, the private sector is increasing the amount of investment in both R&D activities and personnel.

In the next section of the study, a case study will be conducted in order to evaluate the reflections of all these numerical data on the ground and to understand the current practices in OIZs that can be characterized as innovative.

3.5 Case Study

The purpose of the case study was to understand and evaluate the current practices of OIZs in Türkiye, which can be characterized as innovative, in line with the developments in the world and in Türkiye. To do this, 10 interview questions were developed. All questions and responses are given in the Appendix 2: , and Appendix 3: Responses. Representatives from the different units of the OIZs responded to the questions as institutional opinions. Questions were submitted in writing and answers were formally obtained in written form.

One of the important projects carried out in Türkiye to improve the innovative infrastructure of industrial zones is the "Technology Development in OIZs Project". There are four OIZs involved in this project, which is supported by the Presidential

Strategy and Budget Presidency and implemented by the Ministry of Industry and Technology and UNDP. The OIZs interviewed are listed below.

- Manisa OIZ
- Yalova OIZ

In this context, two of the four OIZs mentioned above, Yalova and Manisa OIZ, responded to the questions. Responses were received from Manisa OIZ on July 19, 2024 and Yalova OIZ on September 27, 2024.

Within the scope of the interview, a total of 10 open-ended questions were prepared, and the responses were got by the experts from the Department of Environment, and Innovation Center of the Manisa OIZ. Questions were prepared to better understand their aspects for the green industry, on topics such as innovation, green industry, circular economy, entrepreneurship, green declarations, green laundering, value-added production, current practices and legal infrastructure in Türkiye, increasing professional competence and mitigation of lost professions, industrial symbiosis, and responses was received on both current practices and future visions. Interview question form can be found in Appendix 2: .

The same questions were asked to the representatives of both OIZs and the question set was not changed.

Respondents from both organizations indicated that Türkiye has made significant efforts with different institutions. In particular, supporting these initiatives with European Union and World Bank funds is important to facilitate access to finance and such initiatives increase the level of awareness on the issue.

3.5.1 Manisa OIZ

The first question aimed to get an overall assessment of Türkiye's efforts to transition to a green and sustainable economy

Manisa OIZ emphasized that despite all these efforts, there is a lack of an inclusive study on the extent to which companies are ready for this transformation. In particular, it was stated that the level of preparations for situations where sanctions and trade restrictions may occur should be discussed and it was underlined that more clear and concrete focused studies should be carried out on these issues.

The second question emphasized that entrepreneurship and innovation activities are the pillars for new generation industrial zones and asked for an assessment of the current situation and needs in line with the studies conducted in their OIZs on these issues.

There is a striking point in the response of Manisa OIZ. It is stated that OIZs are in a better institutional position in terms of the mentioned issues, but the efforts of the companies on these issues are low.

It was stated that one of the main purposes of establishing innovation centers within industrial zones is to provide services to firms in the context of entrepreneurship and innovation activities, including business development, and that capacity building activities are carried out through these centers in Manisa OIZ for both firms and different units of the OIZ. In this context, it was stated that it is important that innovation centers are designed and managed as separate units from OIZ administrations, otherwise it is very difficult for OIZs to carry out these activities with their own capacities.

The third question is whether OIZ administrations are conducting a study on the green claims of their companies. While green claims constitute an important opportunity, the possibility of greenwashing has the potential to be an equally important problem. In this context, the work of companies and OIZs will become more important in the coming years.

In the response given by Manisa OIZ, it was stated that companies do not currently have any studies on these issues. At this point, although it is not stated in the response, it is considered that the OIZ management also does not have any work.

The fourth question was designed to assess the relationship between OIZs and both vocational education institutions and universities.

Manisa OIZ stated that both vocational high schools and cooperation with universities are established within OIZs to train qualified personnel. In particular, it was underlined that the fact that vocational high schools are located within OIZs, receive the necessary financial support and work closely with companies contributes to the development of both vocational high schools, students and companies in this field.

In the fifth question, the importance of raising citizens' awareness, participation and trust in the process is emphasized and awareness raising activities carried out by OIZs both inside and outside the OIZ are expected to be evaluated.

In the response provided by Manisa OIZ, it is stated that training and information meetings are organized for companies. In addition, it is reported that capacity building trainings are organized for the OIZ management's own staff. In addition, it is stated that analyzes are conducted to increase the eco-production capacities of companies and the corporate sustainability report is regularly published.

The sixth question is related to incentive mechanisms. In the question, it was stated that green industrial investments, R&D activities or innovative initiatives are expensive and have long payback processes, and an assessment was requested on what kind of incentive mechanisms might be appropriate in this regard.

In the response given by Manisa OIZ, it was stated that no answer could be given since there is no study conducted on this issue.

The seventh question is about the Green Industry Support Program run by the Ministry of Industry and Technology. It was asked whether they received any support under this program and their perspectives on the application criteria.

In its response, Manisa OIZ stated that they were informed about the program, attended various promotional meetings, and even stated that a meeting was held within the OIZ, but they did not make an application.

The eighth question is related to professions that may disappear, require new skills, change shape or be created from scratch with the green and circular economy. It is asked whether OIZs are conducting studies on these issues within their own organization and whether they see a demand from companies in this context.

Manisa OIZ stated that it does not conduct any work on this subject.

The ninth question is related to the dissemination of industrial symbiosis practices. It is evaluated that resource efficiency will increase with the dissemination of industrial symbiosis practices, end of waste, secondary raw material and by-product practices. Resource efficiency is a concept at the core of new generation industrial zones. In this context, opinions on the establishment of a nationwide industrial symbiosis network were asked, as well as opinions on the approach to systematize this issue from the initiative of the companies to a systematic approach supervised by the public authority.

Manisa OIZ stated that such a network has been tried in Türkiye before, and that there have been various efforts by both OIZs and Development Agencies, but without success. It is emphasized that one of the most striking problems is that the culture of cooperation is almost non-existent and this is the point that needs to be improved. On the other hand, it was also stated that a centralized strategic system with penalties and obligations could be more successful, but detailed analysis studies should be carried out.

The tenth and last question deals with the views on the dissemination of green industrial practices and making some practices such as green buildings, green production, green labels, innovation centers, research centers and technology development zones, prevention of waste incineration mandatory under a national strategy.

In the response given by Manisa OIZ, it is stated that a national strategy should be developed for the widespread implementation of green buildings, technology development zones, research centers, green production, green labels, etc. It was

stated that the relevant issues should be defined within the framework of regional development plans and related strategies.

3.5.2 Yalova OIZ

The first question aimed to get an overall assessment of Türkiye's efforts to transition to a green and sustainable economy

Yalova OIZ responded that Türkiye's legislative and policy-making efforts have been very positive, especially in terms of regulating trade relations with the EU. However, it was emphasized that the process has been incomplete on the part of small and medium-sized enterprises. In line with the general opinion, it was emphasized that large-scale companies accelerated this process by themselves, especially in order to sustain their trade with the EU. For this reason, the need for comprehensive and widespread studies on how the process will proceed for small and medium-sized companies was emphasized. At this point, it is stated that especially large-scale companies make a difference in terms of creating the necessary staff and finding investment financing due to their greater opportunities. The second point that draws attention in the response to the question is that companies should be supported more in terms of financing, issues such as incentives and tax reductions should be more on the agenda, and it is underlined that a distinction should be made between companies that carry out environmentally sensitive and sustainable processes and companies that act in the opposite direction. In this context, it was stated that an important source of financing was created with the Green Industry Support Project, however, the importance of implementing a more holistic legislation, action plan, awareness raising, financing, implementation, control and rewarding/punishment steps was emphasized.

The second question emphasized that entrepreneurship and innovation activities are the pillars for new generation industrial zones and asked for an assessment of the current situation and needs in line with the studies conducted in their OIZs on these issues.

Yalova OIZ stated that their motto is from idea to export and that they carry out their activities within this framework and strive to spread the project and innovation culture. In this context, it was stated that project competitions are carried out at the middle and high school levels and that it is very important to spread the idea of entrepreneurship at these levels. It was stated that mentoring, capacity building and financial support are provided to students in national and international competitions and events such as hackathons and ideatons. It was stated that students, industry or individuals from academia who want to engage in entrepreneurship activities are supported to grow through incubation processes within Teknopark. It was stated that with the intellectual and industrial property consultancy unit established within the OIZ, studies are carried out on the development of the national inventory and company-entrepreneur matches are made within the scope of idea and process innovations with the innovation center. With these matches, it was stated that they were directed to the minimum medium-high technology production area. It was stated that this model is expected to have positive contributions for the general entrepreneurship ecosystem, but that the city is just developing in terms of industry and entrepreneurship ecosystem and therefore it is expected to take time to get results. It was stated that this model could yield significant results in a shorter period of time in regions with a more developed entrepreneurship ecosystem.

The third question is whether OIZ administrations are conducting a study on the green claims of their companies. While green claims constitute an important opportunity, the possibility of greenwashing has the potential to be an equally important problem. In this context, the work of companies and OIZs will become more important in the coming years.

In the response given by Yalova OIZ, it was stated that the green claims made by firms have not yet reached a certain level, but after the number of these claims increases and reaches a certain level of maturity, studies can be carried out on whether there is green laundering or verified claims, and at that point, these efforts will gain importance. At this point, it was emphasized that improvements should be made in terms of legal legislation. As an example, it was emphasized that there are

details concerning the chemical and textile sectors in the context of environmental labeling, but the details regarding the environmental declarations of building materials or wood products have not yet been formed, and that work on this should continue.

The fourth question was designed to assess the relationship between OIZs and both vocational education institutions and universities.

In its response to the fourth question, Yalova OIZ stated that it attaches great importance to both vocational education and university education. It was stated that at a time when the factories within the OIZ were not yet operational, a protocol was made with a vocational high school located in an area close to the OIZ and work was started to provide qualified employment to the industry. Within the scope of this project, it was stated that the capacity of the vocational high school was increased by 130% within three years and that students graduating from the vocational high school today are placed in jobs in factories.

