

DOKUZ EYLÜL UNIVERSITY
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DOCTORAL THESIS
Doctor of Philosophy (PhD)

**THE ROLE OF INNOVATION AND SUSTAINABILITY
IN PORT LOGISTICS**

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APPROVAL PAGE



DECLARATION

I hereby declare that this doctoral thesis titled as “The Role of Innovation And Sustainability in Port Logistics” has been written by myself in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honor.

06/12/2023

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ABSTRACT
Doctoral Thesis
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The Role of Innovation and Sustainability In Port Logistics
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When countries, businesses and societies began to experience negative effects that would affect both themselves and the world, they decided to take steps towards sustainability. The first effects of this situation have been seen in the 1987 Brundtland Report. So, the concept of sustainable development has been included in an international report for the first time. With an effort to achieve zero emissions in all the sectors by 2050, Supra-state structures have implemented some advisory decisions of the World Maritime Organization, and as of 2020, ships have been subject to a 0.1% sulfur limit with some condition. Due to emission restrictions, businesses operating in the field of maritime transportation and port management have turned to the efforts to transform their innovation activities into capabilities that can be used in sustainability issues in order to survive and be competitive. These sustainability innovations, which emerged as preventive innovations, have turned into areas of activity called sustainability-oriented innovations (SOI). Considering that port management operates with a multi-stakeholder structure in the international environment, stakeholder relations and stakeholder management have become important for SOI activities in ports. In the light of all these, a case study has been conducted for Borusan Port in this dissertation by considering the stakeholder identification and salience theory and sustainability-oriented innovation approaches. Firstly, a stakeholder analysis has been conducted related to port's operational and SOI activities. There are serious differences

between the stakeholders related to the operational and SOI activities of the port. Secondly, the effect of the SOI activities of the port on emission formation has been determined by emission calculation. It has been found that a significant improvement in the emission efficiency of the port despite the increased handling. Thirdly, the SOI model of Borusan Port has been established. Three selected SOI applications have been evaluated through grounded theory. According to all these findings in the three analyses, Borusan Port's operational and trade activities and SOI activities takes into account its stakeholder structure.

Keywords: Sustainability Oriented Innovation, Port Emission, Stakeholder Analysis, Cold Ironing, Decarbonization, Solar Energy Potential.

ÖZET

Doktora Tezi

Liman Lojistiğinde İnovasyon ve Sürdürülebilirliğin Rolü

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Sosyal Bilimler Enstitüsü

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Ülkeler, işletmeler ve toplumlar hem kendilerini hem de dünyayı etkileyecek olumsuz etkiler yaşamaya başlayınca sürdürülebilirlik konusunda adım atmaya karar verdiler. Bu durumun ilk etkileri 1987 Brundtland Raporu'nda görülmüştür. Böylece sürdürülebilir kalkınma kavramı ilk kez uluslararası bir raporda yer almıştır. 2050 yılına kadar tüm sektörlerde sıfır emisyonu ulaşma çabasıyla devletler üstü yapılar, Dünya Denizcilik Örgütü'nün tavsiye niteliğindeki bazı kararlarını uygulamaya koydu ve 2020 yılı itibarıyla gemiler bazı şartlarla %0,1 kükürt sınırına tabi tutuldu. Emisyon kısıtlamaları nedeniyle deniz taşımacılığı ve liman işletmeciliği alanında faaliyet gösteren işletmeler, hayatta kalabilmek ve rekabetçi olabilmek için inovasyon faaliyetlerini sürdürülebilirlik konularında kullanılabilecek yeteneklere dönüştürme çabalarına yönelmişlerdir. Önleyici yenilikler olarak ortaya çıkan bu sürdürülebilirlik yenilikleri, sürdürülebilirlik odaklı yenilikler (SOI) olarak adlandırılan faaliyet alanlarına dönüşmüştür. Liman yönetimlerinin uluslararası ortamda çok paydaşlı bir yapıyla faaliyet gösterdiği göz önüne alındığında, limanlardaki SOI faaliyetleri için paydaş ilişkileri ve paydaş yönetimi önem kazanmıştır. Tüm bunların ışığında, bu tezde paydaş belirleme ve öne çıkma teorisi ile sürdürülebilirlik odaklı inovasyon yaklaşımları dikkate alınarak Borusan Limanı için bir örnek olay çalışması yapılmıştır. İlk olarak limanın operasyonel ve SOI faaliyetlerine ilişkin bir paydaş analizi yapılmıştır. Limanın operasyonel faaliyetleri ve SOI faaliyetleri ile ilgili olarak paydaşlar arasında ciddi farklılıklar bulunmaktadır. İkinci olarak, limanın SOI

faaliyetlerinin emisyon oluşumuna etkisi emisyon hesaplaması ile belirlenmiştir. Artan elleçlemeye rağmen limanın emisyon verimliliğinde önemli bir iyileşme olduğu tespit edilmiştir. Üçüncü olarak Borusan Limanı'nın SOI modeli oluşturulmuştur. Seçilen üç SOI uygulaması, gömülü teori aracılığıyla değerlendirilmiştir. Üç analizdeki tüm bu bulgulara göre, Borusan Limanı'nın operasyonel ve ticari faaliyetleri ve SOI faaliyetleri paydaşların yapısını dikkate almaktadır.

Anahtar Kelimeler: Sürdürülebilirlik Odaklı İnovasyon, Liman Emisyonu, Paydaş Analizi, Gemiye Kıydan Elektrik Verilmesi, Dekarbonizasyon, Solar Enerji Potansiyeli

THE ROLE OF INNOVATION AND SUSTAINABILITY IN PORT LOGISTICS

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ABBREVIATIONS

AAPA	American Association of Port Authorities
BFI	Buckminster Fuller Institute
CBAM	Carbon Border Adjustment Mechanism
CERES	Coalition For Environmentally Responsible Economics
CF	Control Factors
CLI	Composite Leading Indicator
D	Distance
EFIP	European Federation of Inland Ports
EMAS	Eco-Management and Audit Scheme
EPO	European Patent Office
ESPO	European Seaports Organization
EU	European Union
EF	Emission Factor
E-RTG	Electrified-Rubber Tyred Gantry Crane
FCF	Fuel Correction Factor
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GLEC	Global Logistics Emissions Council
GLOMEEP	Global Maritime Energy Efficiency Partnerships Project
GIS	Geographical Information System
GRI	Global Reporting Initiatives
HDI	Human Development Index
IAPH	International association ports and harbors
ICChemE	The Institution of Chemical Engineers
ICCT	International Council on Clean Transportation
ICTI	Information and communication technologies Index
IMO	International Maritime Organization
IoT	Internet of Things
ISO	International Organization for Standardization

KADES	Kadın Destek Uygulaması (Woman Support Application)
LF	Load Factor
MCRP	Maximum Continuously Rated Power
NGO	Non-Government Organization
NMVOC	Non-Methane Volatile Organic Compounds
NRDC	Natural Resources Defense Council
OHS	Occupational Health & Safety
PACS	Personnel Attendance Control System
PCU	Project Coordination Unit
PDPL	Personal Data Protection Law
PERS	Port Environmental Review System
PET	Polyethylene Terephthalate
PID control	Proportional Integral Derivative control
PPP	Public-Private Partnerships
PPRISM	Port Performance Indicators: Selection and Measurement
RBV	Resource Based View
ROE	Return on Equity
ROI	Return on Investment
SDI	Sustainability-Driven Innovation
SFC	Smart Freight Center
SI	Sustainability Indicator
SSG	Ship to Shore Gantry Crane
SIST	Stakeholder Identification And Salience Theory
SII	Sustainability-Informed Innovation
SRI	Sustainability-Relevant Innovation
TAI	Technology Achievement Index
TBL	Triple Bottom Line
TEAP	Tool for the identification and assessment of Environmental Aspects in Ports
TEIP	Tool for the identification and implementation of Environmental Indicators in Ports
TSIS	Theory of Stakeholder Identification and Salience

UN	United Nations
UNCSD	United Nations Commission on Sustainable Development Framework
UNDP	United Nations Development Program
WCED	World Commission on Environment and Development
WIPO	World Intellectual Property Organization
WPSP	World Port Sustainability Program



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INTRODUCTION

The concept of “sustainability” is increasingly becoming a significant catalyst for business transformation and shaping future outlooks. In order to achieve this objective, it is imperative to adopt a forward-thinking approach. It is evident that addressing sustainability concerns necessitates significant transformations in several domains such as goods, services, processes, marketing, economics, management, and other relevant sectors, including the fundamental business models that underpin them (Seebode et al., 2012). In addition, it seems that one of the assumptions made for 2020 is that the focus of innovation systems will shift from individual challenges to sustainability concerns, and this paradigm change is often called the 6th wave of innovation (Moody and Nogrady, 2010; Desha and Hargroves, 2011; Seebode et al., 2012; Nair and Paulose, 2014; Silva and Serio, 2016). All these elements show that sustainability is an issue that needs to be addressed together with innovation. In addition, numerous studies have shown that innovation makes significant contributions to corporate success and the relationship between innovation and sustainability success (Totterdell et al., 2002; Radnor and Noke, 2006). In this sense, based on the relationship between innovation and sustainability, innovations have a very important place in terms of the gains made in the economic, environmental and social dimensions of sustainability and the preservation of these gains (Hansen et al., 2009b: 686). The synergy arising from the connection between innovation and sustainability has resulted in sustainability-oriented innovation (Amini and Bienstock, 2014: 12). In fact, according to the idea put forward by Hansen et al. (2009b: 687) about sustainability-oriented innovation, they define SOI as “innovation that has an overall positive net effect on the capital stock of an organization”. Sustainability-oriented innovation also includes issues such as the product life cycle and the inclusion of various stakeholders in the innovation process, as it affects the capital stock of the organization. As a result, organizations targeting sustainability-oriented innovations will have to involve not only multiple units within themselves, but also many stakeholders in the business environment (Amini and Bienstock, 2014: 16-17). Additionally, sustainability-oriented innovation is also referred to as sustainability-focused innovation in the literature. Although there is no

clear difference between them, sustainability-focused innovation is generally considered only at the subsystem level and for the new product development process in B2Bs, while sustainability-oriented innovation also includes society and innovation types with a circular based perspective through a supra-systemic structure. This supra-systemic structure can be inter-sectoral, inter-disciplinary and inter-societal (Du et al., 2022: 117). Based on many stakeholders in the business environment, determining sustainability criteria to manage sustainability-oriented innovations, it is required that developing products and services in line with sustainability-oriented innovations, integrating stakeholders into the process, increasing awareness about sustainability and encouraging sustainability activities. In this sense, integrating stakeholders into the process and encouraging them into activities reveals the importance of stakeholder interaction and management in sustainability-oriented innovations. In summary, the connection between innovation and sustainability has brought sustainability-oriented innovations. SOIs also emerge as areas where relations with stakeholders are important (Hansen et al., 2009b: 702). The integration of stakeholders for sustainability-oriented innovations reveals the relationship between stakeholders with sustainability, innovation and sustainability-oriented innovation, as it will help increase the sustainability potential of activities aimed at the changing expectations of important stakeholder groups (Hansen et al., 2009b: 703).

The necessity of sustainability-oriented innovation and interaction between stakeholders also manifests itself in the field of transportation. Current needs must be met without compromising the ability of future generations to meet their own needs sustainable transportation. (Cheng et al., 2015). Especially since approximately 80% of world trade is carried out by sea (Unctad-Rmt, 2018), the field of maritime transportation and port management has become an important area for sustainability and innovation issues (Frankel, 1989). The reason why port management stands out in terms of sustainability and innovations in the field of maritime transportation is that it is a place where many stakeholders and parties, including such as container lines, Ro-Ro lines, general cargo operators, industrial corporations, agencies and forwarders, ship chandlers, stevedoring companies, national and international regulatory structures, central and local governments and non-governments

organizations, fisheries, local residents and press interact (Notteboom and Winkelsmans, 2002: 3). These many stakeholders come together in a complex operation, according to Darbra et al. (2005: 870), “seaports are very complex systems with a wide range of environmental issues: releases to water, air and soil, waste production, noise, and dredging among others”. Therefore, in terms of sustainability, in the port business environments where stakeholder interaction is intense, the emissions caused by ports and the parties they interact with emerge as an issue that needs to be emphasized. As a result of all these interconnected issues, in this doctoral thesis, the role of sustainability and innovation in port management is discussed through sustainability-oriented innovations and stakeholder management.

The concept of basic stakeholder management has been introduced in the first chapter of this dissertation. Regarding stakeholder management, after mentioning the basic stakeholder circles in business management, stakeholder management in port management is mentioned in terms of maritime management field. The status of stakeholder management in port management and multidisciplinary stakeholder identification, salience and classification studies are included in the literature. In addition, stakeholder identification and salience theory and other theories that stakeholder management is related to are explained in terms of stakeholder management relationship.

In the second chapter of the dissertation, the conceptual framework of sustainability, innovation and sustainability-oriented innovation, and the scope of sustainability, innovation and sustainability-oriented innovation in ports have been included. In addition, the connection and importance of open innovation and sustainability-oriented innovations have been mentioned. The second chapter of the dissertation has been completed by conveying the sustainability and innovation activities put forward in the field of port management in recent years and the project and patent themes of container line and port operators around the world.

The third chapter of the dissertation includes case-oriented research consisting of three interrelated analyzes on Borusan Port. These three analyzes constitute the trivet of this thesis research, which examines the role of sustainability and innovation in port management in terms of sustainability-oriented innovations. In the first analysis, a stakeholder analysis of Borusan Port has been conducted in terms

of operational and commercial activities and sustainability and innovation activities. The second analysis has been aimed to determine the impact of the sustainability improvements made by the Borusan port while carrying out its operations on emission efficiency and to determine the solar energy potential of the port. Regarding this, a “what-if” oriented analysis has been made. In the third and final analysis, unlike the first two analyzes where quantitative methods have been preferred; Using grounded theory, which is a qualitative method, the SOI model of the port has been determined in a simultaneous interview with a group of participants consisting of senior and middle level managers of Borusan Port, and the three selected SOI projects have been examined and evaluated through the grounded theory in the light of the related literature in terms of “organizational DNA” metaphor. Under the title of conclusion and discussion, the dissertation has been completed by presenting a discussion of the research results, practical recommendations, theoretical recommendations, strengths of the current research, other related recommendations and limitations for future research.

CHAPTER ONE

THEORETICAL FOUNDATIONS OF THE STUDY IN TERMS OF STAKEHOLDERS AND OTHER RELATED THEORIES

1.1. CONCEPTUAL FRAMEWORK OF THE STAKEHOLDER AND RELATED THEORIES

The reasons for associating the thesis topic with Sustainability, stakeholder management, innovation and sustainability-oriented innovation and the motivation source of the research in this dissertation are explained in 3.1 numbered title. However, in this title, the theoretical framework regarding stakeholder management, stakeholder theories related to the research scopes have been presented. In addition, the relationship between the theoretical framework of stakeholder and port management have been emphasized. Also, the concepts of power, legitimacy and urgency, which are effective in the formation of stakeholder relations, have been explained. Then, some other theories associated with stakeholder management are included within the scope of the research and the chapter has been completed.

1.1.1. The Concept of Stakeholder

As Donaldson and Preston (1995: 65) stated, it has been reported that about a dozen books and more than 100 articles have been published on the concept of stakeholder. Since then, interest in stakeholder theory has grown, not only in the academic world devoted to it, but also in general terms (Friedman, and Miles, 2002: 1). According to Freeman (1984: 5), a stakeholder is defined as “any group or individual who can affect or is affected by the achievement of the organization’s objectives”. The concept of stakeholders is predicated on redefining the organization. The concept generally focuses on what an organization should be and how it should be conceptualized (Fontaine et al., 2006: 3). According to Friedman and Miles (2006: 1), a business should be viewed as a group of stakeholders and its purpose should be to manage the interests, requirements, and perspectives of its stakeholders such as departments, employees, management. This stakeholder management is considered to be carried out by a company's managers.

Table 1: Various Stakeholder Definitions

Date	Author	Stakeholder definition
1983	1. Freeman and Reed (1983: 91)	<i>“Wide: can affect the achievements of an organization’s objectives to who is affected by the achievement of an organization’s objectives Narrow: on which the organization is dependent for its continual survival.”</i>
1984	2. Freeman (1984: 46)	<i>“Can affect or is affected by the achievements of the organization’s objectives.”</i>
1987	3. Cornell and Shapiro (1987: 5)	<i>“Claimants” who have “contracts”.</i>
1988	4. Evan and Freeman (1988: 75-79)	<i>“Have a stake or claim in the firm Benefit from or are harmed by, and whose rights are violated or respected by, corporate actions.”</i>
1990	5. Freeman and Evan (1990: 337)	<i>“Contract holders.”</i>
1991	6. Miller and Lewis (1991: 55)	<i>“Stakeholders are people who can help or hurt the corporation.”</i>
	7. Savage et al. (1991: 61)	<i>“Have an interest in the actions of an organization and have the ability to influence it”</i>
	8. Goodpaster (1991: 54)	<i>“One with a ‘stake’ in the game is one who plays and puts some economic value at risk.”</i>
1992	9. Hill and Jones (1992: 133)	<i>Constituents who have a legitimate claim on the firm... established through the existence of an exchange relationship. They supply ‘the firm with critical resources (contributions) and in exchange each expects its interests to be satisfied (by inducements).</i>
1994	10. Freeman (1994: 415)	<i>“Participants in ‘the human process of joint value creation.”</i>
1995	11. Donaldson and Preston (1995: 85)	<i>“Identified through the actual or potential harms and benefits that they experience or anticipate experiencing as a result of the firm’s actions or inactions.”</i>
	12. Jones (1995: 407)	<i>“Groups and individuals with (a) the power to affect the firm’s performance and/or (b) a stake in the firm’s performance.”</i>
	14. Mitchell et al. (1997: 853-878)	<i>“Legitimate or urgent claim on the corporation or the power to influence the corporation.”</i>
2001	15. Hendry (2001a: 229-230)	<i>“Moral actors . . . relationships cannot be reduced to contractual or economic relations. Include social characteristics such as interdependence.”</i>
2006	16. Friedman and Miles (2006: 11)	<i>“Claimants who influence and are affected by the power, influence, or ability of organizations to influence other parties, through overt and covert contracts through legal and institutional conditions.”</i>
2017	17. McGrath and Whitty (2017: 740)	<i>“Primary, secondary and tertiary claim holders that affect and are affected by the organization with which they are associated, and also affect and are affected by other parties with which the relevant organization is associated.”</i>
2023	18. Hollebeek et al. (2023: 34)	<i>“Claimants who affect and are affected by the relevant organization when control, covariation of interest, mutuality of dependence and information availability are taken into account.”</i>

Source: Compiled by the Author through various sources

The managers should, on the one hand, manage the corporation for the benefit of its stakeholders to ensure their rights and participation in decision-making, and, on the other hand, act as the stockholders' agent to ensure the firm's survival and protect the long-term interests of each group (Fontaine et al., 2006: 3). Midway through the 1980s, research on stakeholders and stakeholder structures acquired traction, but the concept of stakeholder dates back to the 1960s. The term "stakeholder" first appeared in a Stanford Research Institute (SRI) internal memo in 1963 (Freeman, 1984). Afterwards, While some researchers limited the definition of the stakeholder (e.g. related to bearing risk and risky activities) (Clarkson, 1994), others defined the stakeholder extensively such as in the studies of Freeman and Reed (1983: 90-93) and Freeman (1984). When looking at stakeholder definitions in the literature, 69 definitions made between 1963 and 2023 have been found. All of these 69 definitions have not been explained in this dissertation. If briefly summarizing these stakeholder definitions, some of these definitions are: parties who have a common purpose; parties who come together out of necessity; parties who are in influence and influence; parties who form a unity for survival; claimants; those who assert power, legitimacy and urgency; agreements and contracts; the parties that harm or help each other; the parties that are related to each other in social and environmental dependencies and economic actions. From these point of view, the most cited stakeholder definitions and some stakeholder definitions that include different elements of stakeholders are given in Table 1.