Regarding university education, it was stated that within the scope of the protocol signed with Yalova University's Faculty of Engineering, a project has been initiated to gradually move all engineering departments to the OIZ campus, starting with the Mechanical Engineering, Industrial Engineering and Electronics Engineering departments.

In addition, it was reported that the processes for the establishment of a vocational training center and a specialized vocational high school within the OIZ are being carried out with official institutions. Another important initiative at this point is the course programs developed for the unemployed in the city and the employment of these people within the OIZ. With this project, it is planned to employ 20 thousand qualified workers within the OIZ within 6 years without external migration.

In the fifth question, the importance of raising citizens' awareness, participation and trust in the process is emphasized and awareness raising activities carried out by OIZs both inside and outside the OIZ are expected to be evaluated.

In the response given by Yalova OIZ, it was stated that Yalova is not at a point where it has accepted industrial production, which necessitated a lot of awareness and promotion work during the establishment and development process of the OIZ. It was stated that in the past 3 years, many meetings and workshops have been organized with public institutions and the Chamber of Commerce and Industry on awareness raising, awareness and future planning. It was underlined that OIZ tours were organized and awareness-raising activities were disseminated by coming together with middle, high school, high school and university students and the public. The level of public awareness and support has increased in recent years due to factors such as increased employment and educational cooperation.

The sixth question is related to incentive mechanisms. In the question, it was stated that green industrial investments, R&D activities or innovative initiatives are expensive and have long payback processes, and an assessment was requested on what kind of incentive mechanisms might be appropriate in this regard.

In the response given by Yalova OIZ, it was stated that innovative or green OIZs can be implemented without much cost difference with the right green investments during the establishment phase. If the use of green buildings and green practices is supported during the construction phase, the return on investments can be easier. Even incentives such as exemption from certification fees for factories that apply for green building can encourage companies.

The seventh question is about the Green Industry Support Program run by the Ministry of Industry and Technology. It was asked whether they received any support under this program and their perspectives on the application criteria.

Yalova OIZ stated that it actively benefits from the program and that the Integrated Communication and Data Infrastructure System project was supported under the Green Industry Support Program. In this context, it was emphasized that parts with approved zoning plans can receive support during the application process, and it was stated that this situation can be challenging for newly established OIZs at some points.

The eighth question is related to professions that may disappear, require new skills, change shape or be created from scratch with the green and circular economy. It is asked whether OIZs are conducting studies on these issues within their own organization and whether they see a demand from companies in this context.

It was stated that Yalova OIZ conducted a comprehensive survey study on which occupational groups and which types of employees are needed by the companies within the OIZ and an employment road map was created in this context. The activities planned to be carried out within the scope of this study have been planned as short, medium and long term actions. In this context, it was stated that the survey is renewed every year and occupational groups are determined according to the needs. As an output of the study, it was emphasized that the need for green and digital collars is an increasing trend.

The ninth question is related to the dissemination of industrial symbiosis practices. It is evaluated that resource efficiency will increase with the dissemination of industrial symbiosis practices, end of waste, secondary raw material and by-product practices. Resource efficiency is a concept at the core of new generation industrial zones. In this context, opinions on the establishment of a nationwide industrial symbiosis network were asked, as well as opinions on the approach to systematize this issue from the initiative of the companies to a systematic approach supervised by the public authority.

Yalova OIZ responded that the establishment of a nationwide industrial symbiosis network could be very efficient. In particular, it was underlined that symbiotic pairings become more difficult as the area shrinks and specialization increases. In addition, it is considered that it is difficult for companies with low amounts of waste or by-products to be included in the system, but the expansion of the system across the country can facilitate this situation. It was stated that the establishment of a nationwide network can be expected to increase the participation and matching rate. Thus, it was emphasized that costs can be reduced and resource efficiency can increase through joint investments.

The tenth and last question deals with the views on the dissemination of green industrial practices and making some practices such as green buildings, green production, green labels, innovation centers, research centers and technology development zones, prevention of waste incineration mandatory under a national strategy.

In the response given by Yalova OIZ, it was stated that basic approaches to green transformation should be determined and obligations should be imposed on companies. In addition, it is evaluated that an additional scoring system should be introduced for industrialists by determining certain criteria and incentives should be given in this context. It is stated that industrialists are divided into two groups here. It is stated that there are companies that are aware of this transformation and take action on this issue and companies that do not find it necessary to take action on this issue yet. In this context, it is considered that the public authority should evaluate all these contexts and determine the minimum practices such as green building certification, solar panel applications, rainwater retention ponds in OIZs, make them mandatory and inspect them. In addition, as examples of good practices, eco-labels and the use of innovative products that produce less carbon should be promoted.

3.6 Outcomes

In both indices, regional development disparities in Türkiye are clearly seen. This is considered to be a situation that was essentially expected before this study was conducted. Looking at the numerical results, it would be too simplistic to comment that the TR10 region, i.e. the province of Istanbul, which ranks first in both indices, should be selected and should be the center of the green transition in the industry with pilot applications and investments. Istanbul establishes high level of relations with other cities and regions in its hinterland for the flow of goods, people and services. As a result of the process of decentralization of industrial areas first from the city centers and then from the wider borders of the city, which started in the 1980s, a developed industrial structure is observed in the provinces and regions

around Istanbul. In this context, when exogenous factors such as proximity to qualified human resources, R&D investments, developed urban infrastructure, spending capacity, and the creation of Technology Development Zones come together, Istanbul (TR10) and its surrounding regions (TR21, TR41 and TR42) are among the top 6 regions in the total index score ranking in both indices. The other two regions in the top six are Ankara (TR51) and Izmir (TR31), two of the three largest provinces.

The real problem and dilemma starts at this point. Istanbul, Ankara and Izmir are already considered to be cities with growing populations and are likely to trigger different social and economic problems (rising rents, housing problems) if more population arrives. In addition, the earthquake risk, which is very much on the agenda for Izmir and Istanbul and even the surrounding regions, is another issue that needs to be taken into consideration.

In addition, certain situations identified for Istanbul and its surrounding regions also apply to the relationship between Izmir and Manisa. Manisa province draws a significant portion of its human resources for its advanced industry from Izmir, and similarly there is a flow of goods, services and people between the two provinces.

Similarly, the province of Gaziantep, where the country's industry is developed, remains at an average level when evaluated with the surrounding regions and factors such as socio-economic development and innovation infrastructure are considered.

Leaving all this aside, it should be underlined that the main purpose of these index studies is not to select a specific location. One of the reasons for not selecting the most suitable location within the scope of the study is the assessment that the spread of green transformation in industry across the country will become a necessity due to the new world agenda. In this context, it was not considered necessary to make inferences such as “investments should be prioritized in this region” or “this region is sufficiently developed, so there is no need for an extra policy for this region”. The results obtained from these index studies bring regional development differences to the forefront and these differences will directly affect the policies and strategies to

be proposed in the conclusion. Since this study is not motivated by any decision-making motivation, only the implementation of different strategies and policies regionally and the development of related strategies are evaluated and the recommendations to be made in the conclusion will be shaped in this scope.

The answers given to the interview questions conducted within the scope of the case study also contain important findings. First of all, it is understood that there is no current work on greenwashing and green claims, which are critical topics for a green and circular economy. Although it is known that the Ministry of Trade is working on legislation on this issue, it is necessary to increase the awareness and knowledge levels of companies and OIZs or to introduce legal obligations.

A second important finding is that there are no studies on occupations that may lose their function or occupations that require new skills. It can be considered that the lack of a clear legal framework has an impact on this issue. In addition, this problem or opportunity is an important topic that needs to be mitigated in the green transition. It is considered that solution proposals should be developed for this deficiency.

The third topic is the dissemination of industrial symbiosis practices. It is noted that initiatives at the OIZ level have been insufficient and unsuccessful in this regard. However, it is known that industrial symbiosis is one of the most common models for reducing resource use. In this context, the lack of a collaborative culture in companies was emphasized and it is understood that one of the biggest obstacles to the widespread adoption of the system is the failure to adopt this culture. In the response to the question, it is evaluated that although the obligations and sanctions to be imposed by the public authorities may be beneficial, it is considered that it would be more appropriate to establish a system that prioritizes the dissemination of the collaborative culture, emphasizes the importance of reducing the use of raw materials and provides appropriate guidance activities.

A general assessment that emerged from the responses to different questions was that firms lag behind OIZ administrations in some areas. This is especially the case in terms of entrepreneurship activities and innovation. Of course, this situation does not

cover all companies, but it is understood to be an average result. In particular, there are examples of companies that continue activities such as eco-modulation and the use of recycled content. However, it is understood that it would be useful to design mechanisms to increase the average level of participation.

Another critical output from the interview was that a national strategy and action plan could accelerate the green transformation in the industry. This is considered as a clearer and more concrete step in response to the statement “clearer and more concrete activities should be carried out” in the response to the first question. In addition, one of the important findings of both interviews is that large firms are more ready for green transition due to their export-based relations with EU countries, but small and medium enterprises are lagging behind in this context and a national strategy is most necessary for these firms.

Although not mentioned in response to the interview questions, facilitating access to international finance becomes an important topic when considering literature, world examples and the case of Türkiye. In addition to access to international finance, the importance of supporting companies and OIZs by developing national incentive mechanisms is known.

Finally, the importance of vocational high schools in OIZs was emphasized. Literature studies also underline the importance of this relationship. However, at this point, it is considered that there is a need to draw clearer boundaries on issues such as employee rights, work-education balance, occupational health and safety. While the efforts of OIZs to prepare children who are still in the schooling age to become skilled workers are important, this situation should be evaluated in line with human rights. Serious inspections are necessary to prevent many problematic practices, especially in terms of occupational health and safety.

CONCLUSION

Conjectural developments in the world, the necessity of revisions in capitalist production models, problems such as the depletion of natural resources and the climate crisis make it inevitable to change the structures of existing industrial areas. Both the new political economy that the European Union wants to establish with the Green Deal and the Circular Economy Action Plan and the changes envisaged by the United Nations to achieve the Sustainable Development Goals are closely related to industrial zones, which are places of production. These changes envision both spatial innovations and structural and managerial innovations.

As mentioned in the literature review section of the study, the emergence of eco-industrial parks dates back much further than today because the contradictory relationship between industry and environment has always been on the agenda. In this sense, the introduction of certain requirements for the spatial structure of industrial areas (filters, social areas, educational facilities, etc.) are elements that have changed over the years but have not yet become widespread. In Türkiye, the main practices in different Organized Industrial Zones, the increasing number of technoparks, the cooperation of vocational education and industrial organizations, and the cooperation between universities and industries can be given as examples.

Türkiye is currently a candidate country for membership of the European Union and has an export volume of 103.1 billion dollars, according to 2022 data from the Ministry of Trade. Despite differences at the political level, the EU and Türkiye continue their relations as important economic partners. In this context, Türkiye first became a party to the Green Deal and prepared the Green Deal Action Plan and is preparing the Circular Economy Action Plan.

Another indicator of integration with international developments is the projects carried out by the Ministry of Industry and Technology on Green Industries and the harmonization of the legal infrastructure with the amendments to the law.

At this point, it is seen that Türkiye has set legal regulations and criteria for Green Industries, which is the main subject of this thesis. A Green Industry Guide for Organized Industrial Zones has also been prepared.

In addition to all these, it is understood from the answers obtained from interview that an OIZ developed in terms of innovation in Türkiye is at the beginning of the road in certain respects, especially that companies have difficulty in keeping up with some developments. As a general assessment, it can be said that some sectors resist change. In this context, in addition to the work done so far, it is considered that there are many steps to be taken both on a company basis, on an OIZ basis and on a national basis. As can be seen from the numerical data, Türkiye has significant potentials and opportunities, as well as natural challenges and problems.

All these developments have been evaluated in the research. However, it seems that the initiative for the spread of green industries in Türkiye lies with the industrial zones themselves. There is no legal obligation in this regard. In fact, rather than a legal obligation, a holistic strategy, road map or plan has not been created in this sense.

In the conclusion part of the study, action proposals for the dissemination of green industries will be developed with this holistic perspective. While developing action recommendations, the main reference points will be the world examples and the results of Türkiye-specific indices and the evaluation of potentials, and of course the responses of the interview questions. These action recommendations can be considered as a roadmap for transition to Green Industries.

One of the most important components of green and innovative industries is R&D Centers, Technoparks and therefore universities. As seen in past and present examples, the system progresses through collaborations with universities through research centers. Increasing university-industry collaborations can also be seen in the practice of universities (with specific and relevant departments) being directly involved in OIZs over time. This is seen as an element that can directly change the

structure of the university and academia, as well as the impact of Green OIZs on sustainable development.

4.1 Recommended Actions

Action 1: Identification of Potential Priority Development Areas

The planned expansion of Green Industrial Zones is important when economic development disparities between regions are considered. With a planned development policy, not only the deepening of inter-regional inequalities can be prevented, but also measures can be taken to alleviate different problems such as population density, unemployment, infrastructure and urban development. While the most ideal and utopian scenario would be the transformation of all organized industrial zones across the country into green industries, this is far from realistic. In this context, it is recommended that decision makers identify priority key regions or prioritize 26 regions over time through more in-depth potential analyses and network analyses, and that future implementations proceed in line with this prioritization plan. In this prioritization phase, the 7 key product value chains identified in the Circular Economy Action Plan should also be taken as a basis for prioritization. In these 7 sectors (Electronics and ICT, Batteries and Vehicles, Packaging, Plastics, Textiles, Construction and Buildings, Food, Water and Nutrients), efforts to increase circularity should be prioritized and the transition of companies in these sectors to green industry practices should be supported. Separate policies should be developed especially for specialized OIZs operating in these sectors.

Action 2: Green Industry Implementation Strategy and Action Plan

As a result of the evaluations made, it is seen that the developed regions in Türkiye, especially in terms of socio-economic and innovation, are almost equal. It is recommended that a holistic action plan be developed to identify the areas with the most important potential for green industrial zones, to determine the product patterns in these regions, to reveal the relationship networks with different regions and to

follow up these practices. This action plan should be in line with the prioritization in Action 1.

Action 3: Developing/Using Economic Instruments such as Incentives, Tax Reductions, Penalties

Following the prioritization and action plan phase, another critical building block of implementation is economic instruments. Equipment, new technology, R&D and P&D investments, patents, infrastructure investments, green building investments, treatment facilities, etc., which should be part of green industrial zones, are expensive investments. In this context, the action plan proposes the development of economic instruments that incentivize and discourage these activities.

Action 4: Increasing interregional cooperation

It should be noted that Green Industrial Zones may have different characteristics. In this context, there are different clusters in different regions of Türkiye. It is necessary to identify these clusters and support specialization in the regions in line with a strategic plan. Thus, it is considered possible to achieve a balanced regional development. This also inspired by the lack of collaboration culture between companies as it is stated in the interviews. Defining characteristics and clusters may lead to develop such a culture between the companies as well.

Action 5: Increasing the share of public expenditures in investments in R&D and P&D activities

Looking at the current situation in Türkiye, the share of the private sector in R&D expenditures is approximately 61%. It is important for the private sector to continue its investments in this context and its self-transformation capacity is considered positive. However, it is important to increase the share spent on R&D in general public expenditures in terms of efficient utilization of limited resources and technology development.

Action 6: Making it compulsory for newly established organized industrial zones to be in the Green OIZ concept

According to OSBÜK data, there are 403 organized industrial zones in Türkiye, including OIZs under construction, planning and expropriation. While encouraging the existing ones to keep pace with the green transformation is a topic that needs to be addressed, it is considered that the OIZs that are not yet operational should be designed in accordance with the green industry concept.

Action 7: New Green OIZ Criteria

The Green OIZ Guidelines issued by the Ministry of Industry and Technology and the application criteria were reviewed. The application criteria cover many topics, but it is recommended that they be updated at regular intervals and used as evaluation criteria for new OIZs without application. In particular, it is considered appropriate to increase the number of mandatory criteria. It is considered that topics such as Green OIZ Design Certificate, inclusion of climate change and sustainability issues in procurement criteria (green procurement) should be made mandatory. In particular, it is considered that meeting these two criteria is a must for Green OIZs.

Action 8: Determination of Company Selection Criteria

In addition to the responsibilities of the OIZ Management, the criteria that will determine the responsibilities of companies and their "Green Categories" should be determined at the national level or differentiated for OIZs. In this way, the commitments of companies can be recorded and, if necessary, sanctions can be imposed by the OIZ management. In addition, criteria such as green procurement and components such as green buildings can be made mandatory for companies to implement.

Action 9: Establishing a nationwide industrial symbiosis network

One of the most important building blocks for green industries is the efficient use of resources. In this context, practices such as the use of waste or by-products of one company as raw materials by another company should be encouraged to become widespread. In this context, an industrial symbiosis network (which can be an online platform) will have many positive effects such as the spread of green industries,

reduction in the amount of waste, and increased circularity in products. Here, it is important not to be limited to firms only. If such relationships can be established on a regional basis, it is possible to build industrial symbiosis networks to strengthen these relationships. There is another need for making such an action which is to identify the definitions of the by-product and secondary raw material on a legal basis.

Action 10: Identifying indicators and developing monitoring mechanisms

It is necessary to identify and track indicators to monitor progress in green OIZs, and to ensure that the progress of green industry targets is monitored in a transparent manner by including them in the national statistical program.

Action 11: Mitigation of negative impacts

Different impacts of green transformation in industry are expected. Both economic and social impacts will emerge during the transition process. Not only on the basis of industry, green transformation will change many points in the ordinary flow of life and this may have negative effects in the transition process. In this context, these impacts need to be mitigated through various policies. In addition, there may be a situation of lost business lines and the wastage of people employed in these lines. Different studies should be carried out to evaluate the lost employment and integration studies should be carried out due to the green transition.

Action 12: Work on New Jobs and Lines of Business

The green transition is expected to create new business lines in industry. Especially green industries are expected to increase employment. A study needs to be carried out for new business lines, both for the recruitment of labor force to new fields from the business lines that are likely to be lost and for new business lines with longer-term plans and training studies.

Action 13: Facilitating access to international finance

The importance of international financing for the green transition in industry is frequently mentioned both within the EU and in UN documents. In Türkiye, the

process is being carried out with Green OIZs benefiting from the current project carried out with the World Bank's fund. In this context, within the framework of the Strategy and Action Plan mentioned at the beginning of the roadmap, international green funds should be identified and informative activities and integration studies should be carried out to facilitate companies and OIZs to benefit from these funds by producing projects.

Action 14: Conducting awareness raising, awareness and dissemination activities

Awareness-raising, awareness-raising and dissemination activities should be organized both within OIZs and for different groups so that different circles are informed about the issue. Today, the perception of industrial areas is not far from being polluting and environmentally hostile. In addition, for many people, the value of high technology investments is not understood. In this context, it is necessary to carry out activities to disseminate information for the adoption of the green industry concept. It is necessary to open a parenthesis here for City and Regional Planning departments. The perception of old-style industry is still quite common in urban planning and the relocation of industrial areas to the urban periphery is seen as a common phenomenon. In this context, it is also important to carry out studies to include the green industry concept in urban planning.

Action 15: Green Labelling System for promoting products manufactured in the Green Industries

It is proposed to develop green labels to ensure that sustainable, durable, clean products produced in Green OIZs are distinguished by consumers. Similar to the EU Ecolabel regulation, distinguishing these products by consumers is important for the spread of Green OIZs. Thus, both consumers will be able to make informed choices and green companies in Green OIZs will be indirectly supported.