1.1.2. Classification of Stakeholders

There is a direct correlation between stakeholder definitions and the classification and identification of stakeholders (Friedman and Miles, 2006: 13; Fontaine et al., 2006: 6). The most common method for categorizing stakeholders is to contemplate categories of individuals with distinct relationships to corporations. The most common stakeholder groups to consider are (Friedman and Miles, 2006: 13):

- Customers,
- Employees,

- Local communities,
- Suppliers and distributors,
- Shareholders.

This is the most typical and most concise classification for the stakeholders. However, other groups and individuals are also regarded as stakeholders in the literature of Friedman and Miles (2006: 13-14):

- The media,
- The public in general,
- Business partners,
- Future generations,
- Past generations (founders of organizations),
- Academics,
- Competitors,
- NGOs or activists – considered individually, stakeholder representatives,
- Stakeholder representatives such as trade unions or trade associations of suppliers or distributors,
- Financiers other than stockholders (debt holders, bondholders, creditors),
- Government, regulators, policymakers,
- Archetypes or memes.

Apart from the stakeholders listed above, managers are addressed in various ways in the literature (Fontaine et al., 2006: 7). For many scholars, they are considered stakeholders, but they have exclusive access to focal organization resources, so, managers are not stakeholders; actually, they are acted as an arbitrator between investors and employees (Aoki, 1984). Managers are accepted as the embodiment of the actions and responsibilities of the focal organization.

Table 2: Stakeholder Classification Typologies in Terms of Descriptive Approach

Authors	Name of The Classification
1.General Electric in 1930	Shareholders, employees, customers and the general public
2. Freeman (1984: 25)	Employees, special interest groups (SIG), environmentalists, suppliers, governments, local community organizations, owners, consumer advocates, customers, competitors, media.
3.Lerner and Fryxell (1988: 951)	Customer, community, stockholder, government and employees.
4. Droge et al. (1990: 358)	Shareholders, customers, voters, the general public, the financial community, lawmakers, communities, the press, higher education, employees and their families, labour unions, company distributors and other companies including competitors.
5. Donaldson and Preston (1995: 69)	Governments, investors, political groups, suppliers, customers, trade associations, employees, communities.
6. Henriques and Sadorsky (1999: 89)	Regulatory stakeholders, organizational stakeholders, community stakeholders, media.
7. Friedman and Miles (2002: 8)	Shareholders, top management, compatible-necessary partners, the generalpublic, companies connected through common trade associations, trade unions, low-level employees, government and their agencies, costumers, lenders, suppliers and other creditors, some necessary NGO's, some contingent NGO's, aggrieved or criminal members of the public.
8. Friedman and Miles (2006: 13-14)	Customers, employees, local communities, suppliers and distributors, shareholders, the media, the public in general, business partners, future generations, past generations (founders of organizations), academics, competitors, NGOs or activists - considered individually, stakeholder representatives, stakeholder representatives such as trade unions or trade associations of suppliers or distributors, financiers other than stockholders (dept holders, bondholders, creditors), government, regulators, policymakers, archetypes or memes.
9. Lozano et al. (2015: 438)	Shareholders (stockholders) and investors, employees and managers, customers, unions, suppliers and other business partners, local communities, the natural environment, future generations, non-human species, government and regulators, civic institutions, social pressure groups, the media and academia, trade bodies, competitors, general public, environmental pressure groups, (animal-welfare organisations).

Source: Compiled by Author.

Various parties interacting with the organization, through the some elements such as power, influence, communication, pressure, trust, they are accepted as stakeholders (Friedman and Miles, 2006: 13-14) in the literature. Stakeholder classifications created in the literature as a result of these factors have been explained in Table 2.

Freeman (1984) defined stakeholders as “primary” and “secondary” stakeholders. This basic distinction made by Freeman (1984) bears historical traces of the definition put forward by SRI (1963). However, in another approach, General Electric defined stakeholders as “shareholders”, “employees”, “customers” and “the general public” in 1930s (Clarkson, 1995: 105). Customers, suppliers, employees, shareholders, local residents, environmental groups, and community stakeholders, for example, have the power to change public opinion in favor of or against the organization's environmental performance, also as seen on in Table 2, there are also stakeholders with a regulatory role, which include actors and elements such as governments, informal networks and industry leaders (Kelley, 1991). According to Henriques and Sadorsky (1999), Regulatory stakeholders (other than governments), have the ability to persuade governments to adopt similar environmental practices or technology; however, organizational stakeholders have the most direct impact on the business and have the capacity to influence its profitability. The final stakeholder group is the media, which includes mass media groups. In addition, the media has a supportive role for stakeholders such as social groups, residents and surrounding communities.

According to Table 2, according to the accepted descriptive stakeholder classifications in literature, the most common stakeholder in the relevant classifications is society (community or general public). Community is important for integrating the organizational and process capabilities, innovation, development and survival capabilities of every type of organizational ecosystem (Klewitz and Hansen, 2014: 57). Following it, the most common stakeholders in the classifications are the government and other regulatory structures, customers, employees, trade associations, environmental groups, suppliers, other business partners, shareholders, the press, competitors, academic education environment, financial bodies.

1.1.3. Role Classification of Stakeholders

In addition to their basic descriptive structures, stakeholders are also classified in terms of different characteristics such as being decision-makers, being affected or influencing, their level of power, and their level of interest in the group or

organization they are evaluating (Jepsen and Eskerod, 2009: 339-340). As seen in Table 3, there are various classifications in the literature in terms of role similarities and uniqueness of stakeholders.

Table 3: Role Classification Typologies of Stakeholders

<i>Authors</i>	<i>Name of The Classification</i>	<i>The Conceptual Context of Statements</i>
1. Arnstein (1969: 217)	Active stakeholders, responsiveness stakeholders, passive stakeholders.	Active, responsiveness, Passive, stakeholders.
2. Ulrich (1983:252)	Actively involved actors, passively involved actors, clients, decision makers, designers, passively involved representatives.	Active actor, passive actor, clients, decision maker, designer, passive representative.
3. Freeman (1984)	Primary stakeholders, secondary stakeholders.	Primary, secondary, stakeholders.
4. Evan and Freeman (1988)	Narrow stakeholders, wide stakeholders	Narrow, Wide, stakeholders.
5. Goodpastor, (1991: 67-72)	Strategic stakeholders, moral stakeholders.	Strategic, moral, stakeholders.
6. Savage et al. (1991: 62)	Internal stakeholders, external stakeholders, interface stakeholders.	Internal, external, interface, stakeholders.
7. Mahoney (1994: 6-7)	Active stakeholders, passive stakeholders.	Active, Passive, stakeholders.
8. Morgan and Hunt (1994: 34)	Internal stakeholders, buyers, suppliers and lateral stakeholders.	Internal, buyer, supplier, lateral, stakeholders.
9. Bryson (1995: 197)	Informing stakeholders, consulting stakeholders, involving stakeholders, collaborative stakeholders, empowered stakeholders.	Informing, consulting, involving, collaborative, empowered, stakeholders.
10. Mitchell et al. (1997: 874)	Dormant stakeholders, discretionary stakeholders, demanding stakeholders, dominant stakeholders, dangerous stakeholders, dependent stakeholders, definitive stakeholders, non-stakeholders.	Dormant, discretionary, demanding, dominant, dangerous, dependent, definitive, non-stakeholder.
11. Rowley (1997: 901)	Commander stakeholders, compromiser stakeholders, subordinate stakeholders, solitarian stakeholders.	Commander, compromiser, subordinate, solitarian, stakeholder.
12. Eden and Ackermann (1998: 122-349)	Subjected stakeholders, players, crowds, context settlers.	Subjected, players, crowds, context settlers.
13. Frooman (1999: 199)	Low interdependence stakeholders, powered stakeholders, high interdependence stakeholders, weakened stakeholders.	Low interdependence, Powered, high interdependence, weakened, stakeholder.

<i>Authors</i>	<i>Name of The Classification</i>	<i>The Conceptual Context of Statements</i>
14. Friedman and Miles (2002: 7)	Compromised stakeholders, defensive stakeholders, opportunistic stakeholders, eliminated stakeholders.	Compromised, defensive, opportunistic, eliminated, stakeholders.
15. Sirgy (2002: 146)	External stakeholders, internal stakeholders, distal stakeholders.	External, internal, distal, stakeholder.
16. Lorca and Garcia-Diez (2004)	Voluntary stakeholders, involuntary stakeholders	Voluntary, involuntary, stakeholder.
17. Lozano et al. (2015: 438)	Primary social stakeholders, primary non-social stakeholders, Secondary social stakeholders, Secondary non-social stakeholders.	Primary, secondary, social, non-social, stakeholder.
18. Silva et al. (2019: 209)	Standard setters, process enablers, impacted stakeholders, information providers, addressees, decision makers.	Standard, setters, process, enablers, impacted, information, providers, addressees, decision makers.

Source: Compiled by Author

Looking to the Table 3, the role classification is as those in the foreground and those in the background; in the form of primary and secondary stakeholders; or active and inactive roles are determined (as seen on Arnstein, 1969: 217; Ulrich, 1983: 252; Freeman, 1984; Carroll, 1993; Clarkson, 1995: 106; Evan and Freeman, 1988; 6; Evan and Freeman, 1988; Mahoney, 1994: 6-7; Lozano et al. 2015: 438; Chang et al. 2017: 51). The similarity in role classification of scholars has evolved into a different context since the mid-1990s. The classification of stakeholder roles by Lozano et al. (2015: 438) is based on voluntary affiliation. Morgan and Hunt (1994: 34) prioritized the supply chain parties in their classification of stakeholder roles as internal stakeholders, buyers, suppliers and lateral stakeholders, and considered mostly negative elements such as competitors, and regulatory elements such as government agencies as stakeholders. Savage et al. (1991: 62) made a very general role classification that reveals the interaction as internal and external stakeholders and interface stakeholders that provide interaction between the two. Lorca and Garcia-Diez (2004) made a role classification that identifies the stakeholders with the concept of volunteering. This classification is similar to the strategic and moral stakeholder concept of Goodpastor (1991: 67-72). While being a stakeholder morally requires volunteering; being a strategic stakeholder can also be undertaken voluntarily and involuntarily. Another change in the classification of roles after the

mid-1990s was shaped by the importance that should be given to the stakeholders and the effect associated with this importance, taking into account the concepts of power, legitimacy and urgency (Bryson, 1995: 197; Mitchell et al., 1997: 874; Rowley, 1997: 901; Eden, and Ackermann, 1998: 122-349; Frooman, 1999: 199; Friedman, and Miles, 2002: 7; Eidl et al., 2020: 5). However, the most comprehensively and detailed distinction regarding the roles of stakeholders made by Mitchell et al. (1997: 874) and according to their approach, stakeholders are discussed based on eight different organizational characters in terms of their roles. These eight different organizational characters have been examined in terms of three different structures as power, legitimacy and urgency. With this classification, Mitchell et al. (1997: 874) have introduced the stakeholder identification and salience theory. In the 1.1.7.1 numbered title, this theory have been examined in detail.

1.1.4. Classification of Stakeholders in Port Management Literature

Stakeholders in a seaport facility can be described broadly as legal entities, individual or group of persons with a legitimate interest in and affected by port activity (Notteboom and Winkelmans, 2002: 1). Cerit and Güler (1998) and Cerit (2013: 14) classified the stakeholders as customers, substitutes, suppliers, insurance and consulting firms, and society. In this classification, the government is included in supplier groups. In this respect, the government has been seen as a facilitating stakeholder. The regulatory role of governments has been considered secondary. As can be seen the stakeholder classifications in Table 4, stakeholders includes port operators, regulators including customers, employees, governments and national-international structures, distribution channel members as the vertical and horizontal support elements, ship production, repair and maintenance businesses, industry associations, financial institutions, society, non-profit organizations, media and press organizations. These are the general classification in terms of descriptive approach. While some researchers have taken into account the stakeholders in related to general scope; some others have made a detailed classification for the stakeholders (for example, making a detailed distinction for the broker sector). Notteboom and

Winkelmanns (2002: 3) descriptively classifies the stakeholder structure in port management through vertical and horizontal relationships.

These stakeholders have been classified as Notteboom and Winkelmanns (2002: 3):

- The stakeholders that have been integrated to the port-related issues,
- The stakeholders that have not been integrated to the port-related issues,
- The stakeholders that have vertical or horizontal relationship to the port,
- The stakeholders that have a structure from the sea to the port,
- The stakeholders that have a structure from the hinterland to the port, and
- The stakeholders that have a structure from the hinterland to the port.

In this regard, Notteboom and Winkelmanns (2002: 3) has revealed a stakeholder structure that will be taken as basis in the studies related to port and stakeholders. So, in our research, the descriptive stakeholder classification of Notteboom and Winkelmanns (2002: 3), which considering horizontal and vertical integration, has been taken into account for the stakeholder analysis to be made. When looking to the descriptive role classifications of port stakeholders through the current requirements of the sector, in the descriptive classification made by Yoon (2020: 3), new stakeholders of business environment such as cyber security, communication, data handling, consolidated platforms, maritime-specific repair and maintenance businesses, automated cargo inventory solutions have been added to the stakeholder classification in the maritime and port operations sector. It is not an exclusively separate structure of the maritime and port industry; on the contrary, stakeholders are an important issue for ports, as the port industry is the locomotive of the entire transportation and supply chain. Stakeholder interests have a wide variety of regulations and different power, legitimacy and urgency (Yoon, 2020: 1). In addition, with the introduction of autonomous and semi-autonomous unmanned systems, different stakeholders from a wide variety of disciplines have started to take part in the port management sector. In addition, the diversity of stakeholders in the port management sector has brought cultural, ethical and environmental issues to the center of stakeholder management in ports (Chae et al., 2020: 6-12-14).

Table 4: Port Management Stakeholder Classification Typologies in Terms of Descriptive Approach

<i>Authors</i>	<i>Name of The Classification</i>
1.Cerit and Güler (1998) Adopted by: 2.Cerit (2013: 14)	Customers (shippers, passengers); distribution channels (agent, broker, forwarder, logistics agents); substitutes (other modes of transport, other tourism, sports and food sectors); suppliers (energy, shipbuilding and repair, ship supply, logistics, ship, cargo, passenger, water sports technologies and services, safety, security, environment and communication, information and communication technologies and services, government, labor, finance, education, class) , insurance and consulting organizations, society.
3. Ma (2002: 4)	National and international regulatory bodies, ship survey and class societies and ship registration bodies, other ports and terminals, forwarders, shippers, brokers, agents, cargo handling companies, bunkerers, shipyards and shipbuilding industries, ship repairers and maintenance providers, ship scrapping and secondhand market providers, banks, credit institutions, maritime courts, lawyers and arbitration authorities, insurance mutuality agencies.
4. Verbeek (2000)	Charterers, cargo owners, finance providers, ship builders, insurers and insurance brokers, public, classification societies, flag states, port states, IMO, other international and national regulations, ship owners, ports.
5.Notteboom and Winkelmans (2002: 3)	Shipping line, stevedoring companies, logistic service providers, railway companies, inland barge operators, trucking companies, shipping agents, logistic service providers (3PL and 4PL), freight forwarders, towage companies, pilotage services, ship chandlers, repair services (ship repair, container repair), waste reception facilities, inspection services, banks, insurance companies, legal firms, lawyers), industries in foreland of port, industrial companies in ports, industries in hinterland of port, port authorities of other seaports, inland terminal authorities, rail infrastructure management companies, central, regional, and local public authorities (c.f. roads, inland, waterways), supranational public organizations (c.f. EU, WorldBank), central and regional governments (including port commissions), European union, trade negotiations groups (c.f. WTO), local inhabitants groups, consumers, tax payers, environmentalist groups of a local, regional or global scale, the press.
6. De Langen (2006: 468)	Local Residents, national government, local environmental groups, local and regional government, end users, local industries, transport firms.
7. Lützhöft (2011: 283)	Cargo owners, financiers, classification societies, P&I club, brokers, hull insurers, IMO, flag states, coastal states, port states, waterway associations, other ports and terminals, bunkerers, pilotage and tugging firms, labour unions, crew management firms, shipbuilders, repairers and designers, salvors, ship recycling firms, ship agents, education and training facilities, legal structures.

<i>Authors</i>	<i>Name of The Classification</i>
8.Coady et al.(2013: 31)	Employees, Unions, Governments and regulators, public, media, NGO's and academia, local indigenous communities, investors, banks, insurers, suppliers, business partners, classification societies, sustainable shipping coalitions, customers (retailers, manufacturers, cargo owners), other ports, terminals and seaways, ship builders, maritime sector associations, shipowners, charterers, operators,
9. Branten and Purju (2014: 229-230)	Ministry of Economic Affairs and Communications, shipping companies, shipping lines, other ports and cargo handling companies, ocean lines, smaller lines, infrastructure and waste treatment facilities, State-owned ports, shipbuilding companies, central governments, local governments, associations of maritime sector, government agencies and companies, state agencies, local communities and environmental groups, general trade unions, maritime sector trade unions, citizens and academic institutions, employees, Independent trade union for Estonian seamen, other intermediating bodies, media, banks, tourism industry.
10. Pang (2015: 3-5)	Shipowners, shipbuilders, terminal operators, shipbrokers, charterers, ship management companies, other port and terminal operators, ship agents, ship forwarders, governments, classification societies, ship brokers (sale&purchase brokers, chartering brokers, demolition brokers) employees, customers, governments, creditors, labour unions and communities, environmental protection community, trade unions, investors,
11. Notteboom et al. (2015: 230)	Shareholders, financial community, employees and labor unions, concessionaries, port users, carriers, passengers, port services providers, local community and societal groups of interest, regulators.
12. Compassair (2018)	Ship owners, charterers, ship operators, ship management companies, chartering brokers, sale & purchase (S&P) broker, banks and private investors, classification societies, shipyards and demolition yards, traders and hedge funds, other ports and terminals (major ports, feeder ports)
13. Lie (2018: 53-55)	Seafarers, employees, customers, local, owners, local authorities, suppliers, NGO's, initial organization's group firms, focal firms, agents at seaports, unions at seaports, authorities at seaports, environmental unions, local communities, criminal groups, media, the Norwegian embassy, educational institutions.
14. Dooms (2019: 11)	Shareholders, board members, management, employees, customers, suppliers, local communities, government and regulatory agencies, local, regional, national, supranational, trade associations, press and media, non-governmental organizations.
15. Lam and Yap (2019: 5)	Port employees, minority shareholders, port managers, board members, owners of ports (e.g. government/port operator; port regulator), port authority; port state control, national governments, ministries-in-concern (e.g. transport ministry, finance ministry,

<i>Authors</i>	<i>Name of The Classification</i>
	environment ministry, legislators, urban development authorities), labor unions, stakeholder organizations (inland and sea transport operators, logistics company, shipping and transport companies, stevedoring companies), local inhabitants living in close proximity to ports, consumers and tax-payers, non-profit organizations (NGOs) (e.g. environmental groups), media, press.
16. Cerreta et al. (2020: 10)	Shipowners, Merchants, Foundations, Citizens, Fishermans, Tourists, workers, port system authority, Department of transport, municipality of Naples, environmental ministry, universities, high schools, social-cultural groups, agency for environmental protection in campania region (ARPAC).
17. Yoon (2020: 3)	Other terminal operators, docker's unions, terminal operating system developers, equipment leasing companies, port construction companies, port authorities, inland transporters, distriparks and warehouses, shippers, forwarders, tally and surveyor providers, shipping companies, seaman universities and training centers, insurance companies, pilotage and tugging companies, port related service companies, bunkering companies, ship supplying companies, ship repair yards, local branch of ministry of finance, vessel traffic services, government bodies and international organizations, ship registry, immigration bureaus, quarantine stations, customs, new businesses and new entrants (cyber security, communication, data handling, consolidated platform, auto repairing services, auto cargo inventory solutions).
18. Osobajo et al. (2021: 3)	Maritime industry related organizations, government institutions, agencies and regulators, maritime employees, trade unions, local communities, NGO's and civil societies, research and education structures, customers, suppliers, investors, financial related institutions, international organizations, media.
19. Geerts and Dooms (2022: 5)	Customers, employees, governments, investors, suppliers and business partners, port authorities/terminal operators, ship building companies, community, NGO's and academia, unions, media, maritime sector associations, consumers.
20. Theotokatos et al. (2023: 19)	Shipowners, ship operators, ship designers and builders, regulatory authorities, state authorities, port authorities, legal and technical advisors, environmental and societal organisations, International authorities, research institutions and academia, seafarers, public.

Source: Compiled by Authors.

Another link of stakeholders in port management is stakeholder management is an important element in dealing with problems arising from risk management. Namely, breaks that may occur in the supply chain (Akahoshi, 2021: 134) or a global epidemic for Covid-19 risks on ports as seen on (Mankowska et al., 2021: 2). These

are *physical risks* that require attention to stakeholder relations in ports. The *legal risks* arising from the relations between the parties that are the subject of the port management sector and that are directly or indirectly related to each other also reveal the importance of stakeholder management in ports. In addition, the *transition (transformation) risk* arising from the pressure on financial resources and the transition to low GHG emission practices, which is a matter of sustainability, also reveals the importance of stakeholder management in port management arising from innovation and sustainability practices (Akahoshi, 2021: 134).

1.1.5. Role Classification of Stakeholders in Port Management Literature

As in other basic stakeholder classification studies (Jepsen and Eskerod, 2009: 339-340), stakeholder classifications in the field of port management are also classified according to their roles (Eskafi et al., 2019: 215-222). Verbeek (2000) put forward the stakeholder roles as market related, regulators and classification societies. Verbeek (2000) based his classification on power's directing and being neutral (classification societies). Ma (2002: 4) discussed stakeholder roles from a descriptive point of view. Mykoo (2003: 10) and Doods et al. (2004: 14-15) have formed a role as major stakeholder in terms of hard stakeholder and minor stakeholder in terms of soft stakeholder with a similar approach, an approach in which the majority holds the power. Doods et al. (2013: 15-16) created the roles of a stakeholder by taking into account the dependency on location and interests. De Langen (2006: 468) has determined the stakeholder roles by taking into account the conflict of interest of the stakeholders. Notteboom and Winkelmans (2002: 3) described a port environment that included internal stakeholders, external stakeholders, public policy stakeholders, and community stakeholders. Denktas-Sakar and Karatas-Cetin (2012) reaffirmed this categorization of stakeholders made by Notteboom and Winkelmans (2002: 3). Contrary to the stakeholder classification, which is about being in and not in the system put forward by Winch (2004) and Aaltonen and Sivonen (2009); the role classification of stakeholders by Notteboom and Winkelmans (2002: 3) and Denktas-Sakar and Karatas-Cetin (2012) revealed a role distribution suitable for the maritime sector and port management as public policy stakeholders (regulatory) and social stakeholders (community stakeholders).

Table 5: Role Classification Typologies of Ports' Stakeholders

<i>Authors</i>	<i>Name of The Classification</i>
1.Verbeek (2000)	Market forces stakeholders, regulatory forces stakeholders, classification societies.
2.Ma (2002: 4)	Regulatory stakeholders, commercial stakeholders, operational stakeholders, financial stakeholders, legal stakeholders, technical stakeholders.
3.Mykoo (2003: 10)	Major stakeholders, minor stakeholders.
4.Dooms et al. (2004: 14-15)	Soft stakeholders, hard stakeholders.
5.Notteboom, and Winkelmans (2002: 3)	Internal stakeholders, external stakeholders, legislation and public policy stakeholders, community stakeholders.
6.Gomes (2006: 54-58)	Decision Makers, Agenda Developers, Decision Making Facilitators, Performance Developers Decision-Making "Legitimisers", Decision-Making Controllers, Service Deliverers, Policy-Framework Developers.
7.De Langen (2006: 466)	Incident stakeholder, silent stakeholder, negotiated stakeholder, enabling stakeholder.
8.Denktaş-Sakar, Karatas-Cetin (2012: 313)	Collaborator stakeholders, Integrator stakeholders, platform developing stakeholders, action facilitators, interest managing stakeholders.
9.Dooms et al. (2013: 15-16)	Stakeholders whose structure and interests are low in locational dependence, stakeholders whose structure and interests are highly locational, stakeholders whose structure and interests are low in locational independence, stakeholders whose structure and interests are high in locational independence.
10. Parola et al. (2013: 134)	Public stakeholders, private stakeholders,
11.Dooms (2019: 67)	Internal stakeholders, external stakeholders.
12.Lam, and Yap (2019: 5)	Internal stakeholder, public sector, market players (corporate bodies), community (interest groups).
13.Cerreta et al. (2020: 10)	Providers, governors, users, influencers.
14.Geerts, and Dooms (2022: 5)	Stakeholders having Knowledge, stakeholders that informing, stakeholders that advising, stakeholders that providing conditional supports, stakeholders thatpartnerships, minority represented stakeholders, majority represented stakeholders.
15. Roh et al. (2023: 258)	Primary stakeholders, Secondary stakeholders in economic, social and environmental conditions
16.Courtens et al. (2023: 4)	Internal port stakeholders that pursued, internal port stakeholders that discovered, external port stakeholders that pursued, external port stakeholders that discovered.

Source: Compiled by Authors.

Notteboom and Winkelmans (2002: 7) has defined stakeholder roles in terms of having information, participating in decisions, giving direction and being impartial. Gomes (2006: 54-58) has determined the stakeholder roles in terms of

decision making and implementation of decisions, taking into account the legitimacy situations. De Langen (2006: 466) has determined the stakeholder roles in terms of decision making and implementation of decisions, taking into account the legitimacy situations. Denktas-Sakar and Karatas-Cetin (2012: 313) expressed stakeholder roles with a collaborative and activity-oriented approach. Parola et al. (2013: 134) drew a narrow framework and classified the port stakeholders as public and private stakeholders. Again, as Aaltonen and Sivonen (2009) did, Doms (2019) in his study, he made a distinction between being in the system and not being in the system. Lam, and Yap (2019: 5) defined the role of suppliers and customers as market players as part of a corporate structure. Cerreta et al. (2020: 10) have defined the stakeholder roles as those with regulatory power, those affected by this power, users and providers. Geerts and Doms (2022: 5) revealed their stakeholder roles as stakeholders who have information, make notifications, and provide conditional support, minority represented and majority represented. Roh et al. (2023: 258) made a role classification as primary and secondary stakeholders and took this classification into account separately in economic, social and environmental dimensions. Courtens et al. (2023: 4) evaluated the stakeholder roles as internal and external stakeholders in terms of inclusion and non-participation in the system, as Aaltonen and Sivonen (2009) did, and introduced two new elements in this classification as stakeholders that were followed and discovered.

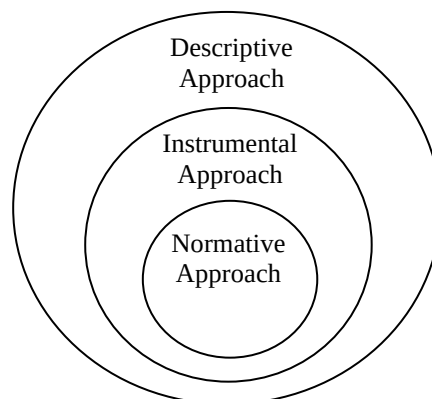
When the studies on stakeholder role classifications in the field of maritime and port management are examined, it is seen that in the studies between the years 2000-2005, the stakeholders have been taken into account only as a result of power relations and primary fields of activity as seen in the studies of Verbeek (2000), Ma (2002: 4), Mykoo (2003: 10), Notteboom, and Winkelmanns (2002: 3-7), Doms et al. (2004: 14-15). In some subsequent studies, stakeholder role classifications have tended towards a distinction in terms of those who reveal, support, and implement the decision mechanism as seen in Gomes (2006: 54-58), De Langen (2006). In some other studies, it has been seen that collaborative, interdependence, solidarity-based and value-adding roles have also been revealed as seen in Denktas-Sakar and Karatas-Cetin (2012: 313), Doms et al. (2013: 15-16).

1.1.6. Conceptual Framework and Classification of Stakeholders

Many scholars have used stakeholder identification and management as a framework for integrating and organizing research in the business and social research literature (Rowley, 1997: 887). After Freeman's (1984) study titled “Strategic Management: A Stakeholder Approach”, the concept of “stakeholder” has been examined as “stakeholder theory of the firm” by some researchers such as Brenner and Cochran (1991), Brenner (1993). Donaldson and Preston (1995) discussed the concept of stakeholder as “stakeholder theory of the corporation”. Thus, researchers developing the stakeholder theory focused on classifying stakeholders. In doing so, they focused on categorizing individual stakeholders into useful categories that enable an understanding of how they affect firms’ operations (Rowley, 1997: 887). In addition, stakeholder theory does not only describe stakeholder impacts; it also provides the necessary structure for describing how businesses respond to these impacts (Freeman, 1984: 46; Nutt and Beckoff, 1992: 439; Donaldson and Preston, 1995: 67; Rowley, 1997: 887; Correa Gomes, 2006: 47-48).

Considering stakeholder theories in terms of their approaches, they are classified as descriptive, instrumental, and normative as stated by Donaldson and Preston (1995: 65). They graphically have illustrated the interrelationship of descriptive, normative and instrumental approaches in stakeholder theory with a figure symbolizing.

Figure 1: Three Aspects of Stakeholder Theory



Source: Donaldson and Preston, 1995: 74.

This structure in Figure 1 is expressed as “Nestedness of the three approaches to stakeholder theory”. In summary, the central core of stakeholder theory in this tripartite approach is normative, and managers and other representatives are assumed to act as if the interests of all stakeholders have intrinsic value. However, Hendry (2001b: 160-173) stated that just as the principles of the normative approach can be based on instrumental principles, the instrumental approach can also be based on normative principles. At the same time, the arguments for the interpretation of existing law and institutional practices, defined by the descriptive approach in both approaches, can be interpreted.

Descriptive approach in stakeholder theory -Stakeholder theory, as descriptive, defines the interests of an organization and its stakeholders and provides a framework for better understanding the relationship between the organization and its stakeholders. Actually, Donaldson and Preston (1995), stated that the stakeholder theory is unquestionably descriptive. In the context of descriptive theory, what is meant by descriptiveness is to determine the general and specific characteristics by determining the damages that may arise with the absence of a situation in terms of businesses and the benefits that can be obtained in the presence of this situation, and to propose a number of solution proposals for businesses. In addition to explaining the specific characteristics and behaviors of businesses in general, the topics covered by the theory include; the structure of the business, the management style of managers, what board members think about the expectations of business founders, and how businesses are actually managed (Donaldson and Preston, 1995: 71). In summary, the descriptive stakeholder theory explains how organizations communicate with and manage their stakeholders (Whysall, 2000: 310), considering the organization at the center of a complex network of relationships where mutual demands, responsibilities, and claims take place, and in some cases, conflicts occur (Donaldson, 1999: 237).

Instrumental approach in stakeholder theory -When stakeholder theories are considered as the instrumental approach, the main purpose of stakeholder theory is to increase the value needed for stakeholders as a tool for the organization to achieve its goals. In this sense, the application of stakeholder theory should benefit both the organization and the stakeholders. In other words, the instrumental

stakeholder theory questions the relationship or the absence of a relationship between stakeholder management and the ability of businesses to achieve their traditional goals (Donaldson and Preston, 1995: 71) and tries to describe what results will arise when managers or businesses follow certain behavior patterns. According to the instrumental theory, if a business wants event A to occur, it must meet the requirements of event B. In this case, event B is a means for the realization of event A. In short, it is stated that this theory is instrumental arguments used to reach some conclusions (Jones, 1995: 410).

Normative approach in stakeholder theory -According to the normative approach of the stakeholder theory is that the application of stakeholder theory is normative, since stakeholders have intrinsic value to businesses, making the stakeholders an absolute necessity for the businesses. Also, the actual basic is based on normative theory; although descriptive and instrumental approaches are important aspects of the theory (Donaldson and Preston, 1995:74). With a similar acceptance, the basis of the model that Freeman (1999: 233), put forward in his work is based on instrumental premises for businesses. If businesses want to be effective, they should pay special attention to groups that affect business activities or are affected by activities carried out to achieve goals. This highlights that stakeholder management has a pragmatic concept. As a result, instrumental stakeholder theory connects managerial activities with results and tries to explain how this link works. Businesses that can show the necessary sensitivity to this bond analyze the real expectations of their stakeholders better than the traditional understanding directed only to the stakeholders who provide financial support to the business, and manage their relations with their stakeholders better (Ertuğrul, 2008: 203).

Convergent stakeholder theory - In line with the Ethics and Social Science-based approaches related to Stakeholder Theory and the disagreements between these views, Jones and Wicks (1999) have developed the “Convergent Stakeholder Theory”, which has both the ethical perspective and the perspective of social science by combining the elements of normative and instrumental theory (Ertuğrul, 2008: 204). Convergent Stakeholder Theory placed “the phrase what will be the result if this event” of instrumental theory to normative theory to see whether practical results could be obtained or not. Also, the main subject of the Convergent Stakeholder

Theory is “It is to determine what kind of stakeholder relations are both morally reliable and viable” (Jones and Wicks, 1999: 209).

Divergent stakeholder theory -According to this theory, Freeman (1999) stated that the business needs to go beyond the direct connections of its network and reach and build relationships with individuals or groups with different views, approaches or interests. Thus, there is a prevailing view that new memberships or collaborative efforts can be partnered with these individuals or groups. In summary, Freeman (1999: 235) responds to attempts to construct a convergent theory by stating that the simultaneous existence of multiple perspectives is important. According to Donaldson and Preston (1995: 67), they listed what needs to be done in order for stakeholder theory to be accepted as a theory: It should be explained how stakeholders interact with the business's focal organisations; a framework should be established to examine the links between the practice of stakeholder management and the achievement of various corporate performance targets; it should be defined how the business should deal with its stakeholders in a fair and honest relationship.

However, identifying, and prioritizing stakeholders while doing all this for the purposeful use of stakeholder theory is quite complex tasks (Best et al., 2019: 1726) and stakeholder theory is insufficient to achieve all these (Donaldson and Preston, 1995; Mitchell et al., 1997: 853; Wood et al., 2018: 235). Therefore, stakeholder identification and salience theory (SIST) can be used to overcome this problem (Mitchell et al., 1998: 853; Neville and Menguc, 2006: 377-389; Neville et al., 2011: 373-374; Wood et al., 2018: 196-235).

1.1.7. Stakeholder Identification and Salience Theory

Identifying stakeholder groups and developing values are critical to the organization's sustainability. Identifying and prioritizing stakeholders, on the other hand, are extremely difficult processes (Best et al., 2019: 1707). To meet these challenging processes, Mitchell et al. (1997: 869) identified three attributes. These are power, legitimacy, and urgency. In fact, although these attributes had been revealed before in Weber (1947), Dahl (1957), Etzioni (1964), Eyestone (1978), Pfeffer (1981), Williamson (1985), Wood (1991), Hill and Jones (1992), Wartick and

Mahon (1994), Suchman (1995). However, Mitchell et al. (1997: 865-867) have come to the forefront by making a classification by considering these attributes at the same time. Mitchell et al. (1997) revealed the stakeholder roles according to the relationship of these attributes with each other.

Power - Most modern definitions of power are based, at least in part, on the early Weberian idea of power is “the probability that one actor within a social relationship would be in a position to carry out his own will despite resistance” (Weber, 1947). Pfeffer (1981: 3) has redefined Dahl's (1957) power definition as “a relationship among social actors in which one social actor, A, can get another social actor, B, to do something that B would not otherwise have done”. Actually, according to like Pfeffer (1981: 3), Weber, (1947) stated, Mitchell et al. (1997: 865) has concurred that “power may be tricky to define, but it is not that difficult to recognize: power is the ability of those who possess power to bring about the outcomes they desire”. Also, from a social perspective, influenced by French and Raven's typology, Mitchell et al., (1997: 865-866), introduced the concept of power as “a party to a relationship has power, to the extent it has or can gain access to coercive, utilitarian, or normative means, to impose its will in the relationship”.

Legitimacy -Stakeholder legitimacy has been a central concern since Freeman's (1984) groundbreaking discussion about stakeholder management, though concerned with questions of legitimacy (Phillips, 2003: 27). and, according to Freeman, the attribute of legitimacy:

Stakeholder connotes legitimacy and while managers may not think that certain groups are legitimate in the sense that their demands on the firm are inappropriate, they had better give legitimacy to these groups in terms of their ability to affect the direction of the firm. Hence, legitimacy can be understood in a managerial sense implying that it is “legitimate to spend time and resources on stakeholders, regardless of the appropriateness of their demands. ...There is, of course, a broader notion of legitimacy which is at issue here. For example, Do all stakeholders have an equally legitimate claim on the resources of the corporation?... (Freeman, 1984: 45).

Phillips (1981: 26) revealed that the concept of legitimacy is related to obligations. and expressed this relationship as “Stakeholder obligations, and therefore stakeholder status, are created when the organization voluntarily accepts the contributions of some group or individual. This voluntary acceptance is linked to

consent, contract, or promise in its capacity for generating obligations".According to Mitchell et al. (1997: 866), legitimacy is "Whether or not that core of legitimacy is to be found in something at risk, or in property rights, in moral claims, or in some other construct, articulations of The Principle of Who or What Really Counts generally are legitimacy based".

In addition, the status of Stakeholders is also an important element in legitimacy. That is, stakeholder status is to a large extent considered together with moral legitimacy, and according to Donaldson and Preston (1995: 86), legitimacy would appear significantly lacking in the context of strategic management theory when it did not take into account the potential influence of strong supporters who could help or hinder the achievement of the organization's goals. Regarding the concept of legitimacy, if stakeholder theory is to be discussed in the context of a strategic management and ethical theory, then it is clear that competitors cannot be excluded from this structure. However, the illegitimate attitudes of competitors do not prevent them from being stakeholders; however, it changes the impact on their stakeholder roles. In this sense, the question of how to take into account the competitors, for example, without bringing them together with the employees, and how to determine the stakeholder roles, comes to the fore (Phillips, 1981: 28-29). However, it is problematic to call powerful groups that have no moral obligations but can still significantly affect the organization as illegitimate (Jones and Wicks, 1999: 207), ignoring legitimate but also not powerful groups may cause problems in terms of urgency, and failure to meet legitimate demands due to lack of power may create other problems for the organization in terms of urgency (Mitchell et al., 1997: 862).

Urgency -The Merriam-Webster Dictionary defines "urgency" as "calling for immediate attention" or "pressing". According to Mitchell et al. (1997: 867) that urgency, which has synonyms such as "compelling" , "driving" and "imperative" emerges only when two conditions are met: (1) a time-sensitive relationship or claim exists, and (2) the relationship or claim is important or crucial to the stakeholder. Urgency can be basically measured on two criteria: time sensitivity and criticality. The degree of managerial delay in attending to the claim of relationship that is unacceptable to the stakeholder is referred to as time sensitivity. Criticality is

concerned with the significance of the stakeholder's claim or relationship to the problem at hand (Mitchell et al., 1997: 867):

Mitchell et al. (1997: 867-868) mentioned some examples of why a stakeholder would view their relationship with the company as critical:

- **Ownership:** The stakeholder's possession of firm-specific assets, or assets related to a firm that cannot be utilized in a different way without losing value, making exiting the partnership exceedingly costly.

- **Sentiment:** As in the case of easily traded stock owned by generations of family members, regardless of the stock's performance.

- **Expectation:** the stakeholder's expectation that the firm would continue to provide something of high value to them (for example, wages and benefits in the case of employees).