Labels may vary depending on the sector. In addition to this green labeling, especially for technological products, the inclusion of durability and repairability

scores on the products or on the websites where they are sold is also considered as a suggestion that will facilitate the development of durable products and their preference by consumers. In addition, the content of the recycled rates used in the products and information on the industrial symbiosis map, if available, should also be included on the products or information cards. In conclusion, these actions can be considered as a simple roadmap and the beginning of a planned implementation plan. Green Industrial Zones are expensive investments, but the returns are expected to be high on the international agenda. In particular, Türkiye does most of its trade with EU member states, which requires full compliance with EU regulations for its exports. At the same time, there are critical issues such as carbon regulation at the border, digital product passport, eco-design that directly concern industrial zones. In this context, the spread of green industries across the country is an issue that should not be left to the initiative of OIZs alone. A roadmap has been developed with major action proposals to ensure a planned green transition in industry.

Action 16: Establishing a Green Industry Coordination Hub

The 15 different actions mentioned above have been produced with the aim of developing green transformation in the industry from a holistic perspective and solving different problems while developing. Action 16 is proposed to coordinate this whole process. As it is known, green transformation is a multi-stakeholder process, and it is considered that it should include many different fields such as industry, trade, environment, economy and finance, urban planning, development policies and therefore different public authorities. In this context, it may be useful to establish a multi-purpose center that can cooperate with different institutions, carry out training and awareness activities as well as consultancy services, and carry out monitoring according to the determined indicators.

Realizing the above-mentioned actions will require a holistic approach and an overall country policy that is multi-stakeholder, collaborative, high economic investment and may take longer than expected to pay off. The expansion of green industries at the end of this concept will not completely solve environmental and climate

problems, but it will enable Türkiye to take different steps towards becoming a competitive economy by increasing its technological development and value-added production. In addition, it is an important integration that needs to be done in order for Türkiye to maintain and improve its current trade volume with the EU. However, packaging these actions too much as a solution to environmental problems and preventing the widespread use of greenwashing are different elements that need to be considered in the process.

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APPENDICES

A. Appendix 1: Raw Data

Per Capita GDP (\$) – TurkStat, 2020

Regional Code	2018(r)	2019(r)	2020(r)	2021(r)	2022
TR10	16 339	15 259	13 925	15 684	17 349
TR21	11 542	10 901	10 498	12 539	13 308
TR22	8 700	8 284	8 001	8 627	9 673
TR31	11 647	10 669	9 922	11 647	13 201
TR32	8 570	8 174	7 245	8 125	9 370
TR33	8 370	7 813	7 522	8 115	8 941
TR41	11 215	10 236	9 383	10 694	11 527
TR42	12 939	11 522	11 022	13 141	14 117
TR51	13 003	12 622	12 090	13 084	13 919
TR52	7 813	7 369	7 133	7 397	8 560
TR61	10 213	9 926	7 173	8 612	10 709
TR62	7 238	6 995	6 829	7 649	8 938
TR63	6 285	5 678	5 433	6 467	7 039
TR71	6 885	6 387	6 137	6 527	7 937
TR72	7 298	6 849	6 712	7 205	7 832
TR81	7 556	6 374	6 275	7 484	8 352
TR82	6 662	6 420	6 530	6 915	7 493
TR83	5 957	5 717	5 518	5 587	6 254
TR90	6 263	6 160	5 839	5 787	5 928
TRA1	6 270	5 954	5 855	5 978	6 227
TRA2	4 181	4 015	4 017	3 902	4 392
TRB1	5 759	5 513	5 496	5 703	5 796
TRB2	3 878	3 760	3 626	3 543	3 844
TRC1	6 231	5 954	6 149	6 937	7 791
TRC2	3 705	3 572	3 429	3 489	4 085
TRC3	4 852	4 715	4 564	4 852	5 460

Export Performance of Exporter – Turkish Exporters Assembly, 2023

Regional Code	Cumulative
TR10	95.895.425,97
TR21	2.108.274,70
TR22	1.183.320,45

TR31	13.913.634,23
TR32	6.197.906,97
TR33	6.298.578,95
TR41	17.765.713,16
TR42	24.881.868,82
TR51	12.264.514,62
TR52	3.620.862,33
TR61	2.883.347,49
TR62	6.133.906,84
TR63	3.772.658,92
TR71	214.430,70
TR72	3.021.670,87
TR81	778.233,00
TR82	619.560,65
TR83	2.598.397,42
TR90	1.822.730,62
TRA1	52.789,02
TRA2	106.064,05
TRB1	752.968,81
TRB2	51.415,38
TRC1	10.256.570,89
TRC2	517.024,88
TRC3	1.777.781,57

Number of Registered Unemployed - TurkStat, 2022

Regional Code	Total Number of Registered 2022
TR10	374037
TR21	63349
TR22	57694
TR31	123731
TR32	91757
TR33	112569
TR41	142905
TR42	128055
TR51	181360
TR52	78585
TR61	99374
TR62	151200
TR63	150790
TR71	70281
TR72	95155

TR81	53367
TR82	36190
TR83	127533
TR90	131455
TRA1	52828
TRA2	48551
TRB1	96055
TRB2	144059
TRC1	123351
TRC2	187604
TRC3	131615

Net Migration – TurkStat, 2022

Regional Code	Age 15-64 (+) Migration	Age 15-64 (-) Migration	Age 15-64 (Net) Migration
TR10	316529	321065	-4536
TR21	69686	45966	23720
TR22	58183	49141	9042
TR31	107261	86833	20428
TR32	89362	72250	17112
TR33	74080	73104	976
TR41	106188	85559	20629
TR42	128851	95078	33773
TR51	154578	131309	23269
TR52	52927	53359	-432
TR61	89598	77282	12316
TR62	82019	88314	-6295
TR63	63034	78232	-15198
TR71	53490	52462	1028
TR72	58679	64828	-6149
TR81	34622	34301	321
TR82	37305	32185	5120
TR83	78565	83044	-4479
TR90	78695	84437	-5742
TRA1	38784	48375	-9591
TRA2	32266	53877	-21611
TRB1	47243	53269	-6026
TRB2	49605	83693	-34088
TRC1	52657	62347	-9690
TRC2	66282	94149	-27867
TRC3	55847	71877	-16030

Average Electricity Consumption – TurkStat, 2021

Regional Code	Average Electricity Consumption per Capita (kWh) - 2021
TR10	2.621,00
TR21	6.067,00
TR22	5.579,50
TR31	4.983,00
TR32	3.416,33
TR33	3.955,50
TR41	6.479,67
TR42	4.789,00
TR51	2.810,00
TR52	4.056,50
TR61	3.348,67
TR62	3.352,00
TR63	5.736,33
TR71	3.087,60
TR72	2.459,00
TR81	5.760,00
TR82	2.726,00
TR83	2.019,75
TR90	2.115,17
TRA1	1.850,33
TRA2	1.143,25
TRB1	2.066,25
TRB2	1.037,50
TRC1	3.476,67
TRC2	2.351,00
TRC3	1.741,50

Average Secondary School Enrollment Rate (Women) – TurkStat, 2022

Regional Code	Average
TR10	94,05
TR21	90,80333333
TR22	94,36
TR31	95,06
TR32	93,84
TR33	94,27
TR41	95,67666667
TR42	96,07

TR51	97,21
TR52	94,26
TR61	96,59
TR62	91,01
TR63	89,41333333
TR71	93,738
TR72	94,22666667
TR81	99,12
TR82	94,30333333
TR83	96,65
TR90	94,39333333
TRA1	95,69
TRA2	89,09
TRB1	92,4425
TRB2	79,485
TRC1	88,43333333
TRC2	76,86
TRC3	81,27

Ratio of Municipal Population Provided with Waste Services to Total Municipal Population (%) – TurkStat, 2022

	Ratio of Municipal Population Provided with Waste Services to Total Municipal Population (%)
TR10	100
TR21	100
TR22	99,5
TR31	100
TR32	99,33333333
TR33	100
TR41	100
TR42	99,6
TR51	100
TR52	99,5
TR61	99,66666667
TR62	99,5
TR63	99,66666667
TR71	99,4
TR72	100
TR81	99,66666667
TR82	98,66666667
TR83	98,5
TR90	97,8
TRA1	98
TRA2	100

TRB1	98,5
TRB2	99,75
TRC1	99,66666667
TRC2	98
TRC3	98,25

Ratio of Municipal Population Provided Wastewater Treatment Service to Total Municipal Population (%) – TurkStat, 2022

Regional Code	Ratio of Municipal Population Provided Wastewater Treatment Service to Total Municipal Population (%)
TR10	100
TR21	76,33333333
TR22	82,5
TR31	100
TR32	87,33333333
TR33	81,5
TR41	66,66666667
TR42	83,4
TR51	50
TR52	84,5
TR61	85,33333333
TR62	77,5
TR63	55,33333333
TR71	67,8
TR72	70,33333333
TR81	82
TR82	36,33333333
TR83	72,5
TR90	57,66666667
TRA1	75
TRA2	27,75
TRB1	72,5
TRB2	32
TRC1	73
TRC2	34
TRC3	47,5

Ratio of Municipal Population Served by Potable and Potable Water Treatment Plant to Total Municipal Population (%) – TurkStat, 2022

Regional Code	Ratio of Municipal Population Served by Potable and Potable Water Treatment Plant to Total Municipal Population (%)
TR10	100
TR21	36
TR22	50,5
TR31	74
TR32	23,66666667
TR33	19,5
TR41	46,66666667
TR42	83,8
TR51	99
TR52	69,5
TR61	24,66666667
TR62	76,5
TR63	17
TR71	43,8
TR72	29,66666667
TR81	76,66666667
TR82	53
TR83	32,75
TR90	55,66666667
TRA1	30,33333333
TRA2	40,75
TRB1	6,75
TRB2	12,25
TRC1	59,66666667
TRC2	77,5
TRC3	32,75

Ratio of Municipal Population Served by Potable and Potable Water Network to Total Municipal Population (%) – TurkStat, 2022

	Ratio of Municipal Population Served by Potable and Potable Water Network to Total Municipal Population (%)
TR10	100
TR21	99,33333333
TR22	99
TR31	100
TR32	99,33333333
TR33	97,75
TR41	99,66666667
TR42	98,6
TR51	99