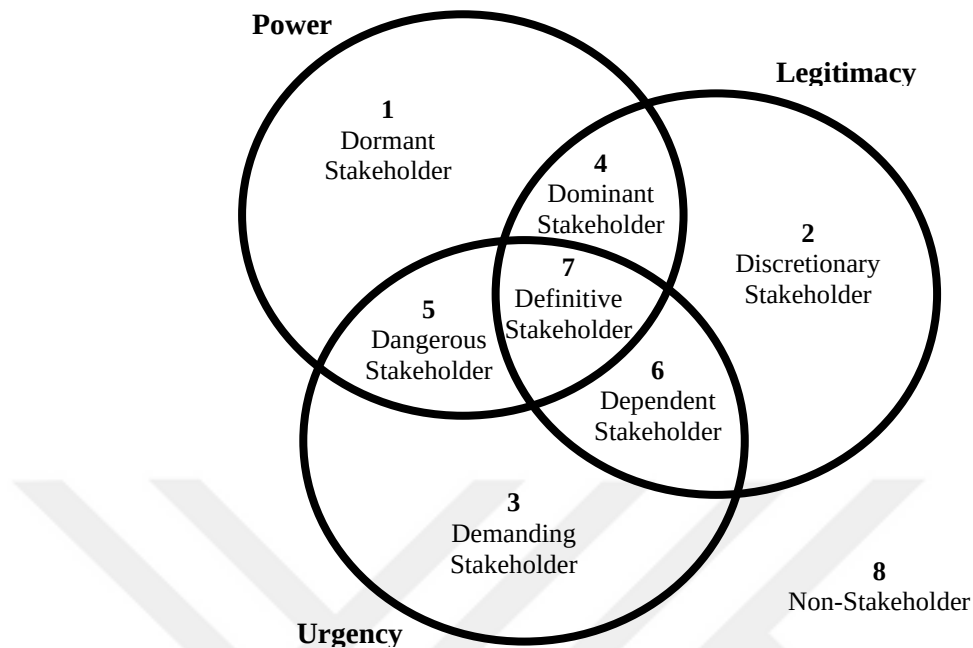
- **Exposure:** the significance the stakeholder attaches to that which is at risk in the relationship with the company.

In this sense, Mitchell et al. (1997: 867) put forward the “Theory of stakeholder identification and salience (TSIS)”, which is claimed to be comprehensive and useful in identifying stakeholders. So, all these three attributes provide a framework for understanding can gain or lose salience to a company.

1.1.7.1. Stakeholder Classes in The Context of Stakeholder Identification And Salience Theory

Mitchell et al. (1997: 872) created an alternative categorization based on the theory's features for identifying stakeholder groups. Figure 3 depicts the qualitative stakeholder classes. As seen in Figure 2, Mitchell et al. (1997: 874) have defined stakeholders in eight groups and three attributes. This model has been tested empirically in a wide variety of studies (Agle et al., 1999; Akpınar and Vincze, 2016; Eesley and Lenox, 2006; Gago and Antolin, 2004; Parent and Deephouse, 2007; Weber and Marley, 2012; Raha et al., 2021). Also, the existing literature offers insightful considerations of how this model of stakeholder salience could be extended further (Friedman and Miles, 2002; Wolfe and Putler, 2002; Neville et al., 2011; Wood et al., 2021).

Figure 2: Stakeholder Typology



Source: Mitchell et al. (1997: 874)

Latent Stakeholders - Stakeholders with one attribute are assumed to have latent relationships with the organization. Passive actors are positioned as latent stakeholders. According to Latent stakeholder concept, “Managers will consider only one of the stakeholder attributes -power, legitimacy, and urgency- to be present, resulting in low stakeholder salience”.

- **Dormant Stakeholders** -The associated attribute of passive stakeholders is power (Mitchell et al., 1997). Dormant stakeholders have the capacity to dictate their claims, but they do not exercise it since there is no valid connection or an urgent claim (Mitchell et al., 1997). The interactions of dormant stakeholders are limited to the company.

- **Discretionary Stakeholders** - The key characteristic of discretionary stakeholders is legitimacy, and they cannot influence organizations owing to a lack of authority and no urgent claims (Mitchell et al., 1997).

- **Demanding Stakeholders** -When “urgency” is the only attribute assigned to a stakeholder group, they are classified as demanding stakeholders. Demanding

stakeholders have pressing claims, but they lack the power or legitimacy to compel organizations to act (Mitchell et al., 1997).

Expectant Stakeholders -Stakeholders with two attributes are classified as “moderately salient” or “expectant” stakeholders. Expectant stakeholders are considered as active actors. So, expectant stakeholders have a greater level of stakeholder-organization engagement than latent stakeholders. Expectant stakeholder concept, “Managers will view two of the stakeholder traits - power, legitimacy, and urgency - to be present, resulting in moderate stakeholder salience” (Mitchell et al., 1997).

- **Dominant Stakeholders** - Organizations prioritize and value the demands of organizations’ dominant stakeholders. They have power and legitimacy attributes at the same time.

- **Dangerous Stakeholders** - Dangerous stakeholders are defined as stakeholders who have urgency and power but lack legitimacy. Because of this circumstance, these stakeholders have the potential to be coercive and aggressive.

- **Dependent Stakeholders** - Dependent stakeholders are stakeholder groups who have a valid urgent demand on the organization. However, since dependent stakeholders have not the power to indulge their willing, they must rely.

Definitive Stakeholders -As definitive stakeholders, Mitchell et al. (1997) have identified highly salient stakeholders. Definitive stakeholders have both power, legitimacy and urgency at the same time.

Non-Stakeholders -Finally, if a stakeholder lacks any of the characteristics, they are classified as non-stakeholders or potential stakeholders Mitchell et al. (1997).

1.1.7.2.Utilization of Stakeholder Identification andSalience Management in Maritime and Port Management

Although there are various stakeholder identification studies in the basic management and marketing literature; but, there are not many studies on the maritime and port management field. These studies areFrankel (1989),Notteboom and Winkelmanns (2002),Dooms and Macharis (2003),Moglia and Sanguineri (2003),

De Langen (2006), Dooms (2010), Denktas-Sakar and Karatas-Cetin (2012), Bergqvist and Egels-Zanden (2012), Videira et al. (2012), Da Cruz et al. (2013), Cerit (2013), Deveci (2013), Dooms et al. (2013), Hall et al. (2013), Lam et al. (2013), Parola and Maugeri, (2013), Parola et al. (2013), Satta et al. (2014), Aerts et al. (2015), Becker and Caldwell (2015), Notteboom et al. (2015), Shiau and Chuang (2013), Afreen and Kumar (2016), Ibrahim (2017), Vancea et al. (2017), Lozano et al. (2018), Lie (2018), Ignaccolo et al. (2018), Dooms (2019), Eskafi et al. (2019), Lam and Yap (2019), Lawer (2019), Mannan (2019), Ashrafi et al. (2019), Ashrafi et al. (2020), Cerreta et al. (2020), Schrobback and Meath (2020), Zarghami and Dumrak (2020), Balci and Surucu-Balci (2021).

While some of these studies reveal the stakeholder status in port competitiveness, (e.g. Notteboom and Winkelmanns, 2002; Cerit, 2013; Da Cruz et al., 2013; Ibrahim, 2017); there are also studies focusing on stakeholder expectations in port management (e.g. Bergqvist and Egels-Zanden, 2012). A group of studies focused on the status and impact of stakeholders in port sustainability (e.g. Denktas-Sakar and Karatas-Cetin, 2012; Videira et al., 2012; Shiau and Chuang, 2013; Dooms, 2019; Lam and Yap, 2019; Cerreta et al., 2020). Some studies deal with the role of stakeholder management in environmental management practices in port management: Hall et al. (2013). Although there are studies focusing on the evaluation of the port reports in terms of stakeholders in terms of content analysis: Parola et al. (2013), Satta et al. (2014), Notteboom et al. (2015); there are also studies dealing with stakeholder involvement in port planning: Frankel (1989), Dooms and Macharis (2003), Moglia and Sanguineri (2003), Dooms (2010), Dooms et al. (2013), Aerts et al. (2015), Ignaccolo et al. (2018), Dooms (2019). In the literature, there are macro and regional studies on the determination of the role of stakeholders in regional sea area plans, including port management: Vancea et al. (2017), Mannan (2019). Some studies have identified drivers and barriers to corporate sustainability in ports in terms of stakeholder management framework: Lozano et al. (2018), Ashrafi et al. (2019), Ashrafi et al. (2020), Schrobback and Meath (2020), Balci and Surucu-Balci (2021). In some studies, the situation of port stakeholders has been examined by taking into account the elements of conflict between stakeholders: De Langen (2006), Lam et al. (2013), Parola and Maugeri (2013), Afreen and Kumar

(2016), Lawer (2019). While Deveci (2013) evaluated the stakeholders of port operators in relation to the legal and commercial environment, Becker and Caldwell (2015) empirically tested the status of stakeholder management in port resilience. While these studies, which are briefly explained, related to stakeholder management in the field of port management with port competitiveness, stakeholder expectations, port sustainability, port planning, conflict management at ports, reporting processes at ports, corporate sustainability at ports, legal and commercial environment situation, and port resilience: Lie (2018), Eskafi et al. (2019), Zarghami and Dumrak (2020). A wide variety of publications were found on stakeholder identification and salience in the literature, without any sectoral distinction. While some of these are focused solely on identifying potential stakeholders and stakeholders according to their primary interests or skills in certain projects: Arnstein (1969: 217), Ulrich (1983:252), Freeman (1984), Carroll (1993), Bryson (1995: 197), Clarkson (1995: 106), Evan and Freeman (1988), Goodpastor (1991: 67-72), Savage et al. (1991: 62), Mahoney (1994: 6-7), Morgan and Hunt (1994: 34), Mitchell et al. (1997: 874), Rowley (1997: 901), Eden and Ackermann (1998: 349), Eidt et al. (2020: 5), Frooman (1999: 199), Friedman and Miles (2002: 7), Sirgy (2002: 146), Lorca and Garcia-Diez (2004), Parent and Deephouse (2007), Aaltonen et al. (2008), Bendjenna et al. (2012), Lozano et al. (2015: 438), Silva et al. (2019: 209). Another remarkable point is that almost all of the exemplary studies evaluated the stakeholders only through two-dimensional (interest-impact, power-interest, interest-influence matrices. However, the theoretical model of Mitchell et al. (1997) in the examples above has also been tested empirically many times in the studies of Agle et al. (1999), Akpınar and Vincze (2016), Eesley and Lenox (2006), Gago and Antolin (2004), Parent and Deephouse (2007: 14), Aaltonen et al. (2008: 514), Bendjenna et al. (2012: 267), Weber and Marley (2012), Poplawska et al. (2015), Elsaid et al. (2017), Perez-Vera and Bermudez-Pena (2018), Raha et al. (2021). For example, Poplawska et al. (2015) used three-dimensional power-legitimacy-urgency model of Mitchell et al. (1997) in their study in which they determined stakeholder profiles through fuzzy logic, which is a numerical method within the scope of corporate social responsibility. Elsaid et al. (2017) conducted stakeholder analysis with a fuzzy inference system to prioritize stakeholders in software engineering using

Mendelow's (1981) power-interest relationship model in their model. Perez-Vera and Bermudez-Pena (2018: 241) designed a stakeholder classification system using fuzzy inference system and clustering algorithms. The model they established has been tested and put forward as a recommendation. Zarghami and Dumrak (2020) determined the roles of stakeholders involved in projects in a project center using a two-dimensional model (impact-involvement matrix) and fuzzy logic method. In the academic literature, three empirical stakeholder identification studies on the port industry could have been found. These are the studies of Lie (2018), Eskafi et al. (2019), Balci and Surucu-Balci (2021: 12), of these, Lie (2018) conducted a series of interviews to determine the stakeholder roles of two maritime companies, namely "Greakstar" and "Gearbulk" operating under the umbrella of the holding.

Table 6: Stakeholder Types According to Their Roles

<i>Dormant Stakeholders</i>	<i>Dominant Stakeholders</i>	<i>Dependent Stakeholders</i>
Criminal Groups.	Seafarers, Employees, Customers, Suppliers, Educational Institutions, The Local Community, Local Owners, Local Authorities, Grieg Star Group, G2Ocean, The Grieg Family, The Media, NGO's, Unions at Seaports, Authorities at Seaports, Agents at Seaports The Norwegian Embassy.	The Environment.

Source: Lie, 2018: 55.

As a result of the study of Lie (2018: 55), it has been determined that criminal groups are dormant in accordance with the literature. While natural life and environmental structure have been identified as dependent stakeholders; A number of stakeholders, primarily seafarers, employees, customers and suppliers, were identified as dominant. It is interesting that educational institutions, local public and NGOs are identified as the dominant stakeholder among them. However, as the maritime companies in the study are based in the Philippines, and Maritime training

institutions are culturally dominant in this region. So, educational institutions have been identified as the dominant stakeholders. In another study, Eskafi et al. (2019: 236) determined the roles of stakeholders in port master planning with a 2D model (power-interest matrix). Balci and Surucu-Balci (2021: 12) have conducted an empirical study on identifying barriers to blockchain adoption for stakeholders in container-based maritime trade and identifying prominent stakeholders. This study represents the first effort at using Mitchell et al. (1997)'s power-legitimacy-urgency model for stakeholder identification within the field of maritime trade. In the study, 11 stakeholders (Container lines, Ports/terminals, Freight forwarders/3PL companies, Beneficial cargo owners/shippers, Customs authorities, Banks, Trade associations, Government authorities, Insurance companies, Software companies, Custom brokers) have been identified, of these, banks and customs have been identified as the dominant stakeholders. The other 9 stakeholders identified stakeholders are definite stakeholders. While salience level is high definitive for container lines, ports/terminals, freight forwarders/3PL companies, beneficial cargo owners/shippers, customs authorities; it is low definitive for trade associations, government authorities, insurance companies, software companies. This situation shows that government authorities are normally the definitive stakeholders with high salience in the literature. However, in this study, the status of government authorities as definitive stakeholders was at a low level. This situation can be stated that although government authorities are definite stakeholders in the adaptation of blockchain applications, their commitment to the issue is low. Similarly, it can be stated that trade associations, insurance and software companies have low ties to the adaptation of blockchain applications.

In essence, there are several deficiencies observed in stakeholder identification studies employing two-dimensional models. Attempting to categorize stakeholder salience levels based solely on one or two attributes, as suggested by various scholars (Ackermann and Eden, 2011; Johnson and Scholes, 1999; Mendelow, 1981; Olander and Landin, 2005; Winch, 2004), is unlikely to produce reliable and comprehensive outcomes, resulting in limited stakeholder representation (Aaltonen et al., 2008: 514; Parent and Deephouse, 2007: 14; Bendjenna et al., 2012: 267; Poplawska et al., 2015: 105). In other words, the sub-attributes under the power

main attribute in Mitchell et al. (1997)'s model take into account the situations such as source control, technical capabilities, access to information and being compelling. The sub-attributes under the legitimacy attribute take into account situations such as being accepted and being desired. The urgency attribute, on the other hand, takes into account the identification of stakeholders whose demand is urgent. In this sense, the urgent attribute makes Mitchell et al. (1997)'s stakeholder identification model done more inclusive than other models. The urgency attribute moves the stakeholder analysis model from a static structure to a dynamic one (Clement, 2005: 260) in terms of time sensitivity and criticality (Mitchell et al., 1997: 867).

1.1.8. Agency Theory

Agency theory contributes to the literature on organizational behavior and management by reinforcing two principles (Eisenhardt, 1989: 58): (1) companies may regulate agent opportunism by investing in information systems that provide a more complete view of the agent's behavior. (2) that external influences like as government regulation, innovations, and new rivals increase risk, leading to challenges of risk sharing in contracts. When the perceptions of the firm in terms of agency and stakeholder theory are compared, there are differences, but there are also cases where they cover or affect each other. While agency theory focuses on conflict relationally; stakeholder theory is based on conditional relationships. Also, the scope of agency theory consists of economic interests. However, in stakeholder theory the scope is shaped on negative and positive events. The main focus of agency theory is to look out for the interests and well-being of shareholders first; however, stakeholder theory focuses on all stakeholders. Agent theory is also included within the scope of this research. Both the agency and stakeholder theories have been utilized for the goal of highlighting the interests of employees, shareholders, consumers, vendors and the general public (Shankman, 1999: 324).

Table 7: Comparison of Agency Theory and Stakeholder Theory

<i>Dimension</i>	<i>Agency Theory</i>	<i>Stakeholder Theory</i>
<i>Theoretical Aspects</i>		
1. Explanatory Power	Narrow	Broad
2. Levels of Analysis	Individual	Individual/firm/societal
3. Unit of Analysis	Contract	Interests/relationships
4. Direction of Relationship	One-way	Two-way
5. Normative Basis of Relationship	Economic	Principled moral reasoning
6. Criteria for Organizational Effectiveness	Efficiency	Fairness
7. Nature of Market	Perfect	Imperfect
8. Role of Ethics	Instrumental	Non-instrumental
9. Normative?	No	Yes
10. Descriptive?	Yes	Yes
11. Role of Resources	Only information	Important for survival
12. Determinants of organizational outcome	Free market Competition	Constrained competition and Cooperation
13. Assumption of free will	Voluntary agents	Interdependence
14. Assumption of power	Equal	Differential

Source:Shankman, 1999: 323.

In summary, they have developed both different and sometimes similar perspectives on the company and its environment (Shankman, 1999: 324). Legitimacy has an important place in stakeholder theory (Mitchell, 1997: 865), while agency theory considers legitimacy as moral or immoral attitudes (Shankman, 1999: 324). In this sense, the attributes of the stakeholder theory have an important place in the agent theory.

1.1.9. Resource Based Theory

RBV has gained widespread acceptance in the strategic management area and has become one of its most significant theories to date, whereas “stakeholder theory was pushed to the side of a tangential theory associated with social responsibility and business ethics” (Freeman et al., 2010: 95). Although RBV grew to become a dominant theory in the Academy of Management's (AoM) strategic management division, and stakeholder work predominantly in the social issues division, they both remained major, largely parallel dialogues among management professors inside the AoM (Freeman et al., 2021: 1760).

Figure 3: The Relationship of the RBV and Stakeholder Theory

The Resource Based View of The Firm To Date	<i>Relevant ideas from Stakeholder Theory</i>	The Resource Based View of The Firm Incorporating Stakeholders
Normativity is avoided. RBV seeks to provide predictions on the operational behavior of profit maximizing enterprises, while considering normative theory as inconsequential or perhaps irrelevant.	Normativity	Values, norms and ethics – the foundation of our society – are integrated into Stakeholder-RBV. Normative theorizing serves a dual purpose by not only aiding firms in ethical decision-making, but also enhancing the accuracy of their forecasts.
The idea of sustainability is tightly connected to competitive advantage. Competitive advantage becomes sustainable when a firm has resources that are not only valuable and rare, but also difficult to substitute and imitate.	Sustainability	The concept of sustainability is not only considered in terms of gaining a competitive edge, but also in terms of fostering connections with stakeholders. The achievement of a sustainable competitive advantage necessitates the establishment and maintenance of sustainable partnerships with stakeholders. The Stakeholder Resource-Based View (RBV) framework attempts to promote sustainability among enterprises by cultivating enduring stakeholder connections.
People are viewed as resources, such as people as employees or people as managers.	People	The Stakeholder Resource-Based View (RBV) has a strong emphasis on human elements. Individuals are seen as ultimate objectives, rather than just instruments. Individuals should be seen as stakeholders rather than as resources, since they provide valuable resources to the organization.
The resource-based view (RBV) places excessive emphasis on competition, asserting that a manager's principal objective is to establish a sustainable competitive advantage in order to surpass other enterprises.	Cooperation	The Stakeholder Resource-Based View (RBV) framework places equal emphasis on both competition and cooperation. The objectives of a manager include a broader range of dimensions beyond the only focus on a firm's financial success. One of the primary objectives of management is to establish a lasting competitive advantage, which entails cultivating cooperative components within a company's economic ties.

Source: Freeman et al. 2021: 1761.

Considering Barney's (2018: 3305) recent conclusion that “resource-based theory's model of profit appropriation must incorporate a stakeholder perspective”. Freeman et al. (2021: 1757) have proposed that the Resource-Based View (RBV) can provide valuable insights in four key areas: normativity, sustainability, human resources, and cooperation. So, the integration of stakeholder theory with the resource-based view (RBV) holds significant potential for advancing the comprehension of management. In addition, both the stakeholder theory and the

resource-based approach require the presence of decision makers and the proper allocation of resources, and the aim of both theories is to create competitive advantage.

1.1.10. Dynamic Capability Theory

Stakeholder theory emphasizes the mutually beneficial potential for value generation among a company's stakeholder groups. Dynamic capabilities comprise processes and activities targeted at detecting opportunities (sensing), mobilizing resources (seizing), and making necessary changes for value generation (transforming) (Murphy and Wilson, 2022: 211). According to Agwunobi et al. (2016: 141), having dynamic capabilities is a competitive differentiator and a managerial need for firms. Mandal (2007: 664) reveals that dynamic capabilities like as sensing, learning, coordinating, and integrating improve collaboration between organizations and their suppliers. He also promotes organizations to build these competencies, with a particular emphasis on developing skills to improve supply chain performance. When there is trust, fairness, and belief in the firm's larger mission inside and between stakeholder groups, relationship capacities tend to be strong, it has long been regarded as advantageous (Willis et al., 2016: 2). In summary, a guiding system for improvement can be established by purposefully developing dynamic capabilities while constantly learning from stakeholder groups and improving the service provided to them, which are essential for success in organizations (Murphy and Wilson, 2022: 218).

CHAPTER TWO

CONCEPTUAL FRAMEWORK OF SUSTAINABILITY, INNOVATION AND SUSTAINABILITY-ORIENTED INNOVATION

2.1. CONCEPT OF SUSTAINABILITY

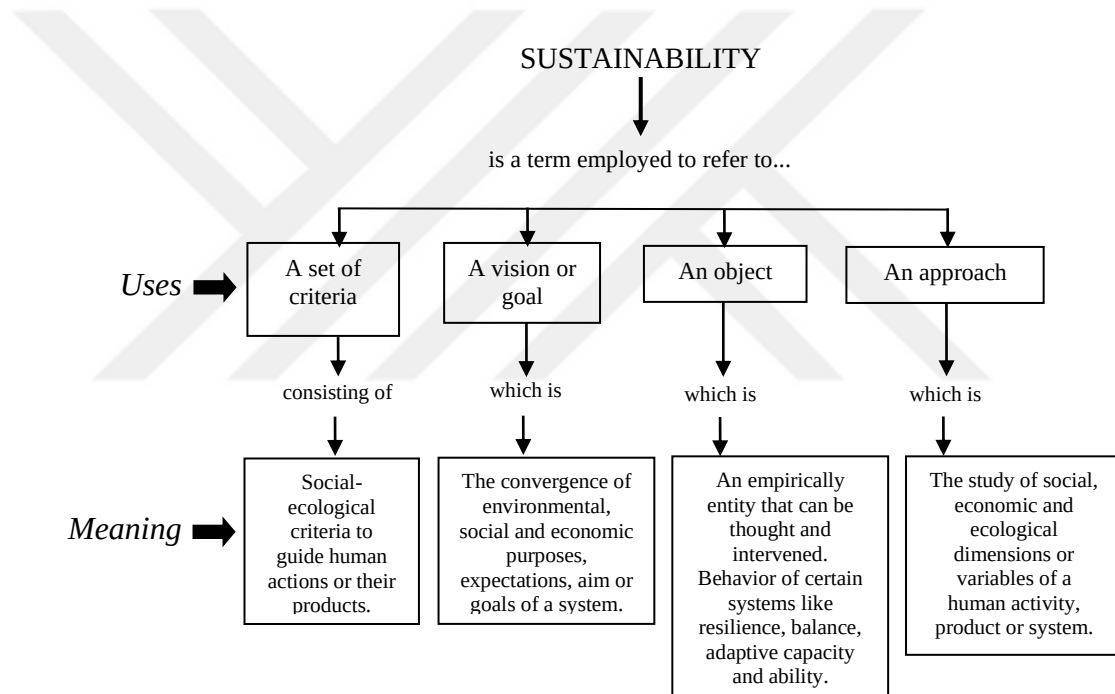
In recent years, there has been a growing demand to expand the scope of corporate accountability from solely focusing on economic performance for shareholders, to encompass sustainability performance for all stakeholders, placing increased pressure on organizations and the industry as a whole (Visser, 2002).

In balancing the relationship between creating a sustainable world and the existence of individuals, societies and organizations, fundamental problems such as competition, cooperation, sharing and protection of the ecosystem arise. Naturally, failure of a stakeholder who does not fulfill its obligations to the other stakeholders for its own benefit, harms the business environment of other stakeholders, therefore, increase the burden of other stakeholders on many issues. From a narrow perspective, this situation is a threat to the existence and sustainability of individuals and organizations. In addition, this threat only affects the economic sustainability of stakeholders and has relatively limited consequences. However, from a broad perspective, if stakeholders do not fulfill their obligations, they harm both the sustainability of other stakeholders and their own assets. Damaging the other parties, they are associated with (individuals, organizations, businesses, sectors or countries) indirectly brings about holistic damages at economic, social and environmental levels (Clifton and Amran, 2010: 125-130). In sustainability and stakeholder interaction, food industries providing agricultural training to farmers and meeting their equipment needs are examples of the relationship between stakeholder interaction and sustainability from a broad perspective (Amponsah-Tawiah and Dartey-Baah, 2010: 196). Providing employment opportunities for women in professions such as crane operators, where mostly men work, is another example of the relationship between stakeholder interaction and sustainability (Borusaneşittir, 2023: 50-57). In SOIs, responsibilities are not based on the individual interests of the organization or individuals; taken into consideration for all stakeholders (Klewitz and Hansen, 2014:

1).According to Salas-Zapata and Ortiz-Munos (2019: 155), the concept of sustainability encompasses four distinct elements in terms of contextas seen on Figure 4:

A set of guiding criteria for human action - The term “sustainability” is frequently utilized by scholars and researchers to denote the incorporation of a specific set of social-environmental criteria or qualities into human behavior. These actions may be associated with products or processes that, regardless, involve a certain degree of interdependence between human beings and the ecosystem.

Figure 4: Conceptual Context of Sustainability in Terms of Its Using And Meanings



Source: Salas-Zapata and Ortiz-Munos, 2019: 155.

A goal of humankind - The term “sustainability” is also utilized to denote a societal objective. Scholars, researchers, and professionals frequently assert that a system is deemed sustainable based on its specific objectives.

An object role - Sustainability, as a concept, possesses an inherent existence and can be subject to representation, examination, and intervention. Hence, the

discussions surrounding the subject of sustainability science are situated within this particular context.

An approach of study - Sustainability can be conceptualized as a methodological framework for examining specific systems. The term "sustainability" is used by researchers to indicate their intention to examine variables that assess the environmental, social, and ecological performance of a reference system.

Although there is no generally accepted one-to-one equivalent in the Turkish literature, the concept of sustainability, which we can translate as “the ability or ability to be continuous or ability to be permanent”, corresponds to the Latin word “sustain” (Şen et al., 2018: 5). According to Yolles and Fink (2014: 1), quoting Lutz Newton and Freyfogle (2005), the concept of sustainability was first used by the online version of Oxford Dictionary in the mid-1980s. In addition, the fact that it was included in the 1987 Brundtland report in the same period emerged as the period in which sustainability was taken notice for the first time in a real sense and started to be studied (Sneddon et al., 2006: 253); however, the notion of sustainability can be traced back to the late 18th century (Milne, 2019). In 1799, Alexander Von Humboldt was a Prussian Explorer and scientist. his studies on botanical geography formed the basis of the branch of biogeography. In his exploration trips, it is revealed that the existence of the resources in the nature depends on the movement of nature as a whole. He also argued that the existence of the nature would be sustained by human self-development. (Kates, 2012: 4). However, with the Brundtland Report, a multi-dimensional sense of sustainability has created the basis for everyone to make a different meaning from sustainability. In this context, it is possible to say that sustainable development is built on the following three issues (Şen et al., 2018: 1):

- Sustainability must be economically feasible and focus on efficient long-term use of resources (Economic dimension).
- Sustainability should be focused on protecting the environment in human actions and activities (Environmental dimension).
- With sustainability, individuals and societies should be treated fairly and equally, especially in the elimination of global poverty, and environmental exploitation of poor countries should be prevented (Social dimension).

Table 8: Some Sustainability Definitions in Terms of Conceptual Context

Source	Sustainability Definition	Conceptual Context of The Definition
WCED (1987: 37)	<i>“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”</i>	Fairness and Balance in resource use capabilities for the well-being of the planet.
Hockerts (1999: 30)	<i>“Any state of a business in which it meets the needs of its stakeholders without compromising its ability also to meet their needs in the future.”</i>	Balancing the resource use capabilities of the parties for the well-being of the planet.
Dyllick and Hockerts (2002: 132)	<i>“Consumption of natural resources at a rate that can be naturally replenished and the emission of waste at a rate that can be absorbed by nature.”</i>	Saving the resources for the well-being of the planet.
Ehrenfeld (2005: 23)	<i>“The possibility that all forms of life will flourish forever.”</i>	Providing perpetual improvement ability, saving the well-being of the planet wholly.
Walker and Brammer (2009: 128)	<i>“Activities that attempt to improve the environmental performance of purchased inputs or of the suppliers that provide them.”</i>	Efforts for ecological efficiency in the stakeholder interactions.
Pfeffer (2010: 36)	<i>“An effort to conserve natural resources and avoid waste in operations.”</i>	Efficiently and effectively resource use capabilities for preventing contamination.
Ahuja (2021: 8)	<i>“Sustainability is the concept of striking the right balance between economy, equity and environment.”</i>	Fairness and right balance between triple bottom lines requirements.

Source: Compiled by Author from various sources.

Taşcıoğlu (2014: 30) asserts that the concept of sustainability has been delineated across various disciplines, including management and social science, environmental science, and technical science. There exists a multitude of definitions of sustainability within contemporary literature, potentially attributable to the a fore mentioned rationale. First scientific and worldwide accepted three of these definitions related to sustainability has been introduced in the United Nations 1987 Brundtland report and some other definitions are that as seen on the Table 8.

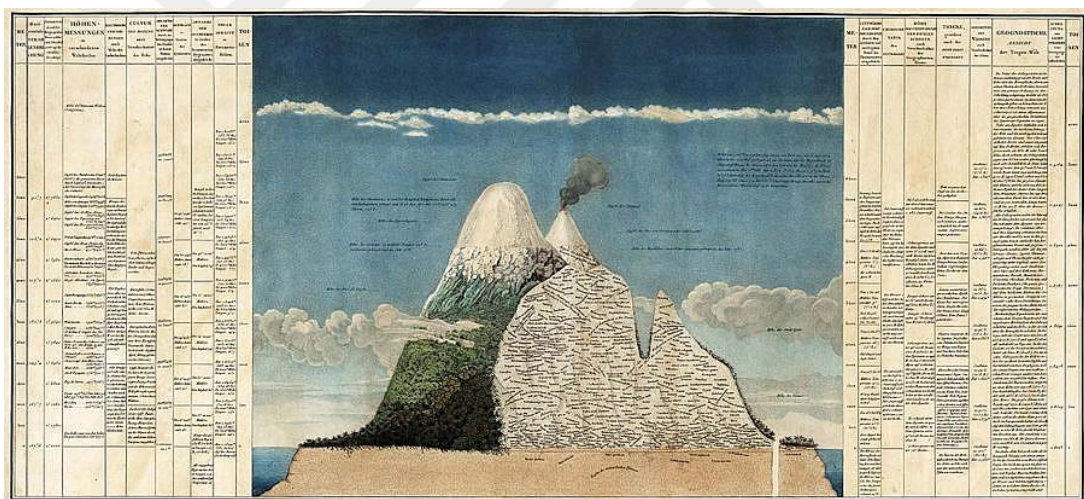
According to Table 8, some other definitions of the sustainability have been compiled and statements have been grouped for the conceptual contexts of the related definitions. In this sense, the relevant definitions of sustainability can be summarized in terms of conceptual context as fairness and balance in resource use capabilities for the well-being of the planet, balancing the resource use capabilities of the parties for the well-being of the planet, saving the resources for the well-being of the planet, providing perpetual improvement ability, efforts for ecological efficiency in the stakeholder interactions, efficiently and effectively resource use capabilities

for preventing contamination, fairness and right balance between triple bottom lines requirements.

2.1.1. Historical Development of Sustainability

Following an introduction to the contextual framework and understanding of the fundamental definitions pertaining to the concept of sustainability, a succinct overview of its historical progression shall be provided. In the late 18th century, Carlowitz, a German miner, employed the term “mining industry’s masts” to signify the utilization of timber plantations in a manner that would enhance productivity and sustainability (Aksoy, 2013: 10).

Figure 5: Study Notes of Alexander Von Humbolt on Environmental and Ecological Preservation in the World



Source: David Rumsey Map Collection, 2019.

Also, the research conducted by Alexander Von Humboldt on botanical geography has provided valuable insights into the necessary measures for environmental and ecological preservation within the realm of biogeography (Kates, 2012: 4). In this sense, sustainability is concerned balanced development, with ecological concerns as well as having important implications for intergenerational equity. This situation reveals the link between population ecology and sustainability in terms of Alexander Von Humboldt perspective (Salimath and Jones III, 2011:

888). Sustainability is based on the balanced and fair use of resources (WCED, 1987: 37; Ahuja, 2021: 8) and the holistic well-being of the planet (WCED, 1987: 37; Hockerts, 1999: 30; Dyllick and Hockerts, 2002: 132; Ehrenfeld, 2005: 23; Walker and Brammer, 2009: 128). Population ecology assumes that organizations will grow and institutionalize by adapting to their environment. Moreover, when this growth occurs radically, it often ends in failure. Failure to comply with the purpose of adaptation for the existence of the organization is effective in this case. Since sustainability requires harmony, balance and justice in the use of resources, it can be stated that these two concepts are intertwined (Salimath and Jones III, 2011: 875-888).

The development of the concept of sustainability and sustainable development has progressed with the reports put forward by a number of supra-state structures. It would be appropriate to briefly mention the supra-state studies and reports that play a role in the development of sustainability. The first of these is Brundtland Report prepared by WCED. The “World Commission on Environment and Development” (WCED), has established by the United Nations in 1987, comprised representatives from twenty nations. The commission produced and released the “Brundtland Report”, officially has titled “Our Common Future”. The report has emphasized the need to establish a correlation between environmental and economic development, with a particular focus on ensuring the sustainability of this relationship (WCED, 1987: 49).Elkington (1994: 90) put forward the TBL approach and defended the People (Social), Planet (Environment), Profit (Economy) approach in the field of sustainability. This approach refers to the measurability context of sustainability (Salas-Zapata and Ortiz-Munos, 2019: 155).

The United Nations Conference on Environment and Development, commonly referred to as the UN Conference on Environment and Development, took place in Rio de Janeiro in 1992. The conference involved the participation of 178 countries. During the conference, a key emphasis was placed on the centrality of human beings in the context of sustainable development. It was explicitly stated that individuals possess the entitlement to lead a productive existence that is in harmonious coexistence with the natural environment. The conference featured the publication of a set of 27 principles (UN, 1992a: Principle 1-2).

The conference held in Rio, commonly referred to as the world summit, was attended by 117 Heads of State from 179 countries. During this event, a declaration comprising of 27 principles was established. The aforementioned set of 27 principles delineates the rights and obligations of nations in their pursuit of human development and prosperity (Başarır, 2008: 37). Furthermore, the document entitled “Agenda 21”, which was presented at the conference, addresses various issues including inequalities, escalating poverty, hunger, diseases, illiteracy, and the degradation of ecosystems. These concerns are examined from both an international and national perspective, with a focus on sustainable settlement and agriculture, as well as the promotion and management of rural development. Additionally, the document delves into several key concepts such as waste management and the efficient utilization of water resources (UN, 1992b).

In the subsequent five years, the United Nations convened the “Rio + 5” Forum in New York. The objective of the forum was to facilitate the smooth transition towards the execution of the principles and agenda that were published in 1992 (Aksoy, 2013: 12).

The 2002 “World Summit on Sustainable Development” held in Johannesburg facilitated discussions on the implementation status, effectiveness, challenges, and recommended actions pertaining to the issues addressed in the Rio Declaration, Agenda 21, and Rio + 5 Forum up until that year (Çamur and Vaizoğlu, 2007: 300). With the participation of sector representatives in this conference, sustainable development was addressed institutionally for the first time (Aksoy, 2013: 12).

After that, Rio+20, United Nations Conference on Sustainable Development was held in Rio de Janeiro, Brazil, on 20-22 June 2012 (Aksoy, 2013: 12). The report, which was published during the summit titled “The Future We Want”, was evaluated within the framework of sustainable development and poverty eradication (Sürücü, 2015: 47).

After this series of conferences, international sustainability conferences, the number of sustainability-oriented regulations have experienced a rise with widespread at the national and international levels (e.g. EU Sustainable Finance Disclosure Regulation, IMO GHG Emissions Standard 2014 and 2021).

The “European Green Deal – EU Green Deal” of 11 December 2019 is a roadmap aimed at restating the previous commitments of the European Union (EU) in a broader and more effective way in tackling climate and environmental challenges. Public and private sector organizations and international organizations that are directly or indirectly connected with the EU are also within the scope of the published agreement (Fetting, 2020: 5).

2.1.2. The Principles of Sustainable Development

The definition of sustainable development, as formulated by the World Commission on Environment and Development (WCED) in 1987, is grounded upon three fundamental principles. These principles encompass environmental integrity, social justice, and economic well-being. The achievement of economically sustainable development is contingent upon the consideration of all principles, each of which holds individual significance (Bansal, 2005: 198):

Environmental integrity - The increase of environmental pollution, accompanied with population growth, the depletion of natural resources, and the emission of hazardous gases into the atmosphere, represents a subset of the factors that pose a threat to the integrity of the environment. When the natural environment is at risk, it has a direct impact on vital resources necessary for human survival, thereby hindering the attainment of environmental integrity.

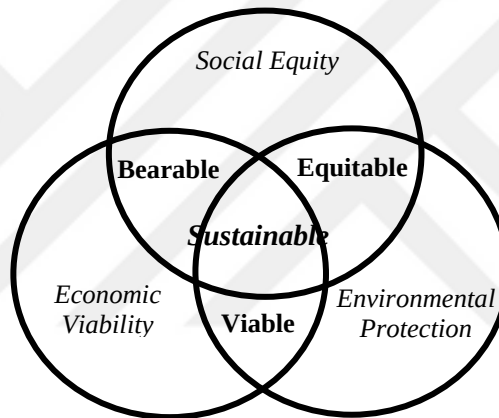
Social equity - Every individual in society has equal rights to access natural resources and opportunities. The establishment of equal rights guarantees that both current and future generations have equitable access to resources and opportunities.

Economic prosperity - The principle of economic welfare entails the production and provision of goods and services in a manner that enhances the standard of living for individuals. A society that fails to ensure economic welfare poses a threat to its overall well-being, as the absence of equitable distribution of economic resources undermines social justice and compromises environmental sustainability.

2.1.3. Three Dimensions of Sustainability

Since the convening of the “Earth Summit” in 1992, a widespread consensus has emerged at the global level, acknowledging that sustainable development entails the integration of economic growth, social progress, and stewardship of the environment (Tanzil, and Beloff, 2006: 41). In this aspect, sustainable development encompasses a composite framework comprising qualitative and quantitative elements, encompassing economic, environmental, and social transformations. (Munier, 2005: 17).

Figure 6: Three Pillars of Sustainability



Source: Ugbaja, 2016: 13.

These dimensions are expressed as triple bottom line by Elkington (1994: 90). He has conceptualized the social dimension as people, the environmental dimension as planet and the economic dimension as profit. Researchers have employed several conceptual frameworks to describe these elements, but it is crucial to give equal consideration to all the three elements in order to accurately generate sustainability outcomes (Rogers et al., 2007: 42). According to Figure 6, the formation of a *bearable* structure arises when both economic and social perspectives are taken into account. The creation of an economical and environmental perspective leads to the establishment of a “viable” structure. If social and environmental perspectives are established, it is “equitable” noting the inclusion of a just structure as well. However, the achievement of sustainability necessitates the harmonious integration of all three

perspectives, thereby ensuring equilibrium and coherence among these three structures (bearable, viable, equitable) (Ugbaja, 2016: 13).