TR52	99,5
TR61	100
TR62	99,5
TR63	96,66666667
TR71	98,6
TR72	99,33333333
TR81	99
TR82	96
TR83	99,25
TR90	94
TRA1	100
TRA2	93,5
TRB1	99
TRB2	96,5
TRC1	95,33333333
TRC2	95
TRC3	98

Ratio of Municipal Population Served by Sewerage Network to Total Municipal Population (%) – TurkStat, 2022

Regional Code	Ratio of Municipal Population Served by Sewerage Network to Total Municipal Population (%)
TR10	100
TR21	97,33333333
TR22	93
TR31	100
TR32	87,33333333
TR33	95,25
TR41	97,33333333
TR42	93,2
TR51	98
TR52	93,5
TR61	92,66666667
TR62	89
TR63	80,66666667
TR71	94,2
TR72	98
TR81	95,33333333
TR82	94
TR83	94,25
TR90	87,16666667

TRA1	86,33333333
TRA2	91,25
TRB1	94,75
TRB2	86,75
TRC1	97,33333333
TRC2	76,5
TRC3	92,5

Total Cash Loans - BDDK, 2023

Regional Code	Total Cash Loans (TL)
TR10	4.369.573.409
TR21	167.171.549
TR22	154.140.423
TR31	620.027.868
TR32	419.284.611
TR33	232.494.588
TR41	461.170.995
TR42	457.113.939
TR51	1.639.656.557
TR52	239.581.323
TR61	487.677.112
TR62	385.573.288
TR63	294.544.846
TR71	120.709.242
TR72	196.617.170
TR81	76.973.746
TR82	58.416.443
TR83	215.828.397
TR90	206.940.170
TRA1	66.940.597
TRA2	39.244.526
TRB1	94.840.201
TRB2	66.422.234
TRC1	376.828.114
TRC2	173.268.577
TRC3	110.897.840

Total Deposits (TL) – BDDK, 2023

Regional Code	Total Deposits (TL)
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TR10	6.197.575.905
TR21	189.989.594
TR22	180.231.308
TR31	732.596.539
TR32	427.665.568
TR33	226.513.954
TR41	515.895.482
TR42	449.469.734
TR51	2.077.995.659
TR52	210.726.803
TR61	492.368.725
TR62	383.007.608
TR63	249.621.565
TR71	125.746.411
TR72	206.419.323
TR81	84.037.875
TR82	57.113.346
TR83	174.660.273
TR90	199.528.778
TRA1	44.073.476
TRA2	31.578.971
TRB1	109.934.606
TRB2	44.139.451
TRC1	207.443.221
TRC2	107.158.640
TRC3	98.965.691

R&D Expenditure (1000 TL) – TurkStat, 2022

Regional Code	R&D Expenditure (1000 TL)
TR10	60008213
TR21	4028977
TR22	1729479
TR31	8511097
TR32	2279014
TR33	4698724
TR41	11021406
TR42	16785073
TR51	59100052

TR52	3184497
TR61	3431018
TR62	2922586
TR63	1316154
TR71	1548688
TR72	3131491
TR81	964437
TR82	589058
TR83	2028664
TR90	2025809
TRA1	2328128
TRA2	592399
TRB1	2084952
TRB2	970451
TRC1	1575568
TRC2	1295578
TRC3	518229

R&d Human Personal – TurkStat, 2022

	R&d Human Personal
TR10	116658
TR21	7637
TR22	4411
TR31	22107
TR32	7181
TR33	9144
TR41	20277
TR42	29194
TR51	75870
TR52	8480
TR61	9793
TR62	7044
TR63	3836
TR71	4963
TR72	8516
TR81	2990
TR82	1823
TR83	6459
TR90	7307
TRA1	5059

TRA2	1797
TRB1	6005
TRB2	2580
TRC1	4192
TRC2	3251
TRC3	1583

Employed persons by economic activity (NACE Rev. 2) [15 years and over] :
Industry (%) – TurkStat, 2023

Regional Code	Employed persons by economic activity (NACE Rev. 2) [15 years and over] : Industry (%) 2023
TR10	29,3
TR21	39
TR22	23,9
TR31	32,8
TR32	24
TR33	28,8
TR41	42
TR42	36,5
TR51	26,4
TR52	28,5
TR61	15,1
TR62	24,7
TR63	26,3
TR71	22
TR72	26,1
TR81	28
TR82	20,4
TR83	18,7
TR90	17,9
TRA1	13,4
TRA2	14,1
TRB1	22,1
TRB2	23
TRC1	35,6
TRC2	25,3
TRC3	22,8

Exports by economic activities (ISIC, Rev.4) (USD 1000) : Information and
communication – TurkStat, 2023

Regional Code	Exports by economic activities (ISIC, Rev.4) (USD 1000) : Information and communication
TR10	129707
TR21	582
TR22	207
TR31	47639
TR32	296
TR33	178
TR41	4032
TR42	573
TR51	28637
TR52	484
TR61	735
TR62	496
TR63	363
TR71	13
TR72	365
TR81	1
TR82	2
TR83	347
TR90	9
TRA1	2
TRA2	24
TRB1	4
TRB2	8
TRC1	354
TRC2	21
TRC3	106

Total Number of Patent Registered and Patent Applications, Turkish Patent Institution, 2023

Regional Code	Total Patent Registered (2009-2023)	Patent Applications by Regions (2009-2023)
TR10	13412	39862
TR21	512	1696
TR22	117	776
TR31	1201	4759

TR32	252	1481
TR33	842	3919
TR41	2588	7487
TR42	1857	5899
TR51	3329	11576
TR52	712	2490
TR61	338	1879
TR62	275	1699
TR63	142	861
TR71	89	514
TR72	412	2154
TR81	81	394
TR82	47	227
TR83	201	1223
TR90	183	1038
TRA1	60	776
TRA2	9	120
TRB1	129	713
TRB2	16	221
TRC1	370	1730
TRC2	59	469
TRC3	27	262

Total Number of Technology Development Zones – Ministry of Industry and Technology, 2024

Regional Code	Number of Technology Development Zones
TR10	17
TR21	3
TR22	2
TR31	5
TR32	3
TR33	3
TR41	4
TR42	11
TR51	13
TR52	3
TR61	4
TR62	3

TR63	4
TR71	4
TR72	4
TR81	2
TR82	2
TR83	3
TR90	2
TRA1	1
TRA2	1
TRB1	2
TRB2	1
TRC1	3
TRC2	2
TRC3	1

Total Number of R&D Centers - Ministry of Industry and Technology, 2024

Regional Code	Number of R&D Centers
TR10	420
TR21	59
TR22	16
TR31	99
TR32	25
TR33	48
TR41	160
TR42	175
TR51	150
TR52	23
TR61	19
TR62	22
TR63	19
TR71	4
TR72	20
TR81	3
TR82	1
TR83	8
TR90	4
TRA1	1
TRA2	0
TRB1	6

TRB2	0
TRC1	15
TRC2	4
TRC3	1

Number of Entrepreneurship – TurkStat, 2022

Regional Code	Number of Entrepreneurship
TR10	1.144.953
TR21	106.449
TR22	109.577
TR31	280.685
TR32	226.636
TR33	135.288
TR41	235.252
TR42	212.590
TR51	338.871
TR52	138.163
TR61	239.654
TR62	211.617
TR63	149.915
TR71	85.956
TR72	118.839
TR81	49.155
TR82	38.439
TR83	138.161
TR90	135.524
TRA1	39.968
TRA2	30.676
TRB1	74.551
TRB2	57.440
TRC1	130.229
TRC2	117.058
TRC3	62.230

Share of Information and Communications in GDP (%) – TurkStat, 2022

Regional Code	Information and Communications in GDP
TR10	65,36

TR21	0,37
TR22	0,31
TR31	4,18
TR32	0,6
TR33	0,31
TR41	1,43
TR42	2,82
TR51	18,22
TR52	0,5
TR61	1
TR62	0,84
TR63	0,32
TR71	0,16
TR72	0,77
TR81	0,1
TR82	0,09
TR83	0,47
TR90	0,43
TRA1	0,27
TRA2	0,08
TRB1	0,3
TRB2	0,14
TRC1	0,35
TRC2	0,48
TRC3	0,09

Number of Registered Trademark – Turkish Patent Institution, 2023

	Number of Registered Trademark
TR10	53506
TR21	1495
TR22	1546
TR31	8125
TR32	4551
TR33	2065
TR41	6633
TR42	4693
TR51	10206
TR52	4775

TR61	5051
TR62	3811
TR63	1759
TR71	1128
TR72	2575
TR81	451
TR82	293
TR83	1779
TR90	1777
TRA1	340
TRA2	191
TRB1	816
TRB2	392
TRC1	3464
TRC2	1395
TRC3	843

Number of Registered Design - Turkish Patent Institution, 2023

	Number of Registered Design
TR10	17823
TR21	594
TR22	178
TR31	3266
TR32	888
TR33	1028
TR41	9043
TR42	1025
TR51	3458
TR52	1862
TR61	970
TR62	2002
TR63	843
TR71	177
TR72	3725
TR81	170
TR82	262
TR83	1370
TR90	1091

TRA1	289
TRA2	42
TRB1	260
TRB2	124
TRC1	3389
TRC2	299
TRC3	249

Number of Design Centers – Ministry of Industry and Technology, 2024

Regional Code	Number of Design Centers
TR10	148
TR21	14
TR22	1
TR31	25
TR32	15
TR33	8
TR41	37
TR42	26
TR51	37
TR52	1
TR61	1
TR62	9
TR63	2
TR71	0
TR72	5
TR81	2
TR82	0
TR83	0
TR90	0
TRA1	0
TRA2	0
TRB1	1
TRB2	0
TRC1	1
TRC2	0
TRC3	0

Number of Utility Model Registered – Turkish Patent Institution, 2023

Regional Code	Number of Utility Model Registered
TR10	523
TR21	19
TR22	31
TR31	110
TR32	36
TR33	53
TR41	189
TR42	91
TR51	165
TR52	101
TR61	36
TR62	51
TR63	17
TR71	15
TR72	63
TR81	12
TR82	14
TR83	16
TR90	13
TRA1	6
TRA2	3
TRB1	10
TRB2	4
TRC1	33
TRC2	9
TRC3	7

B. Appendix 2: Question Form

Dear Concerned,

This questionnaire is applied within the scope of the graduation thesis of Middle East Technical University, Institute of Science and Technology, Regional Planning Graduate Program. The aim of the study is to reveal Turkey's potential in the green transition in industry, to evaluate current studies and to develop supportive policies for this. Within the scope of the study, Turkey's legal infrastructure is examined, the potentials of the regions in Turkey are evaluated according to the NUTS-2 classification with the created innovation and socio-economic development indices. In addition, Turkey's statistics within the scope of the United Nations Sustainable Development Goals are analyzed and the general trends in Turkey are evaluated.

In order to evaluate the practical reflections of desk studies and statistical data, it was deemed appropriate to conduct case studies with Manisa OIZ and Yalova OIZ, where projects were carried out within the framework of the "Technology Development in OIZs Project" supported by the Presidency Strategy and Budget Presidency and carried out in cooperation with the Ministry of Industry and Technology and UNDP.

These interview questions will include questions on critical issues within the scope of Next Generation Industrial Zones such as innovation, green industry, circular economy, entrepreneurship, green claims, greenwashing, value-added production, and the answers to the questions will be evaluated within the scope of the thesis study.

It is expected to get answers from a institutional perspective rather than an individual opinion so that any kind of personal information is processed. Question form contains 10 open-ended questions and it is expected you to answer these questions.

Deniz Ege Alkaya

MSc. Student / METU Regional Planning

Please kindly note that, if you have any further questions about the research you can contact the author by sending an e-mail to egealkaya@gmail.com address.

1. How do you evaluate Türkiye's efforts and initiatives towards transition to green and circular economy (Green Deal Action Plan, Circular Economy Action Plan, Green Industry Support Project, etc.)? *Cevap:*

2. Entrepreneurship and innovation concepts are seen as two important building blocks of new generation industrial zones. In this context, how would you evaluate

the activities and initiatives of your Organized Industrial Zone? What are the good aspects, which issues can be improved and what kind of studies are needed for this?

3. Greenwashing and green claims bring opportunities and challenges for a green and circular economy. Are there any plans to develop a verification mechanism to verify the green claims made by the companies within your organization or to verify whether the work carried out is greenwashing? Are there any shortcomings in terms of legal regulations in this regard?

4. The relationship between new generation industrial zones and both vocational education and university education is very important. Can you evaluate the activities carried out by your Organized Industrial Zone in order to train qualified personnel and to access human resources that can develop technology and contribute to the production of value-added products?

5. For a green and circular economy and sustainable and innovative production, citizens' awareness, participation in and support for the process are as important as industrial zones. In this context, can you give information about the awareness-raising and awareness-raising activities you have carried out inside or outside the OIZ?

6. One of the prominent topics related to green and innovative industrial zones is that investments are expensive and have a long payback period. In this context, what kind of incentive models can be developed for companies and OIZs that make these investments?

7. Are you aware of the Green Industry Support Program run by the Ministry of Industry and Technology? Have you made an application as an OIZ? If yes, how do you evaluate the application criteria?

8. With the green transformation in industry and the transition to a circular economy, it is one of the possible expectations that some professions will disappear and new business lines that require new skills will emerge. In this context, is there any work you are conducting as OIZ? If yes, could you tell us a little about it?

9. In the broadest sense, the dissemination of industrial symbiosis practices will enable resource efficiency and waste reduction through end of waste, secondary raw material and by-product applications. In this context, what are your ideas on the establishment of a strategic industrial symbiosis network across the country? Although these are practices carried out by the initiatives of companies, what would be your approach to the establishment of a platform supervised and systematized by public authorities?

10. What are your views on developing a national strategy for the dissemination of green industrial practices and making certain practices (green buildings, green production, green label, innovation center, technology development zones, research centers, non-incineration of waste, etc.) mandatory within the scope of the national strategy?

C. Appendix 3: Responses

Manisa OIZ:

1. Türkiye'nin yeşil ve dögüsel ekonomiye geçişe yönelik çalışmalarını ve girişimlerini (Yeşil Mutabakat Eylem Planı, Dögüsel Ekonomi Eylem Planı, Yeşil Sanayi Destek Projesi vb.) nasıl değerlendiriyorsunuz?

Cevap: Sanayi ve Teknoloji Bakanlığı ve TÜBİTAK koordinasyonunda bir çok çalışma yapılıyor. Özellikle Dünya Bankası Desteği oluşturulan programlar sanayide ciddi bir farkındalık ve gelişim oluşacağı düşüncesindeyiz. Fakat bu çalışmalar gelinen noktada yeterli mi, firmalar başta AB olmak üzere oluşacak yaptırım ve gelişimlere ne derece hazır tartışılmalıdır. Daha net ve somut odaklı çalışmalar yapılmalıdır.

2. Girişimcilik ve yenilikçilik (inovasyon) kavramları yeni nesil sanayi bölgelerinin iki önemli yapı taşı olarak görülmektedir. Bu bağlamda Organize Sanayi Bölgenizin çalışmalarını ve girişimlerini nasıl değerlendirirsiniz? İyi yönleri nelerdir, hangi konular geliştirilebilir ve buna yönelik nasıl çalışma-lara ihtiyaç bulunmaktadır?

Cevap: Girişimcilik hizmetlerinden oldukça başarılıdır. Fakat konu firma yenilikçilik ve girişimcilik odaklı çalışmalar olduğunda çok az sayı da OSB'nin olduğu görülecektir. Bu kapsamda Prof. Dr. Mehmet Cansız'ın OSB'ler üzerine olan çalışmaları incelenebilir. OSB'lerde yenilikçilik ve girişimcilik kavramlarının geliştirilmesi, firmalar bu alanlarda iş geliştirme hizmetlerinin verilmesi için Yenilik Merkezleri kurulmuştur. Bu merkezler OSB'ler de hem firmalar hem de OSB yönetimleri için çalışmalar yapmış, kapasite geliştirmeye çalışmıştır. OSB'lerin içinde Yenilik Merkezleri ayrı departmanlar olmadığı sürece OSB'lerin bu çalışmaları kendi kapasiteleri ile yapmaları pek mümkün değildir.

3. Yeşil aklama (greenwashing) ve yeşil beyanlar (green claims) yeşil ve dögüsel bir ekonomiye yönelik fırsatları ve sorunları beraberinde getirmektedir. Bünyenizde bulunan firmalar tarafından yapılan yeşil beyanların doğrulanmasına ilişkin ya da yapılan çalışmaların yeşil aklama olup olmadığına dair bir doğrulama mekanizması geliştirilmesi planlanıyor mu? Bu konuda yasal mevzuatlar açısından yaşanan bir eksiklik bulunuyor mu?

Cevap: Bu konuda her hangi bir bilgimiz yoktur.

4. Yeni nesil sanayi bölgelerinin gerek mesleki eğitim gerekse de üniversite eğitimi ile ilişkisi oldukça önemlidir. Hem kalifiye eleman yetiştirmek hem de teknoloji geliştirebilecek ve katma değerli ürün üretimine katkı sağlayabilecek insan

kaynağına erişebilmek için Organize Sanayi Bölgeniz tarafın-dan yapılan çalışmaları değerlendirebilir misiniz?

Cevap: OSB'ler bünyelerinde nitelikli personel yetiştirmek için hem Meslek lisesi hem de üniversite kurmaktadır. Özellikle Meslek liselerinin OSB bünyesinde olup gerekli finansal desteği alması, firmalar ile yakın çalışmalar yapması hem meslek lisesinin hem öğrencilerin hem de firmaların bu alandaki gelişimine katkı vermektedir.

5. Yeşil ve döngüsel ekonomi ile sürdürülebilir ve yenilikçi üretim için sanayi bölgeleri kadar vatandaşların bilinçlenmesi, sürece katılımı ve süreci desteklemesi de öne çıkmaktadır. Bu bağlamda OSB içinde veya dışında gerçekleştirdiğiniz bilinçlendirme ve farkındalık çalışmaları hakkında bilgi verebilir misiniz?

Cevap: OSB içinde; Firmaların eko üretim kapasitelerinin arttırmaya yönelik analizler OSB'nin sürdürülebilirlik raporu ve OSB personelinin kapasite geliştirme çalışmaları Firmalar yönelik eğitimler ve bilgilendirme toplantıları

6. Yeşil ve yenilikçi sanayi bölgeleri ile ilgili ön plana çıkan başlıklardan bir tanesi de yatırımların pahalı ve geri dönüş süresi uzun olması olarak tespit edilmiştir. Bu bağlamda bu yatırımları yapan firmalara ve OSB'lere yönelik nasıl teşvik modelleri geliştirilebilir?

Cevap: Bu konu özel bir çalışmamız olmadığı için cevap verilememektedir.

7. Sanayi ve Teknoloji Bakanlığı tarafından yürütülen Yeşil Sanayi Destek Programı hakkında bilgi sahibi misiniz? OSB olarak bir başvurunuz oldu mu? Eğer cevap evetse başvuru kriterlerini nasıl değerlendiriyorsunuz?

Cevap: Program hakkında bilgi sahibiyiz. Programın tanıtım toplantılarını Bölgemizde gerçekleştirdik. OSB olarak başvuru yapmadık

8. Sanayide yeşil dönüşüm ve döngüsel ekonomiye geçiş ile birlikte bazı mesleklerin ortadan kaybolması ve yeni beceriler gerektiren yeni iş kollarının ortaya çıkması olası beklentilerden biridir. Bu bağlamda OSB olarak yürüt-tüğünüz bir çalışma var mıdır? Evet ise biraz bahsedebilir misiniz?

Cevap: Çalışma bulunmamaktadır.