2.1.3.1. The Economic Dimension

Economic sustainability is the effect of the organization's business practices on the economic system (Elkington, 1997). Economic sustainability is a complex issue that is “golden child of sustainability” (Doane and MacGillivray, 2001: 18). Since it is a complex issue, Harris (2000: 5) posits that an economically sustainable system is characterized by its capacity to generate commodities and services in accordance with enduring principles, effectively handle governmental and foreign debts, and prevent sectoral imbalances that have detrimental effects on agricultural and industrial production. In an ideal scenario where organizations or nations had a comprehensive understanding of economic sustainability, the outcomes would encompass full employment, reduced poverty rates, and the absence of bankruptcies. Regrettably, this forementioned assertion does not hold wholly true (Doane and MacGillivray, 2001: 18). However, with these whole economic imbalances, the economic aspect of sustainability focuses on the generation of value and the financial consequences of a company's sustainability initiatives (Bansal, 2005: 198). The concept of economic sustainability necessitates an examination of both the internal and external ramifications of sustainability management. This implies that the management of economic sustainability necessitates taking into account (Doane and MacGillivray, 2001: 19):

- The financial performance of the company,
- Managing the intangible assets of the company,
- Company's and its tangible and intangible assets influence on the wider economy,
- The effect of economic structure of the company influences and manages social and environmental impacts.

The importance of economic sustainability is increasingly recognized, especially by top political representatives. The fact that maintaining economic growth is a very important and universal issue can be understood from the

destruction caused by the economic crises. In parallel, economic growth has been the most important policy objective since the 1960s, and thus finding the balance between sustainability and economic growth has become an important issue for countries and sectors (Moldan et al., 2012: 5).

2.1.3.2. The Social Dimension

Advocates of sustainable development have recognized the significance of the social aspect as a crucial element of sustainability. Furthermore, they have recognized the longstanding presence of this dimension (Eş, 2008: 23). The social dimension of sustainability is currently widely acknowledged; yet, it is unfortunately that a singular and unambiguous definition of social sustainability has yet to be established (Bramley et al., 2006: 1). Moldan et al. (2012) argue that the complexity of economic, social, and cultural contexts, along with variations between industries, presents significant challenges in establishing a precise definition for social sustainability. Polese and Stren (2000: 16-17) defines social sustainability as:

development (and/or growth) that is compatible with the harmonious evolution of civil society, fostering an environment conducive to the compatible cohabitation of culturally and socially diverse groups while at the same time encouraging social integration, with improvements in the quality of life for all segments of the population.

Essentially, based on this definition, certain studies within the realm of social sustainability encompass the stated objective of fulfilling fundamental needs and addressing the issue of “underdevelopment”. Conversely, other studies place equal emphasis on modifying the detrimental conduct of affluent individuals and advocating for enhanced environmental ethics. Also, other researchers appear to conceptualize social sustainability as the act of upholding or safeguarding desired lifestyles and safeguarding specific socio-cultural customs (Vallance et al., 2011:342). The social dimension is often neglected when policy makers develop future scenarios. However, given the balance between social and environmental developments in a market economy, environmental and social dimensions need to be developed equally and from the very beginning of the process (Omann and Spangenberg, 2002: 1). In summary, social sustainability is the product of the

balance between human desires, needs and biophysical environmental requirements, which is an element of development. Namely, social sustainability requires the regulation of human wants and needs according to the requirements of the biophysical environment, and also a fair balance between human wants and needs (Vallance et al., 2011:345).

2.1.3.3. The Environmental Dimension

Addressing the challenges associated with environmental issues necessitates the implementation of regulatory measures pertaining to energy, agricultural and livestock practices, industrial manufacturing, transportation, and the interconnections among these sectors, while duly considering the ecological system. (Rogers et al., 2007: 88-96). Environmental sustainability is defined as “maintaining natural capital”. There is a basic “input-output rule” and “operational principles” regarding the provision and measurement of environmental sustainability. While the “input rule” deals with the amount and proportion of renewable and non-renewable resources in the system, the “output rule” deals with the waste absorption capabilities of current inputs by operational processes in the future. The “operating principles” are to take the environment into account while transforming the inputs into the output that the population will need with technology and capital consumption within the economic system run by human beings (Goodland, 1995: 10). In this sense, the environmental dimension of sustainability includes reducing the damage caused by humans to the environment, protecting the natural environment and ecosystem, and it requires taking measures to reduce the possible effects on the environment in the future in order to meet the needs of humanity (Eş, 2008: 18).

2.1.4. Sustainability Assessment

The importance of measuring sustainability has increased significantly, as indicated by the business principle that emphasizes the need to measure in order to effectively manage. This is particularly relevant when we make decisions and strive to achieve the goals of sustainable development (Tanzil and Beloff, 2006: 46). The

measurement of sustainability and the assessment of progress in this regard are intricate endeavors that frequently involve the use of comparative evaluations, ranking lists, and policy targets (Cook et al., 2017: 463).

Table 9: Important Aspects of Sustainability Measurement in A Company

<i>Dimensions</i>	<i>Sub-Dimensions</i>	<i>Indicators</i>	<i>Examples</i>
<i>Environmental</i>	<i>Resources</i>	Renewable Energy generation and usage,	Renewable energy ration in total energy, Wind energyratio,solar energy ratio.
	<i>Pollutants and Waste</i>	Elimination ratio of land, soil and waterwaste, Air emission ratio	Recycled waste ratio, Emissions ofSO _x , NO _x PM2.5 PM10, CO ₂ , CO, NMVOC and other GHG.
<i>Economic</i>	<i>Internal</i>	Financial situation metrics	ROI, ROE, profit.
	<i>External</i>	Benefits to local and regional community (contribution to the economy)	Donation for community needing (school, education center).
<i>Social</i>	<i>Workplace</i>	Workplace conditions, Employee safety and security, education and training,	Female employee employment rate, work accident rate, Lost workday rate.
	<i>Community</i>	Social impacts of operations, Stakeholder engagements, human rights activities	Social and education activity for community teenagers, trainee programs, public education activities.

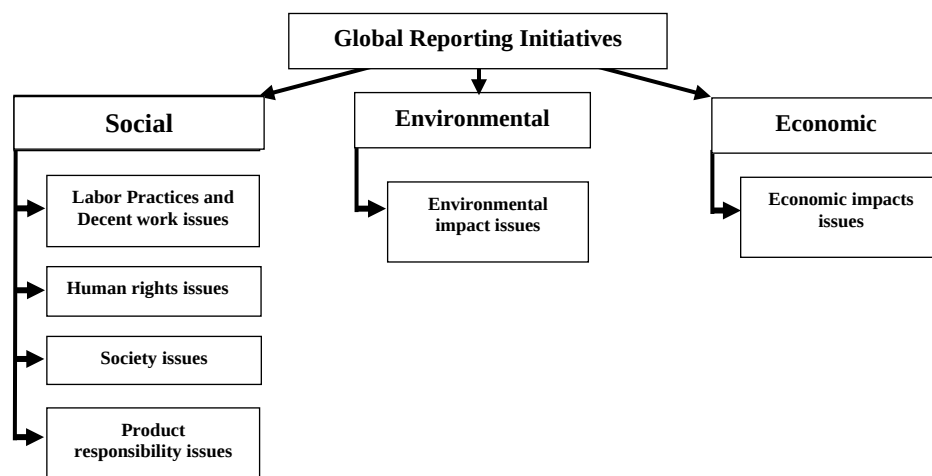
Source: Tanzil and Beloff, 2006: 44.

The prioritization of sustainability features, in terms of their relevance and importance, is influenced by various factors. These factors encompass the nature of the business, operational circumstances, historical context, community concerns, and other company-specific or organizational considerations. Typically, the environmental, economic, and social components that are pertinent to most firms include resource utilization and waste management, internal and external monetary costs and benefits, as well as the well-being of individuals in both the workplace and the surrounding community impacted by the company's operations. Furthermore, the success of the organization in several dimensions of sustainability is fundamentally influenced by its strategy, structure, and methods for managing sustainability (Tanzil

and Beloff, 2006: 44-45). In addition to the aforementioned indicators, variations might also arise from disparities in company operations and variations in performance measurement levels. In the given context, there exist numerous indicators that can be utilized to assess the performance of a company. In this regards, it is imperative for every sector or organization to develop their own specialized tools for measuring sustainability within their own fields. (Eş, 2008: 48).As Tanzil and Beloff (2006: 44) stated, the basic sustainability measurement criteria are as seen in Table 9. However, there are some basic metrics for sustainability assessment at firm and regional level in the international literature (Labuschagne et al., 2005: 374). These key metrics are described below:

Global reporting initiatives -The Global Reporting Initiative (GRI) was established in 1997 by the United Nations Environment Programme (UNEP) and the Coalition for Environmentally Responsible Economics (CERES), a non-governmental organization based in the United States. The primary objective of this initiative was to improve the overall quality, rigor, and usefulness of sustainability reporting (GRI, 2002: i). According to GRI secretaries, *GRI is committed to continually improving the Guidelines in line with the evolving consensus on how to best measure performance against the goal of sustainable development* (GRI, 2002: 9).

Figure 7: Global Reporting Initiative Framework



Source: GRI, 2002: 36.

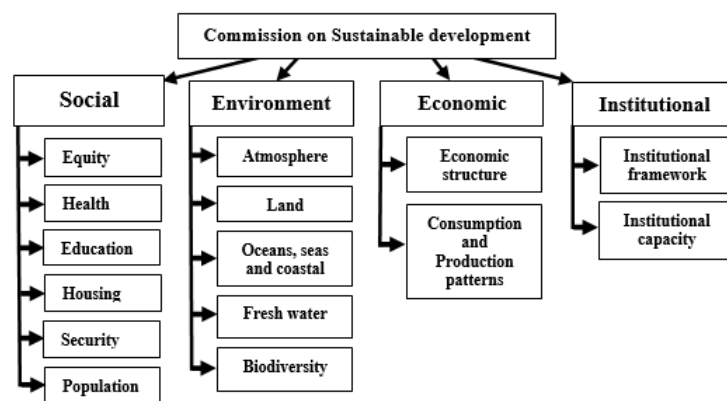
The guideline encompasses a comprehensive set of over 100 indicators. Nevertheless, the evaluation of certain indicators may cause challenges, and there is a lack of guidance regarding the selection process for these indicators (Veleva and Ellenbecker, 2000: 105-108).

Sustainability metrics of the Institution of Chemical Engineers -The Institution of Chemical Engineers (ICHEME) offers standardized reporting forms and conversion tables. This framework exhibits less complexity and a greater focus on generating impact (ICHEME, 2010: 2). Nevertheless, the framework exhibits a clear bias towards environmental considerations, prioritizing quantifiable indicators that may not be feasible in all operational contexts, particularly during the first stages of a project's life cycle (Labuschagne, 2005: 8-38).

Wuppertal sustainability indicators -The Wuppertal Institute has put up a set of indicators that correspond to the four dimensions of sustainable development, as outlined by the United Nations Commission on Sustainable Development (UNCSD). Additionally, the institute has also presented interlinkage indicators that establish connections between these dimensions (Spangenberg and Bonniot, 1998: 13).

United Nations Commission on Sustainable Development Framework - The sustainability indicator framework developed by the United Nations Commission on Sustainable Development (UNCSD) serves as a tool for assessing the extent to which governments are making progress towards achieving sustainable development objectives (Labuschagne et al., 2005: 375).

Figure 8: United Nations Commission on Sustainable Development Framework



Source: Labuschagne et al., 2005: 375.

The elements encompassed within the United Nations Conference on Sustainable Development (UNCSD) framework may not all hold significance for the business community, particularly at the operational and project levels. Nevertheless, the framework offers valuable insights into the comprehensive understanding of sustainability at a national scale, along with identifying specific domains where businesses may actively contribute (Labuschagne et al., 2005: 375).

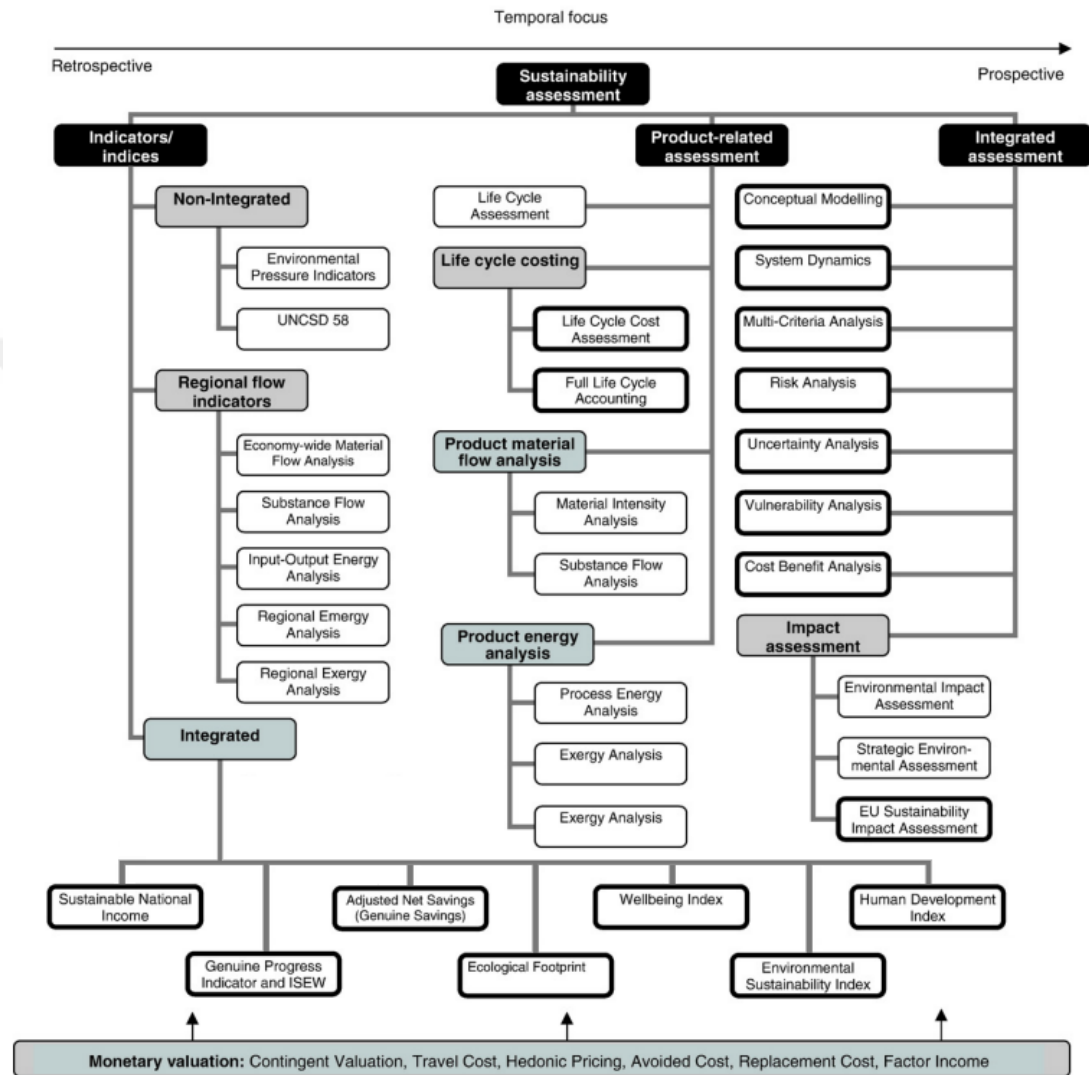
2.1.5. Guideline for Construction of Indices for Sustainability Assessment

Two distinct techniques can be identified for conducting Sustainability Assessment. Mainstream economists commonly employ the monetary aggregation method, while scholars and researchers in alternative disciplines tend to favor the utilization of physical indicators. Various economic approaches can be employed to address environmental concerns and promote sustainability. These approaches encompass strategies such as incorporating environmental considerations into the calculation of Gross Domestic Product (GDP), adopting resource accounting methods that account for the functions of natural resources, utilizing sustainable growth models, and establishing criteria for weak and strong sustainability conditions. Mainstream economists think that sustainable growth is an integral component of achieving sustainable economic development. However, Neo-classical models place have achieved by employing resources and technologies in an optimal manner, while taking into account the discounted benefits derived from environmental functions and nonrenewable natural resources (Singh et al., 2009: 194-195).

Ness et al. (2007: 500) have proposed a comprehensive framework for a sustainability assessment tool, as depicted in Figure 9. The framework comprises three overarching categories, namely: (1) indicators and indices, which can be further subdivided into non-integrated and integrated subcategories, (2) assessment tools pertaining to products, with a specific emphasis on material and/or energy flows throughout the life cycle of a product or service, and (3) integrated assessment, which encompasses a set of tools typically oriented towards effecting policy modifications or facilitating project execution. Additionally, the figure includes a

comprehensive category located near the bottom, which encompasses non-market values required in all three categories.

Figure 9: Framework of Sustainability Assessment Tools



Source:Ness et al., 2007: 500.

Sustainability assessment tools consist of indicators and indices. Indices appear when indicators are consistently included in the calculation (Harger and Meyer, 1996: 1752). In some cases, a composite index is constructed in studies where any variable is used to measure the status of one or more other variables (Singh et al., 2009: 195). Composite indexes are created by integrating qualitative

situations and numerical variables within a measurement system that employs multiple mathematical measurements. The purpose of these indexes is to unveil certain objectives, while also allowing for the statistical demonstration of links between the aforementioned situations and factors (Booyesen, 2002: 115).

The process of constructing composite indicators necessitates the decision-making in some issues. Some factors give rise to uncertainties in the analysis, including but not limited to the selection of data, imprecision in the data, methods used for data imputation, data normalization techniques, weighting schemes, values assigned to weights, and methods employed for data aggregation (Singh et al., 2009: 197). In addition to the utilization of composite indexes in the sustainability assessment, synthetic indices are also employed. Synthetic indexes enable the utilization of inferential data to construct indexes when complete data sets are not available (IGI, 2019).

2.1.6. Port Sustainability

Ports serve as a crucial conduit for facilitating the transportation of substantial quantities of cargo from maritime vessels, such as container ships, dry bulk carriers, and liquid bulk carriers, to be further conveyed inland to logistical centers by road and rail networks, and occasionally airports (Higgins et al., 2012: 11-12). Ports play an important role in regional development with container and bulk cargo movements and passenger movements, creating economic and social benefits (Bottasso et al., 2013: 37), Ports also contribute directly and indirectly to the rise of GDP at their location with the activities they carry out and create economic benefits. However, in addition to all its social and economic benefits, ports have operational and managerial processes that have serious environmental impacts due to both loading and unloading activities and greenhouse gas emissions from ships, land and rail connections (Bottasso et al., 2014: 44).

Port sustainability is defined as “business strategies and activities that meet the current and future needs of the port and its stakeholders, while protecting and sustaining human and natural resources” (AAPA, 2007: 25-26). According to Darbra et al. (2005: 870) “seaports are very complex systems with a wide range of

environmental issues: releases to water, air and soil, waste production, noise, and dredging among others”. The first sustainability-based study in the field of port management and maritime trade was written by Ernst G. Frankel in 1989. Although the focus of the study seems to be sustainability in the field of maritime trade and port management; The term “sustainability” is not mentioned in the study of Frankel. However, as a strategic management context, it offers a strategic planning approach on environmental issues and stakeholders to be considered in the conduct of the activities of the parties to the maritime trade activities (Frankel, 1989: 126-129).

In studies carried out until the early 90s, the issue of port sustainability consisted only of ownership structure, basic operational capabilities and economies of scale, and was mostly in the local context (Denktas-Sakar and Karatas-Cetin, 2012; Laxe et al., 2016). In the research conducted until the late the 2000s, the primary emphasis of port sustainability was predominantly centered on environmental concerns as seen on the studies of Wooldridge et al. (1999), Carpenter and Macgill (2003), Darbra et al. (2005), Hall (2007), De Langen (2006). However, ports are increasingly being pressured by the shipping industry and port associations to improve their sustainability activities and performance in terms of both environmental and also economic and social dimensions (Fobbe et al., 2020). During the 2000s, there was a recognized need for central and regional capacities and rules to ensure the sustainability of ports characterized by multiple actors and complex structures that enabling effective execution of operational activities (Bichou and Gray, 2005: 75; Cheon, 2017: 61).