9. En genel kapsamsıyla endüstriyel simbiyoz uygulamalarının yaygınlaştırılması kaynak verimliliğinin sağlanması ile atık sonu (end of waste), ikincil hammadde ve yan ürün uygulamaları ile atık azaltımı mümkün olacaktır. Bu bağlamda, ülke çapında stratejik bir endüstriyel simbiyoz ağının kurulması hakkındaki fikirleriniz nelerdir? Bunlar firmaların inisiyatifleri ile gerçekleştirilen

uygulamalar olsa da kamu otoriteleri tarafından denetlenen ve sistematik hale getirilen bir platformun kurulması ile ilgili yaklaşımınız nasıl olur?

Cevap: Türkiye gerek OSB gerek kalkınma ajansları eliyle yapılan simbiyoz çalışmaları başarılı olmamıştır. Bazı işbirlikleri kültürel olarak da kabul edilmelidir. Ne yazık ki simbiyoz çalışması için gerçekleşmesi gereken ortak çalışma kültürü henüz tam olarak firmalarımızda yerleşmemiştir. Devlet eliyle yapılacak ve firmalara zorunlu/yaptırım oluşturacak bir yapı kurulursa belki daha başarılı olabilir. Ama bunun çok detaylı analiz edilerek çalışması gerekmektedir.

10. Yeşil sanayi uygulamalarının yaygınlaştırılması açısından ulusal bir strateji geliştirilmesi ve ulusal strateji kapsamında belli başlı uygulamaların (yeşil bi-nalar, yeşil üretim, yeşil etiket, yenilik merkezi, teknoloji geliştirme bölgeleri, araştırma merkezleri, atıkların yakılmaması, vb.) zorunlu hale getirilmesi hakkındaki görüşleriniz nelerdir?

Cevap: Bahsedilen yapıların kurulması ancak ulusal bir strateji kapsamında gerçekleşebilir. Bu başlıkların Kalkınma planına ve ona bağlı olarak oluşturulacak bir strateji ile tanımlanması gerekmektedir.

Yalova OIZ:

1. Türkiye'nin yeşil ve döngüsel ekonomiye geçişe yönelik çalışmalarını ve girişimlerini (Yeşil Mutabakat Eylem Planı, Döngüsel Ekonomi Eylem Planı, Yeşil Sanayi Destek Projesi vb.) nasıl değerlendiriyorsunuz?

Cevap: Türkiye'nin yeşil ve döngüsel ekonomiye geçişe yönelik çalışmalarını ve girişimlerini ülke politikasının gündemine almasını olumlu buluyorum. Özellikle Avrupa birliği ile ticari ilişkilerin düzenlenmesi kapsamında giriş hızlı bir şekilde yapıldı. Ancak bunun özellikle küçük orta ölçekli firmaların süreci nasıl ele alacağı konularını netleştirerek genele yaygınlaştırılması gerekmektedir. Çünkü büyük ölçekli firmalarımız yurt dışı ilişkilerinden dolayı bu sürece mecburen hızlandırılmış bir şekilde yaşamakta ve gerekli kadroları oluşturma imkanları olduğu için çalışmalarını başarılı bir şekilde sürdürebilmektedirler. Tesislerin finansman açısından daha fazla teşvik edilmesi gerektiğini düşünmekteyiz. Ülkemizde hala teşvik, vergi vb. süreçlerde çevreye uyumlu şekilde çalışan firmalar ile çevreyi kirleten firmaların ayırımı yapan bir kriter maalesef yok. Yeşil Sanayi Destek Projesi ile güzel bir finans kaynağı oluşturulmuş durumda ancak bu destek kapsamında özellikle GES yatırımları için firmalar Çağrı Mektubu almakta sıkıntı

çekmektedir. Bir yandan GES kurulsun diye finans kaynağı oluşturulurken diğer taraftan kurmak isteyen tesislere kapasite nedeniyle çağrı mektubu alamaması bu süreçte dar boğaz oluşturmaktadır. Konunun bütüncül ele alınarak mevzuat, eylem planı, farkındalık, finansman, uygulama, kontrol ve varsa ödüllendirme basamakları arasında dar boğaz oluşturmamız gerekli.

2. Girişimcilik ve yenilikçilik (inovasyon) kavramları yeni nesil sanayi bölgelerinin iki önemli yapı taşı olarak görülmektedir. Bu bağlamda Organize Sanayi Bölgenizin çalışmalarını ve girişimlerini nasıl değerlendirirsiniz? İyi yönleri nelerdir, hangi konular geliştirilebilir ve buna yönelik nasıl çalışmalara ihtiyaç bulunmaktadır?

Cevap: OSB'miz fikirden ihracata mottosu ile faaliyetlerine devam etmektedir. Bu sebeple bölgemizde proje kültürünün, inovasyon kültürünün oluşması ve yaygınlaşması için özellikle çaba sarfetmekteyiz. Ortaokul ve liselerden başlayarak proje yarışmalarıyla süreç için kültür bazı oluşturacak, taze kan sağlayacak öğrencilerimizi bu konuda yönlendiriyoruz. Düzenlediğimiz hackathon, ideaton gibi yarışmalar yada ulusal ve uluslararası yarışmalarla öğrencilerimize bu anlamda mentorluk, kapasite geliştirme ve finansman destekleri sağlıyoruz. Yetişen öğrencilerimiz yada sanayi ve akademiden gelen girişimcilerimizi Teknoparkımızda kuluçka süreçlerinden geçirerek büyümelerine gelişmelerine destek oluyoruz. Fikri sinai mülkiyet danışma birimimizle milli hamle envanterimizi geliştirmeye çalışırken diğer yandan yenilik merkezimizde bu fikir ve süreç inovasyonları anlamında firma eşleşmeleri yaparak minimum orta yüksek teknoloji üretim alanına zorluyoruz. Uyguladığımız modelin bir ekosistem oluşturacağını ve pozitif katkılarını olacağını düşünüyoruz ancak ilimiz sanayi ve girişimcilik alanında yeni gelişmekte olan bir bölge olduğu için bu çıktuları almamız biraz zaman alıyor. Modelimizin daha oturmuş bölgelerde de uygulanması halinde daha ses getirecek sonuçlar alınabilecektir.

3. Yeşil aklama (greenwashing) ve yeşil beyanlar (green claims) yeşil ve döngüsel bir ekonomiye yönelik fırsatları ve sorunları beraberinde getirmektedir. Bünyenizde bulunan firmalar tarafından yapılan yeşil beyanların

doğrulanmasına ilişkin ya da yapılan çalışmaların yeşil aklama olup olmadığına dair bir doğrulama mekanizması geliştirilmesi planlanıyor mu? Bu konuda yasal mevzuatlar açısından yaşanan bir eksiklik bulunuyor mu?

Cevap: Henüz firmalar tarafından yapılan yeşil beyanlar istediğimiz düzeye ulaşmış değil. bölgemiz özelinde yeşil beyanların bildirim seviyesi belirli bir olgunluğa ulaştıktan sonra bunların yeşil aklama ya da doğrulanmış beyan olup olmadığı konusundaki incelemeler o zaman daha önem kazanacaktır.

Yasal mevzuat konusunda eksik olduğunu düşünüyoruz çünkü burada sadece çevre etiketi ile ilgili tekstil ve kimya sektörünü ilgilendiren detaylar bulunmakta ancak bir yapı malzemesinin veya ahşap ürünlerinin çevresel beyanlarına yönelik detaylar oluşturulmamış durumda bunun yaygınlaştırılması konusunda çalışmaların devam etmesi gerekiyor.

4. Yeni nesil sanayi bölgelerinin gerek mesleki eğitim gerekse de üniversite eğitimi ile ilişkisi oldukça önemlidir. Hem kalifiye eleman yetiştirmek hem de teknoloji geliştirebilecek ve katma değerli ürün üretimine katkı sağlayabilecek insan kaynağına erişebilmek için Organize Sanayi Bölgemiz tarafından yapılan çalışmaları değerlendirebilir misiniz?

Cevap: Organize sanayimiz mesleki eğitime ve üniversite eğitimine oldukça önem vermektedir. Henüz hiçbir fabrikamız faaliyette değilken meslek lisesi yapma projemizi daha erken sonuç alabilmek için ilimizde bulunan, OSB'imize yakın ancak çok fazla öğrencimizin tercih etmediği meslek liselerinden birini seçip bunu bir protokolle rehabilite ettikten sonra sanayiye nitelikli istihdam olarak geri döndürmek için çalışmamıza başladık. Bu kapsamda bir meslek lisemizin kapasitesini 3 yıl içerisinde %130'a yakın artırarak tam kapasiteye ulaştırdık ve şu an mezunlarını yeni açılan fabrikalarımıza yerleştirmeye başladık. Yine diğer bir yandan üniversite eğitimi kapsamında Yalova üniversitemizin mühendislik fakültesi ile yaptığımız protokol kapsamında makine, endüstri ve elektronik bölümlerinden başlayarak kademeli olarak tüm mühendislik fakültesi bölümlerinin organize sanayi bölgemiz içerisine taşınmasıyla ilgili bir proje başlattık. 5 bloktan oluşan üniversite binamızın ilk bloğu tamamlandı ve önümüzdeki güz döneminde öğrencilerimiz OSB ekosistemi içerisinde olacaklar. Ayrıca yine aynı kampus içerisinde meslek

yüksekokulunda ihtisas alanınıza uygun bölümlerinin bulunmasıyla alakalı bir çalışma yürütüyoruz. Buna ek olarak Milli Eğitim bakanlığımızla geçen aylarda imzaladığımız protokol kapsamında OSB'miz içine bir ihtisas meslek lisesi ve bir mesleki eğitim merkezi yapma projemizi de imza altına aldık. Buna ek olarak ilimizdeki işsiz potansiyelini hızlı bir şekilde nitelikli istihdama çevirebilmek için Kalkınma Ajansı desteğiyle nitelikli istihdam merkezi projemizi hayata geçirdik. Burada maksimum 2 aylık kurslarla mevcutta işsiz olan ancak alana uygun olmayan kursiyerlerimizi sanayicimize uygun kaynak, cnc, makine operatörlüğü ve kalite uzmanlığı gibi alanlarda yetiştirerek istihdam etmeye başladık. Dış göç almadan, il içinden, 6 yılda 20 bin nitelikli personel yetiştirmek ve bu kişileri bölgemizde istihdam ederek katma değerli üretime kazandırmak gibi iddialı bir hedefimiz var, bu hedefe uygun şekilde çalışmalarımızı sürdürüyoruz.