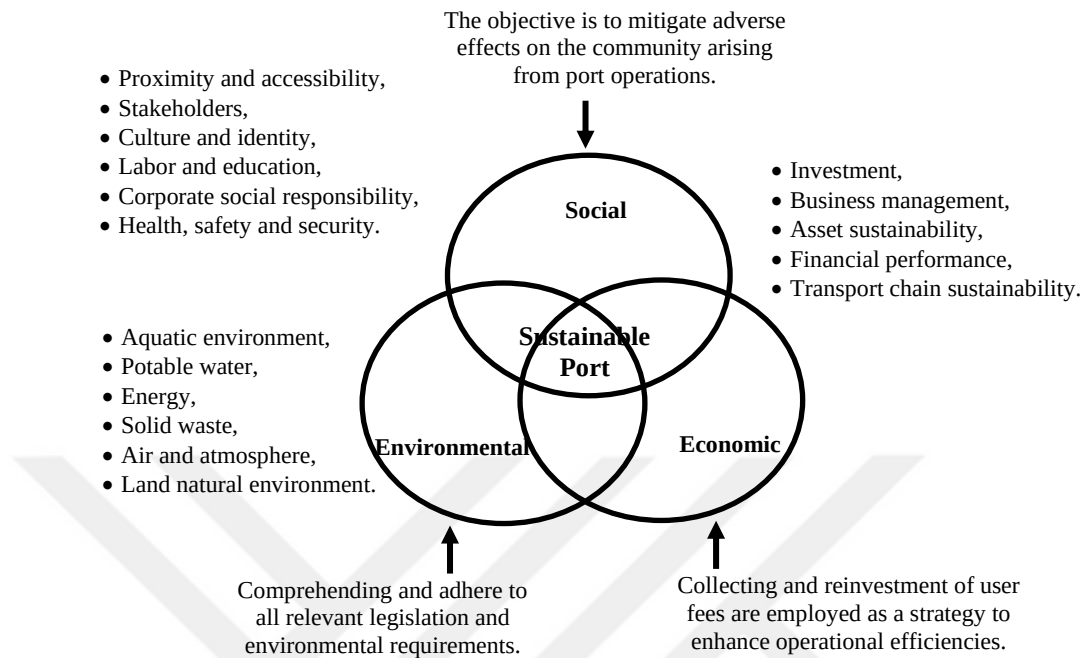
In this sense, European Seaports Organisation ESPO (2013: 2) has identified environmental priorities for the land and seaside development of ports. Following ESPO, GLEC also introduced a metric for the measurement of emissions in the logistics industry in 2014, with some industry members coming together (Akopian, 2019). Global Maritime Energy Efficiency Partnerships Project (GLOMEET) and International Maritime Organisation (IMO) 2018 published a user guide called “port emission toolkit 1 and 2” on emission measurement at ports in 2018 (www.glomeet.imo.org). This toolkit also offers innovation solutions for both emission measurement and emission reduction with 2nd guide of this toolkit. IMO has also published 4 different greenhouse gas emission reports for the maritime

sector between 2000-2020 (www.imo.org). In this sense, sustainability in the study of Frankel (1989), which was first introduced by strategic planning in the environmental context in the field of maritime trade, was associated with economic and social issues (Wooldridge et al., 1999), and then its context was brought back to the environmental dimension with organizations that took a regulatory role (Akopian, 2019).

2.1.7. Dimensions of Sustainable Port Management

There is a growing acknowledgment that sustainable port management necessitates the adoption of an integrated planning approach. This approach encompasses several key elements, including the harmonious interaction with natural ecosystems, the incorporation of inclusive stakeholder design, and the collaborative value creation. Furthermore, a crucial aspect of sustainable port management involves the implementation of adaptable designs capable of withstanding future uncertainties while maintaining operational functionality. In this regards, the integration of engineering, ecological, economic, and governance issues in port design poses challenges to its implementation due to its multidisciplinary nature (Slinger, 2017: 1). This indicates the need for a basic structural framework for measuring port sustainability (Denktas-Sakar and Karatas-Cetin, 2012: 305). Figure 10 shows the basic structure of the triple balance sheet approach for this need in ports. Indicators to be created regarding the dimensions of sustainability in ports are included in the variables associated with each dimension. For example, while ROI (return on investment) is an important indicator for the financial performance variable in the economic dimension, the accident frequency rate will be an important indicator for the health, safety and security variable in the social dimension. For example, the share of renewable energy use in all energy needs is an indicator that is under the energy variable of the environmental dimension.

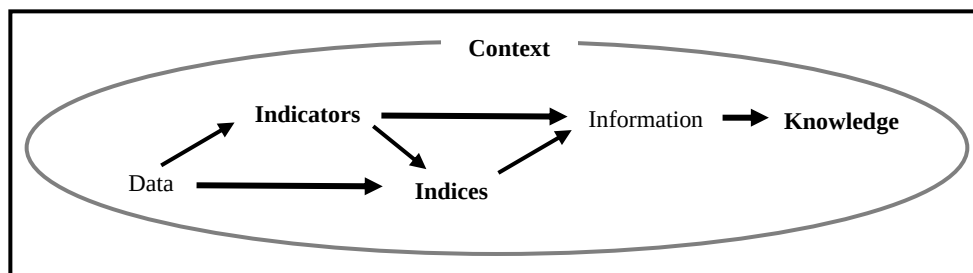
Figure 10:Dimensions of Sustainable Ports and Their Variables Required for Preparing the Main Indicators



Source: Denktas-Sakar and Karatas-Cetin (2012: 304).

Indicators and indices -The analysis and interpretation of the Sustainability Indicator (SI) should be conducted by considering the concept of “*distance-to-target*” and its relationship with other indicators, while also acknowledging the influence of the real-world setting. Thus, the data they convey can be transformed into knowledge for the purpose of acquiring understanding about the sustainability of a specific system as seen on Figure 11 (Waas et al., 2014: 5525).

Figure 11: The Indicators and Indices From Data to Knowledge



Source: Waas et al., 2014: 5525.

Indicators and indices are employed for the purpose of quantifying the level of sustainability within ports. In this context, the qualities of indicators involved Table 10 in the construction of indices must be considered (Peris-Mora et al., 2005: 1653).

Table 10: General Characteristics of Port Indicators

<i>Characteristics of Indicators</i>	<i>Definitions of Indicators' Characteristics</i>
<i>Representativeness</i>	The indicators should represent environmental behavior as accurately as possible
<i>Conciseness</i>	The indicator should allow for the simplification of the number of variables, which characterizes a phenomenon of condensing the information with the least possible loss of information
<i>Purpose</i>	The indicator should allow an activity to be evaluated in such a way that goals are accomplished
<i>Usefulness</i>	The indicator should be a useful tool for the activity
<i>Relevance</i>	Within the environmental awareness framework
<i>Adaptability</i>	Being adapted or easily adapted to other indicators, models and prediction systems (EEA, OCDE, EC)
<i>Comparability</i>	Over time (the development of a phenomenon), and within regional, national and international frameworks
<i>Sensitivity</i>	The indicator should be sensitive to environmental changes with fast, adaptable and appropriate responses to them. Thus, they should have variable values according to the changes in the phenomenon
<i>Clarity</i>	The system should be coherent and focus on essential data. The indicators should be concise, accurate, simple and easy to interpret
<i>Reliability and objectivity</i>	In obtaining and developing the data
<i>Easy to obtain</i>	From the phenomenon being evaluated
<i>Continuity</i>	The collecting data criteria should be constant over time in order to compare results
<i>Regularity</i>	The indicators should be determined at appropriately short intervals for the purpose of having the opportunity to actively pursue and influence the desired data
<i>Scientific verification</i>	The indicator should be preferably quantitative. If this were not possible, it should be hierarchically categorized
<i>Well-defined limits</i>	The indicator should provide information about its own limitations
<i>Cost-effectiveness</i>	The indicator should be administratively efficient in terms of the costs involved in obtaining the data and use of the information

Source: Peris-Mora et al. 2005: 1653.

In the realm of decision-making, it is imperative to take into account the real-world context when addressing sustainability issues. This is due to the fact that sustainability indicators, along with their corresponding frameworks or models, are inherently social constructs. Also, SI involve the process of reducing and simplifying the intricate nature of reality, which is characterized by numerous uncertainties and risks. These indicators are developed through diverse methods of learning (Gallopín, 1997: 13; Meadows, 1998: 4-6). In addition, while creating the indicators, the indicators that are the subject of the sustainability evaluation should be determined by paying attention to the distinction between the society and the stakeholder, taking into account the expertise (top-down) and stakeholder opinions (bottom-up). Considering the pre-implementation situation (ex-ante) and post-implementation situation (ex-post) for sustainability evaluation, it is an issue that should be considered both for presenting and determining the projections to the decision makers regarding sustainability (Waas et al., 2014: 5524-5525). In summary, as Dahl, (2012: 15) stated, “Even the best system of indicators will need to be complemented by other measures and inputs to ensure decisions in the interest of long-term sustainability”. In this sense, “ex-ante” and “ex-post” assessments are combined. This will help sustainability assessments to provide results that will provide consistency in decision making (Waas et al., 2014: 5525).

Economic dimension in sustainable port management -The measurement of sustainability activities is based on the principle of maintaining the balance between “input”, “operational principles”(Goodland, 1995: 10), Those are the “processing” and “consumption” of the “input” (Shiau and Chuang, 2013: 33), and “output” (Goodland, 1995: 10). The location of the port and the situation of the parties involved directly and indirectly in the port activities are critical points (Dooms et al., 2013: 15-16). Ports contribute directly or indirectly to the increase in GDP in the location where they operate and create economic benefits (Bottasso et al., 2014: 44). Hence, the positive and negative economic effects of a port on the Gross Domestic Product (GDP) highlight the economic dimension of port sustainability (Ogara et al., 2023: 5).

Table 11: Basic Economic Indicators of a Port in Terms of Economic Sustainability

<i>System</i>	<i>Economic Indicators</i>	<i>What is measured</i>	<i>Source</i>
City System	Contribution to GDP	Port development	Zhang et al. (2011); Merk and Dang (2013); Tan et al. (2017); Ding et al. (2016); Xiao and Lam (2017); Xu et al. (2017); Chen and Lam (2018); Li et al. (2018b); Yi et al. (2019); Stein and Acciaro (2020); Ogara et al. (2023)
Port System	Income		Barros (2003); Bichou, and Gray, (2004); Merk and Dang (2013); Asgari et al. (2015); Hakam (2015); Laxe et al. (2016); Lu et al. (2016); Xiao and Lam (2017); Van der Lugt, and De Jong (2017); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Ogara et al. (2023);
Port System	Revenues		Martinez et al. (1999); Bichou, and Gray, (2004); Cullinane et al. (2004); Merk and Dang (2013); Asgari et al. (2015); Hakam (2015); Shiao, and Chuang, (2013); Laxe et al. (2016); Lu et al. (2016); Xiao and Lam (2017); Van der Lugt, and De Jong (2017); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Ogara et al. (2023)
Port System	Profit		Bichou, and Gray, (2004); Asgari et al. (2015); Hakam (2015); Sislian et al. (2016); Wang, and Zhao, (2016); Laxe et al. (2016); Lu et al. (2016); Van der Lugt, and De Jong (2017); Oh et al. (2018); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Ogara et al. (2023)
Port System	Expenses		Bichou, and Gray, (2004); Cullinane et al. (2004); Asgari et al. (2015); Hakam (2015); Laxe et al. (2016); Van der Lugt, and De Jong (2017); Bjerkan and Seter (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020)
Port System	Ship visits		Park and De (2004); PPRISM (2012); Shiao, and Chuang, (2013); Asgari et al. (2015); Hakam (2015); Indra, and Notteboom (2015); Bjerkan and Seter (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020)
Port System	Capacities		Cullinane et al. (2004); Park and De (2004); Shiao, and Chuang, (2013); Yap, and Lam (2013); Asgari et al. (2015); Hakam (2015); Sislian et al. (2016); Laxe et al. (2016); Wang, and Zhao, (2016); Van der Lugt, and De Jong (2017); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Alamoush et al. (2021)
Port-City System	Passenger visits		Shiao, and Chuang, (2013); Stein and Acciaro (2020)
Port System	Cargo throughput		Roll and Hayuth (1993); Martinez et al. (1999); Tongzon (2001); Valentine and Gray (2001); Itoh (2002); Barros and Athanassiou (2004); Park and De (2004); Turner et al. (2004); Wang and Cullinane (2006); Rios and Maçada (2006); Cullinane and Wang (2006); Díaz et al. (2008); Sharma and Yu (2009); Quaresma Dias (2012); Merk and Dang (2013); Shiao, and Chuang, (2013); Yap, and Lam (2013); Asgari et al. (2015); Hakam (2015); Laxe et al. (2016); Serebrisky et al. (2016); Cui (2017); Wang, and Zhao, (2016); Xiao and Lam (2017); Van der Lugt, and De Jong (2017); Chen and Lam (2018); Li et al. (2018a); Oh et al. (2018); Wanke et al., (2018); Lim et al. (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Alamoush et al. (2021)
Port System	Capital investment		Zhang et al. (2011); Shiao, and Chuang, (2013); Asgari et al. (2015); Hakam (2015); Lu et al. (2016a); Laxe et al. (2016); Van der Lugt, and De Jong (2017); Oh et al. (2018); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Alamoush et al. (2021)
Port-City System	Investment in R&D and innovation		Yap, and Lam (2013); Acciaro et al. (2014); Molina-Serrano et al. (2020); Alamoush et al. (2021);

Source: Compiled by Author Adapted from Kong and Liu, 2021: 4; Ogara et al., 2023: 6.

Within the scope of this doctoral thesis, the dimensions of port sustainability and the grouping of indicators related to these dimensions were created by port-city interaction. According to this approach, indicators in sustainability dimensions are considered in relation to the indicators they affect within the “port system”, “city system” and “port-city system”(Kong and Liu, 2021: 4). In summary, As seen on Table 11, the port city is made up of interconnected entities that are both interdependent and influential on each other. In this sense, the main measure in the economic dimension of port sustainability is focused on *port development* (Ogara et al., 2023: 5).

Social dimension in sustainable port management - The social dimension in port sustainability consists of determining the social needs with an indicator group that takes into account the human needs and the needs of the community in the region where the port is located (Carpenter and Lozano, 2020: 45). The social dimension of sustainability indirectly includes regulations and improvements related to the economic and environmental dimensions. Namely, the act of creating a safer workable job in relation to the social dimension brings a development that reduces the risks of occupational accidents socially, while at the same time it can provide a much more efficient operation economically (Tanzil and Beloff, 2006: 42-43-54; Garcia-Onetti et al., 2021: 9). In this sense, the regulation regarding one dimension of sustainability also helps to achieve gains related to other dimensions (Tanzil and Beloff, 2006: 42-43-54). The sustainability dimensions are interrelated with each other, socio-economic benefit (Garcia-Onetti et al. 2021: 1), socio-ecological benefit (Garcia-Onetti et al., 2021: 9) and eco-efficiency benefit (Laxe et al., 2016: 238) are nested in the sense of creating. Research has mostly overlooked the social dimension (Denktas-Sakar and Karatas-Cetin, 2012: 302); Although The ESPO environmental priorities European port industry survey has consistently scored port partnerships with the local community as high since 2009 (Portopia, 2017a: 26; Puig et al., 2017: 111). Furthermore, a comprehensive research that covers all facets dimensions of sustainability in ports and all aspects related to their relationships has not yet been defined in the current studies (Fobbe et al., 2020: 157). However, a study by Ogara (2023: 12) in terms of port-city interaction and sustainable development goals is the first study to consider the interaction of sustainability dimensions in ports.

Table 12: Basic Social Indicators of a Port in Terms of Social Sustainability

<i>System</i>	<i>Social Indicators</i>	<i>What is measured</i>	<i>Source</i>
Port-City System	Number of port security and safety incidents	Port-city development	Fobbe et al. (2020); PPRISM (2012); Shiau and Chuang (2013); Asgari et al. (2015); Indra, and Notteboom (2015); Lu et al. (2016a); Van der Lugt and De Jong (2017); Portopia (2017a); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Alamoush et al. (2021).
Port-City System	Number of woman employee		PPRISM (2012); Shiau and Chuang (2013); Van der Lugt, and De Jong (2017); Portopia (2017a); Indra, and Notteboom (2015); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Alamoush et al. (2021).
Port-City System	Number of disabled employees		PPRISM (2012); Shiau and Chuang (2013); Van der Lugt, and De Jong (2017); Portopia (2017a); Indra and Notteboom (2015); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Alamoush et al. (2021).
Port System	Job-training intensity of employee		Zhang et al. (2011); PPRISM (2012); Chiu et al. (2014); Shiau and Chuang (2013); Asgari et al. (2015); Sislian et al. (2016); Chen and Pak (2017); Laxe et al. (2017); Van der Lugt, and De Jong (2017); Portopia (2017a); Oh et al. (2018); Fobbe et al. (2020); Lim et al. (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Alamoush et al. (2021).
Port-City System	Giving support to community's social activities, economical activities, and projects in general		Chiu et al. (2014); Lu et al. (2016a); Roh et al. (2016); Chen and Pak (2017); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Fobbe et al. (2020); Alamoush et al. (2021).
Port-City System	Providing scholarships and internship to students		Lu et al. (2016a); Roh et al. (2016); Sislian et al. (2016); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Fobbe et al. (2020); Alamoush et al. (2021).
Port-City System	Working with external partners such as academics/research institution to evaluate port projects		Shiau and Chuang (2013); Roh et al. (2016); Lu et al. (2016a); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Fobbe et al. (2020); Molina-Serrano et al. (2020); Alamoush et al. (2021).
Port-City System	Cooperation with urban authority to evaluate projects such as port expansion.		Shiau and Chuang (2013); Lu et al. (2016a); Roh et al. (2016); Laxe et al. (2017); Oh et al. (2018); Lim et al. (2019); Fobbe et al. (2020); Molina-Serrano et al. (2020); Alamoush et al. (2021).

Source: Compiled by Author from Kong and Liu, 2021: 4; Ogara et al., 2023: 6.

In addition, sustainability dimensions have brought standards to cover all service and production enterprises under the umbrella of Global Reporting Initiatives (GRI), and indicators have been developed to measure the activities of enterprises regarding social dimensions (GRI, 2002). However, the unique dynamics of the port management sector necessitated the privatization of these indicators for ports. Indicators regarding the social dimension of sustainability are given in the Table 12

above. The significance of social acts within port environments are of great importance. Ports demonstrate a commitment to social sustainability by implementing measures both within their organization and in their interactions with other entities to address concerns related to employees, society, supply chain members, and stakeholders. Also, social activities play a crucial role in promoting the social dimension of sustainability, as they involve several aspects such as employees' rights, safety and security, community welfare, and the well-being of seafarers. As evidenced by the data presented in Table 12, a range of metrics can be employed to facilitate pertinent initiatives aimed at enhancing employee welfare, mitigating accidents, and fostering social inclusivity and community support (Alamouch et al., 2021: 23). As seen in Table 12, the measurement of the social dimension of port sustainability is based on port-city development (Ogara et al., 2023: 8). The main point here is that almost all the indicators related to the social dimension in port sustainability are formed within the "port-city system". According to Carpenter and Lozano (2020: 45), the development of the social dimension in the sustainability dimensions of the port is hierarchically kept in the background compared to the city. However, the existence of the port and the fact that it is acceptable in terms of social indicators also directly affects the social structure of the cities where they are located. For this reason, almost all of the indicators related to the social dimension are subject to the "port-city system".

Environmental dimension in sustainable port management -The concept of environmental sustainability can be defined as the practice of preserving and conserving natural capital. The provision and measurement of environmental sustainability are governed by a fundamental "input-output rule" and "operational guidelines". The input rule pertains to the quantity and ratio of renewable and non-renewable resources inside the system, whereas the output rule pertains to the capacity of future operational processes to absorb the waste generated by present inputs (Goodland, 1995: 10). According to Table 13, the environmental dimensions of Port sustainability mainly aim at measuring "Affected Marine/Urban Ecosystem" (Ogara et al., 2023: 8). In addition, all of the indicators related to the environmental dimension are within the "port-city system" (Kong and Liu, 2021: 4). The port and the city in which it is located directly affect each other in terms of environment.

Naturally, the issues related to the environmental dimension of port sustainability directly affect the city as well. (Carpenter and Lozano, 2020: 45).