5. Yeşil ve dögüsel ekonomi ile sürdürülebilir ve yenilikçi üretim için sanayi bölgeleri kadar vatandaşların bilinçlenmesi, sürece katılımı ve süreci desteklemesi de öne çıkmaktadır. Bu bağlamda OSB içinde veya dışında gerçekleştirdiğiniz bilinçlendirme ve farkındalık çalışmaları hakkında bilgi verebilir misiniz?

Cevap: İlimiz henüz sanayi üretimini kabullenmiş bir aşamada değil ve ne yazık ki son birkaç on yılda birçok başarısız sanayi bölgesi kurma deneyimi olmuş. Kurulum aşamasında olduğumuz geçtiğimiz 3 yıl bu algıyı yıkmak için yoğun bir uğraş verdik. İl özel idare ve belediyelerle ortak olarak halkımızda farkındalığı artırıcı toplantılar düzenledik. TSO ortaklığında ilin kamu ve özel kurumlarını bir araya getirerek hem bilinçlendirme ve farkındalık hem de gelecek dönem planlamasına yönelik çalıştaylar düzenledik. Ortaokul, meslek lisesi MYO ve üniversite öğrencileriyle buluşup, ve bazen de öğrencileri ve halkı bölgemize getirerek istihdam farkındalığı oluşturmaya çalıştık. Bu aşamadan geçen yıla kadar fiili olarak üretim tesislerimizi görmeden ve ilk meslek liseli öğrencimiz tesislerimizde çalışmaya başlayana kadar ki süreçte çok etkili olamadık. Ancak geldiğimiz durum itibariyle son yıllarda süregelen bilinçlendirme ve farkındalık etkinlerimizde bahsettiğimiz vaatlerimizin birer birer realize olduğu görüldükçe bölge açısından daha fazla destek görmeye başladığımızı ve artık arkamızda olduklarını hissettiğimiz dönemdeyiz.

6. Yeşil ve yenilikçi sanayi bölgeleri ile ilgili ön plana çıkan başlıklardan bir tanesi de yatırımların pahalı ve geri dönüş süresi uzun olması olarak tespit edilmiştir. Bu bağlamda bu yatırımları yapan firmalara ve OSB'lere yönelik nasıl teşvik modelleri geliştirilebilir?

Cevap: Aslında yeşil ya da yenilikçi sanayi bölgeleri oluşturmak için yapılacak yatırımlar esasında pahalı sayılamaz çünkü planlama aşamasında yatırımlar ilk yapımından itibaren yeşil olarak uygulanırsa ekstra maliyet farkı oluşturmayan çok ciddi unsurlar var. su kullanımı ya da enerji tasarrufu anlamında led armatürler, tasarruflu rezervuarlar ısı geçirgenliği uygun inşaat malzemeleri vesaireler çok ufak değişikliklerle ekstra maliyet oluşturmadan daha yeşil ve daha yenilikçi olarak uygulanabiliyor. Bu nedenle inşaat daha inşaat aşamasında iken yeşil binaların kullanımı desteklenmelidir. Şu an maalesef böyle bir destek mevcut değil, en azından yeşil bina başvurusu yapan fabrikalar bunun belgelendirilmesi aşamasındaki harçlardan muaf tutulsa bile çok ciddi bir teşvik kapsamı geliştirmiş olabilir. Bununla birlikte işletme döneminde sanayicilerin şu an en fazla rağbet gösterdiği güneş enerjisi üretim tesislerini çatılarını kurma konusunda sıkıntılar yaşanmaktadır. Bu sıkıntı elektrik üretim kapasiteleriyle alakalı çağrı mektupları kapsamındadır ve buradaki darboğaz çözülerek daha fazla sanayicinin yeşil enerjiden faydalanması teşvik edilebilir.

7. Sanayi ve Teknoloji Bakanlığı tarafından yürütülen Yeşil Sanayi Destek Programı hakkında bilgi sahibi misiniz? OSB olarak bir başvurunuz oldu mu? Eğer cevap evetse başvuru kriterlerini nasıl değerlendiriyorsunuz?

Cevap: Yeşil sanayi destek programı kapsamında Entegre İletişim ve Veri Altyapı Sistemi projemiz desteklendi. Ancak başvuru kapsamı yeni kurulan ve kamulaştırmasını tamamlamış ancak etaplı altyapı planlaması nedeniyle alanının henüz tamamının onaylı imar planı olmayan OSB'ler için oldukça sınırlayıcı. Projeniz altyapı kapsamında olsa bile sadece onaylı imar planı kapsamında olan alan için destek alabiliyorsunuz. Ancak diğer kısımlarda da zaten etaplanma yaklaşımımız gereği altyapı tamamlanmaya yakın olduğunda imara açılıyor. Dolayısıyla kısmi altyapı desteği olarak cazip kredi fırsatlarından yararlanmış olacağız.

8. Sanayide yeşil dönüşüm ve döngüsel ekonomiye geçiş ile birlikte bazı mesleklerin ortadan kaybolması ve yeni beceriler gerektiren yeni iş kollarının ortaya çıkması olası beklentilerden biridir. Bu bağlamda OSB olarak yürüttüğünüz bir çalışma var mıdır? Evet ise biraz bahsedebilir misiniz?

Cevap: OSB olarak katılımcularımıza hangi meslek gruplarında ne tür çalışanlara ihtiyaç duyduklarına dair kapsamlı bir yerinde anket çalışması düzenleyerek bu çalışmayı bir istihdam yol haritası raporu şeklinde konsolide ettik. Çalışma kapsamında kısa orta ve uzun vadede yapacağımız eylem planlarını derledik. Her yıl periyodik olarak üretime geçen yada geçmek üzere olan katılımcularımızla bu çalışmanın anket kısmını yeniliyoruz ve ihtiyaca yönelik nitelikte operatör yada uzman bulabilmek ve yoksa yetiştirebilmek maksadıyla bu veriler ışığında planlamalar yaparak ihtiyaç olan, artık ihtiyaç olmayan yada yeni ihtiyaç duyulan meslek gruplarını belirliyoruz. Bu kapsamda yeşil ve dijital yaka personel ihtiyacının giderek artan bir trendi olduğunu görüyoruz.

9. En genel kapsamsıyla endüstriyel simbiyoz uygulamalarının yaygınlaştırılması kaynak verimliliğinin sağlanması ile atık sonu (end of waste), ikincil hammadde ve yan ürün uygulamaları ile atık azaltımı mümkün olacaktır. Bu bağlamda, ülke çapında stratejik bir endüstriyel simbiyoz ağının kurulması hakkındaki fikirleriniz nelerdir? Bunlar firmaların inisiyatifleri ile gerçekleştirilen uygulamalar olsa da kamu otoriteleri tarafından denetlenen ve sistematik hale getirilen bir platformun kurulması ile ilgili yaklaşımınız nasıl olur?

Cevap: Kesinlikle ülke çapında endüstriyel simbiyoz ağının kurulmasını uygun olacağını düşünüyoruz çünkü simbiyotik eşleşmeler alan daraldıkça ve ihtisaslaşma artıkça zorlaştırıyor. Bununla birlikte atık miktarı az olan firmaların simbiyotik ilişkilere girmesi imkansızlaşıyor. Ancak ülke çapında böyle bir platformun olması hâlinde hem simbiyotik olanaklar daha net bir şekilde belirlenmiş olduğundan katılım oranında ve eşleşme oranında ciddi bir artış olacak hem de her firmanın münferiden yatırım yapması yerine ortak yatırımlar ile yatırımların firma başı maliyeti azalmış olacaktır.

10. Yeşil sanayi uygulamalarının yaygınlaştırılması açısından ulusal bir strateji geliştirilmesi ve ulusal strateji kapsamında belli başlı uygulamaların (yeşil

binalar, yeşil üretim, yeşil etiket, yenilik merkezi, teknoloji geliştirme bölgeleri, araştırma merkezleri, atıkların yakılmaması, vb.) zorunlu hale getirilmesi hakkındaki görüşleriniz nelerdir?

Cevap: Yeşil dönüşüm konusunda temel yaklaşımlar belirlenmeli ve bunlar firmalara zorunlu hale getirilmelidir diğer taraftan geliştirici fark yaratabilecek özellikler de belirlenerek sanayicilere ilave bir puanlama sistemi getirerek teşviklerden yararlanması sağlanabilir. Aslında bu konuda sanayiciler ikiye ayrılıyor dış ticaret anlamında ihracat yapıp bu konunun farkında olan hatta zorunlu olanlar ya da şu an gerekli olmadığını düşünenler. Ancak bizim gibi kamu otoritesini temsil eden OSB yönetimi gibi kurumların yeşil dönüşüm konusunda ticari yada kanunu olarak uygulama yapması zorunlu olmayan sanayicileri de düşünerek onları yönlendirici şekilde OSB'mizde olduğu gibi üretim tesislerimizde yeşil bina sertifikasyonu zorunluluğu, inşaat projelerinde statik yüklerinin çatılarına güneş paneli koyacak şekilde hesaplanması ya da yağmur suyu biriktirme havuzlarının zorunlu olması gibi asgari uygulamalar belirlenerek bunların kati şekilde uygulanması denetlenmelidir. Ayrıca olsa iyi olur gibi ek uygulamalar eko etiket gibi ya da daha inovatif ürünlerin daha az karbon üreten üretim tekniklerinin kullanılması kapsamında hizmet verecek yenilik merkezi gibi ya da fikrin geliştirmesine destek olacak OSB içerisindeki teknoloji geliştirme bölgeleri araştırma merkezleri gibi merkezlerin kurulmasına da ön ayak olunmalıdır.

D. Appendix 4: Index Maps