Table 13: Basic Environmental Indicators of a Port in Terms of Environmental Sustainability

<i>System</i>	<i>Social Indicators</i>	<i>What is measured</i>	<i>Source</i>
Port-City System	Emissions of GHG's	Affected Marine/Urban Ecosystem	Darbra et al. (2005); Peris-Mora (2005); Shiau and Chuang (2013); Chiu et al. (2014); Asgari et al. (2015); Sislian et al. (2016); Chen and Lam (2018); Bjerkan and Seter (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Ogara et al. (2023).
Port-City System	Emissions of other air pollutants (such as PM2.5; PM10; HC;SO ₂)		Peris-Mora (2005); Shiau and Chuang (2013); Chiu et al. (2014); Asgari et al. (2015); Alamoush et al. (2021); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Iris and Lam (2019); Ogara et al. (2023).
Port-City System	Water Pollution and consumption		Darbra et al. (2005); Peris-Mora (2005); Chiu et al. (2014); Chen and Pak (2017); Puig et al. (2017); Di Vaio et al. (2018); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020).
Port-City System	Noise		Darbra et al. (2005); Peris-Mora (2005); Shiau and Chuang (2013); Asgari et al. (2015); Sislian et al. (2016); Chen and Pak (2017); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Ogara et al. (2023).
Port-City System	Odour and Dust		Darbra et al. (2005); Peris-Mora (2005); Chiu et al. (2014); Chen and Pak (2017); Lu et al. (2016c); Muangpan and Suthiwartnarueput (2019); Stein and Acciaro (2020); Alamoush et al. (2021).
Port-City System	Light Emission		Chen and Pak (2017); Di Vaio et al. (2018); Stein and Acciaro (2020)
Port-City System	Cold Ironing		Lu et al. (2016c); Chen and Pak (2017); Iris and Lam (2019)
Port-City System	Renewable or Alternative energy usage		Peris-Mora (2005); Chiu et al. (2014); Asgari et al. (2015); Lu et al. (2016c); Puig et al. (2017); Iris and Lam (2019); Chen and Lam (2018); Bjerkan and Seter (2019); Muangpan and Suthiwartnarueput (2019); Stein and Acciaro (2020); Ogara et al. (2023).
Port-City System	Fuel Consumption (Fuel-oil, gasoline, diesel-oil, LPG, LNG)		Peris-Mora (2005); Chiu et al. (2014); Asgari et al. (2015); Bjerkan and Seter (2019); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020); Stein and Acciaro (2020)
Port-City System	Recycling of Wastes		Peris-Mora (2005); Shiau and Chuang (2013); Chiu et al. (2014); Asgari et al. (2015); Chen and Pak (2017); Puig et al. (2017); Roos and Neto (2017); Di Vaio et al. (2018); Molina-Serrano et al. (2020); Stein and Acciaro (2020); Ogara et al. (2023).
Port-City System	Recovered rainwater		Puig et al. (2017).
Port-City System	Dredging and Disposal		Sislian et al. (2016); Molina-Serrano et al. (2020); Stein and Acciaro (2020);
Port-City System	Environmental Certifications		Asgari et al. (2015); Muangpan and Suthiwartnarueput (2019); Molina-Serrano et al. (2020).

Source: Compiled by Author Adapted from Kong and Liu, 2021: 4; Ogara et al., 2023: 6.

In summary, compared to the economic dimension; the effect of interdependence in the port-city interaction in environmental and social dimensions is much greater and the speed of this effect is much higher. For this reason, the sustainability structure in environmental and social dimensions is formed as a port-city system. Already, implementing a stakeholder framework that supports port-city integration is a necessity, not a choice (Carpenter and Lozano, 2020: 46). According to Goodland (1995: 10), the operational principles involve considering the environment during the process of converting inputs into outputs that meet the population's requirements. The efforts made by ports to mitigate environmental externalities are extensively discussed and analyzed in academic literature as seen in Table 13. However, environmental measures and actions are implemented inside recognized environmental management systems, and their progress is reported through various schemes. Some examples of environmental management systems include the ISO14001, the European Union's eco-management and audit scheme (EMAS), the ESPO self-diagnosis method (SDM), and the port environmental review system (PERS) known as the EcoPort initiative. These systems incorporate the fundamental requirements of environmental management standards such as ISO 14001 (Alamouh et al., 2021: 16). The subsequent sections will elucidate the sustainability measurement and assessment techniques that have been specifically developed for ports.

2.1.8. Sustainability Assessment in Port Sector

The significance of the sustainability concept, particularly within the realm of seaports, has experienced a notable surge in recent years, as evidenced by the heightened attention from media outlets and the proliferation of scholarly articles from diverse stakeholders, including the general public, academics, and corporate entities (Hakam and Solvang, 2013: 803). Port operations can have varying effects on the environment, society and economy, and these effects can also be negative especially on environment and society (Trozzi and Vaccaro, 2000: 151; Puig et al., 2015a). These negative effects result in outputs such as waste and wastewater disposal, noise and dust generation, dredging, and greenhouse gas emissions as a

result of operational activities in port areas, jeopardizing employee safety and security, as well as causing health problems for employees and society, all of which have a negative impact on the environment (Peris-Mora et al., 2005; Acciaro et al., 2014a). Ports have to consider the effects of environmental issues on their activities (Beleya et al., 2015: 23; Roh et al., 2016: 107). If we look at the issue from an academic point of view, there are studies that consider the efficiency of port logistics systems and operational activities more over environmental factors. In fact, most of the port sustainability studies in the literature focus on environmental factors instead of integrated sustainability management (Peris-Mora et al., 2005: 1649). Research on port sustainability are encountered in studies on routine port operations such as the studies in Bateman (1996), Beleya et al. (2015), Di Vaio et al. (2018) since environmental sustainability is a necessary element in the implementation of sustainable management strategies in port operations (Puig et al., 2015: 16; Kim and Chiang, 2017: 125).

In research, approaches to sustainable port management have been handled in different ways. The assessment of port sustainability requires subject and case specificity in operational processes, due to differences in ownership and operating structure, and business-specific characteristics such as geographical location and capacity (Li and Yang, 2010: 175; Dinwoodie et al., 2012: 263). In addition, sustainability measurement and evaluation may include uncertainties by nature and should include a clear and transparent evaluation process that will reduce these uncertainties. In this sense, a sustainability assessment whose uncertainties are not defined will not be reliable and valid. (Waas et al., 2014: 5527). For example, Jiang et al. (2018), conducted a sustainability assessment with data envelopment analysis on variables that contain uncertainty such as pollutants and neighbor relations with residential communities in the case of 23 Chinese ports. They found that 14 ports, including the Shanghai port, had sustainability inefficiencies. In their research, they attributed the main reason for this situation to managerial problems and failure to take preventive measures.

Port-City integration in the context of sustainability -The impacts of ports on sustainability issues, both positive and negative, also have implications for the settlements in the region (Carpenter and Lozano: 2020: 37). According to Bottasso et

According to Figure 12, Path A exemplifies a scenario wherein the city and port are aligned in their pursuit of a comprehensive and environmentally conscious port-city development. This road represents the most efficient and cooperative approach to achieving their shared objectives. Path B demonstrates a situation in which the city's endeavors towards sustainability are progressing at a faster pace compared to the port, whereas Path C depicts the port's sustainability efforts advancing more rapidly than those of the city. Ultimately, in both scenarios, the urban area and harbor attain sustainability; however, this outcome is realized over a more protracted duration compared to Path A. Path D exhibits a longer duration compared to the other paths, so indicating that sustainability endeavors may reach a plateau at specific time intervals and within particular domains (e.g. environmental sustainability) before advancing towards the comprehensive development of the port-city is resumed at a later stage. Various alternative pathways may arise within the conceptual framework, contingent upon the particular contextual factors of the city and port under investigation. The framework demonstrates that the incorporation of sustainability elements encompassing economic viability, environmental orientation, and social orientation is necessary for the attainment of a comprehensive port-city model in the current era and beyond. In Summary, A is the most direct route and collaborative route for the sustainability development, in B the city's sustainability efforts are faster than port, in C the port's efforts are faster than city, and D the path is more chaotic (Carpenter and Lozano, 2020: 45). The sequencing of environmentally oriented and socially oriented measures is not inherently predetermined. In certain instances, urban areas may prioritize the well-being of their residents, placing greater emphasis on socially oriented measures such as housing and employment, rather than environmental concerns. (Camagani et al., 1998: 114-117). In the context of port sustainability assessment, it is noteworthy that environmental oriented metrics are accorded more priority compared to socially oriented measures (Wooldridge et al., 1999: 413-423-424; Carpenter and Macgill, 2003: 23-24; Darbra et al., 2005: 866-873; Hall, 2007: 97-98). Achieving favorable outcomes in port sustainability assessments, it is imperative to incorporate the sustainability dimensions of environmental and social orientation. This can be

accomplished through the implementation of a stakeholder framework that promotes port-city integration (Carpenter and Lozano, 2020: 46).

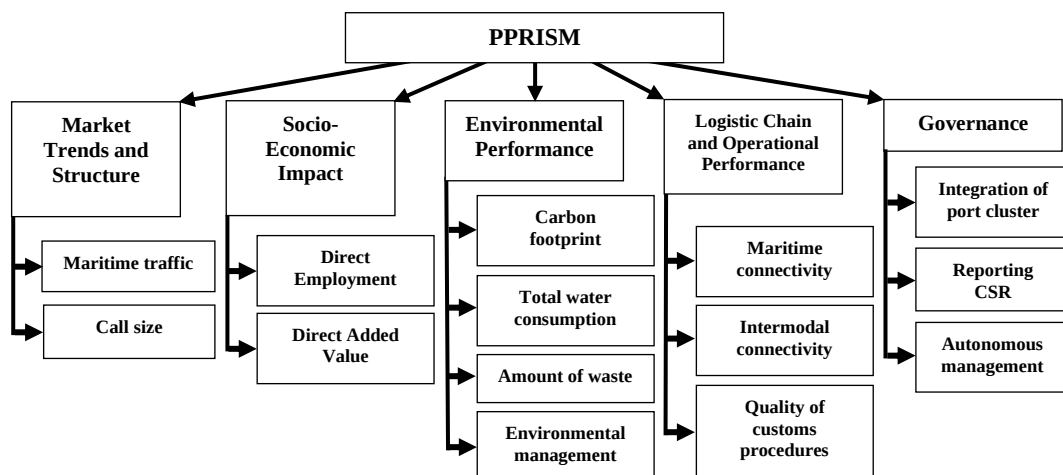
2.1.9. Projects and institutional Structures Related to Port Sustainability

Numerous global organizations have undertaken initiatives aimed at assessing the sustainability of ports, developing a range of indicators, indexes, and policies for the purpose of assessment and evaluation. An explanation of these structures has been provided in this title.

INDAPORT project -The INDAPORT project was undertaken with the objective of developing a sustainability indicator system for the port industry. This initiative has been a direct outcome of the research project, which took place from 2002 to 2004. The primary purpose of the research study has been to establish indicator systems that could be utilized to effectively implement sustainable environmental management practices within the port business (Peris-Mora et al., 2005: 1650).

Port performance indicators: selection and measurement (PPRISM) -The initiation of the PPRISM initiative by ESPO signifies an initial endeavor towards the establishment of a performance measuring culture inside European ports (PPRISM, 2012: 8).

Figure 13: Port Sustainability Indicators of PPRISM Project



Source: PPRISM, 2012: 8.

The PPRISM project, which spans over a duration of two years (between the years of 2010 and 2012), seeks to identify a comprehensive and viable set of performance indicators for the port system inside the European Union. This project is co-funded by the European Commission (PPRISM, 2012: 8). These indicators enable the port industry to quantitatively evaluate, analyze, and convey the influence of the European port system on various aspects of society, environment, and economy (PPRISM, 2012: 2).

PORTOPIA project - The PORTOPIA project was initiated in 2013 (Portopia, 2017a: 3) as a follow-up to the PPRISM study, which was conducted from 2010 to 2012 (PPRISM, 2012: 2). The conclusive report of the PORTOPIA project was delivered in 2017 (Portopia, 2017a: 6). This project is distinctive in that it has conducted the assessment and measurement of port sustainability at a European level. Furthermore, as a consequence of this undertaking, two reports were compiled: “European port industry sustainability report 2017” focusing on ports (Portopia, 2017a), and “Annual Report For Inland Ports 2017” specifically addressing inland water ports (Portopia, 2017b). Currently, Portopia's inland waterway sustainability activities are carried out by the European Federation of Inland Ports (EFIP) with the support of ESPO.

Tool for the identification and assessment of environmental aspects in Ports (TEAP)- The Tool for the identification and application of Environmental Indicators in Ports (TEIP) is associated with Tool for the identification and assessment of Environmental Aspects in Ports (TEAP). The outcomes derived from the components acquired in (TEAP) can be immediately utilized in TEIP for the aggregation of indicators. Nevertheless, in the event that a port has already established its own Strategic Environmental Assessments (SEAs), it may proceed immediately to the TEIP (Puig et al., 2017: 35). In summary, TEAP is involved in identifying competencies that help determine which indicators should be used to evaluate environmental performance, such as ISO 14001, EMAS and PERS specifications.

Tool for the identification and implementation of environmental indicators in ports (TEIP) -The TEIP tool was implemented as part of the PORTOPIA project, which was sponsored by the European Union and spanned from

2013 to 2017. The objective of this initiative is to establish a Service Cloud platform that enables European ports to effectively manage and evaluate their performance using specific performance indicators. By employing this approach, port managers will possess the capability to monitor the yearly fluctuations in their port's performance and make comparisons with the sector's average (Puig et al., 2017: 35).

EcoPorts foundation -The primary objective of the EcoPorts Foundation is to facilitate the advancement of practical strategies for ports that aspire to enhance their environmental performance. Additionally, the foundation endeavors to foster the exchange of knowledge and skills among port administrations, with the ultimate aim of establishing equitable conditions by discouraging the utilization of poor environmental practices as a means of competition (ESPO, 2003: 8).

World port sustainability program (WPSP) - The primary objective of the World Ports Sustainability Program is to showcase the prominent role played by ports worldwide in actively contributing to the Sustainable Development Goals established by the United Nations. The program aims to enhance the capabilities of port community actors globally, enabling them to effectively collaborate with business, governmental, and societal stakeholders. This collaboration is intended to generate sustained benefits for local communities and broader areas where the ports are situated (WPSP). WPSP carries out its activities within the body of the International Association Ports and Harbors (IAPH). WPSP uses metrics and policies created by projects such as Portopia, Ecoport, TEAP, TEIP, INDAPORT to evaluate and measure the sustainability level of the ports' activities (IAPH).

GreenVoyage2050 project (Port Emission Toolkit Guide 1 and Guide 2) - The GreenVoyage2050 Project is run through the International Maritime Organization's Project Coordination Unit (PCU). This guide is intended to serve as a resource guide for ports seeking to develop or improve their assessment of air pollutant and/or greenhouse gas emissions. In the 2nd series of this guide, applications that can be made for emission reduction are mentioned. These guidelines complement the previous work of the IAPH by updating its port sustainability related works (GEF-UNDP-IMO GloMEEP Project and IAPH, 2018: xiii).

IMO GHGstudy 2000-2009-2014-2020 -These are the reports that present the current situation and projection to prevent the formation of GHG originating from vessels. They are comprehensive reports that provide the calculation of GHG emissions from ships in the study and the situation on a spatial and equipment basis (IMO, 2021).

Global Logistics Emissions Council (GLEC) - GLEC is one of the decarbonization programs (GLEC, Clean Cargo, Sustainable Freight Buyers Alliance, Clean Air Transport) of the Smart Freight Center (SFC), an international non-profit organization focused on reducing the emission impacts of global freight transport. The Global Logistics Emissions Council (GLEC) was founded in 2014 as a collaborative initiative, comprising over 50 entities including enterprises, industry associations, and green freight initiatives. This voluntary cooperation has garnered support from various stakeholders, including experts, governments, and other relevant parties. The Global Logistics Emissions Council (GLEC) collaboratively devises and executes international protocols aimed at quantifying, disclosing, and mitigating carbon emissions within the logistics sector, with a specific focus on industry applicability (Smart Freight Centre, 2019: 4).

Port Operators Association of Türkiye (Turklım) -Marmara Port Operators Association (MARLİM) has been established in 1996 in order to seek solutions to the sectoral problems of private sector port and pier operators, whose numbers and capacities are increasing, on a common platform and to ensure solidarity. Due to the place of the organizations represented by the association in the country's economy and their activities throughout Türkiye, the title of the association was changed to Turkish Port Operators Association (Turklım) with the approval of the Republic of Türkiye Ministry of Internal Affairs on 07.02.2006. Turklım is an active member of the International Association of Ports and Harbors (IAPH), the Federation of Sectoral Associations (SEDEFED) and the MedCruise Association. There are 7 working groups within Turklım, where member ports come together regularly and share ideas and solutions. These are general cargo and dry cargo, container, Ro-Ro, liquid bulk cargo, cruise, digital technologies and Health, environment and safety working groups. and Health, environment and safety working groups. The health, environment and security working group stands out as a

working group where improvement and solution suggestions are discussed for activities related to the theme of sustainability and OHS in ports (Turklm, 2023b).

This dissertation study has two important contexts for port management. One of these is stakeholder relations, their identification and salience level. The second context is sustainability-oriented innovations. Following the stakeholders, the concept of sustainability has been first emphasized. Another element of sustainability-oriented innovations is the concept of innovation. In summary, sustainability and innovation are not handled separately in innovations involving sustainability. Sustainability and innovation considered as a whole, they have become an umbrella structure (Zvezdov and Schaltegger, 2013: 2363). For this reason, the concept of innovation has been emphasized before moving on to sustainability-oriented innovation.

2.2. INNOVATION

Sustainability is not an issue that can be addressed alone. In this thesis study, the previous titles focused on the concept of stakeholder, stakeholder theories and the importance of sustainability issues, respectively. Sustainability issues are intertwined with stakeholder management. These issues require a multilateral approach (Shaikh and Randhawa, 2022: 5). Additionally, the importance of stakeholder management and sustainability activities in port management and the roles of stakeholders have been emphasized. Innovation and sustainability are interconnected concepts in the balanced development of environmental, economic and social development (Michelino et al., 2019: 11-12). There are studies in the literature that reveal that innovations have positive effects on sustainability performance (Leach et al., 2012: 4). In summary, innovations are seen as an important tool for organizations to achieve their goals in sustainability activities. For this reason, organizations based on sustainability must address innovation and sustainability together (Adams et al., 2016: 180). Therefore, under this heading, innovation, types of innovation, levels of business model innovations, traditional (closed) innovation and open innovation are emphasized. In addition, the determinants of open innovation, the criteria that are effective in the selection of innovations, and the factors affecting the dissemination and adoption of innovations have been explained for use in the application part.

Innovation themes in the field of maritime and port management and port management patent areas have been explained.

In order to foster long-term growth, innovation plays a crucial role inside economic endeavors (Acciaro et al., 2018: 787). According to, De Martino et al. (2013: 123), in modern business environments, the adoption of innovative strategies has emerged as a crucial factor in bolstering the competitive advantage of firms, regardless of their specific industry. The impact of innovation varies among industries, with certain markets or enterprises within the same market exhibiting differing rates of response to the introduction of a particular invention. Some may exhibit a slower adoption or adaptation process, while others may see more benefits or demonstrate a more rapid promotion of the innovation. The variation in innovation across different sectors (Hipp and Grupp, 2005: 517) underscores the significance of examining the innovative process in order to comprehend the factors that may facilitate the various stages of said process (Acciaro et al., 2018: 787).

Definition of innovation -According to Schumpeter (1939), innovation is “a linear path in which the economic gain assures an irreversible mutation of the competitive conditions”. This definition has had a profound impact on the field of economic philosophy (Acciaro et al., 2018: 788). The key importance of the innovation process is emphasized in macroeconomic growth theory. In the scholarly literature, innovation initiatives are commonly characterized as outcomes resulting from the intricate interactions of complex systems involving multiple actors. These actors play a significant role in influencing the success and adoption of a particular invention (e.g. Rogers, 1962). According to Oslo Manual 2018, “An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)” (OECD/Eurostat, 2018: 20). Drucker (1985), proposed a more operational definition: “Innovation is change that creates a new dimension of performance and to innovate is to turn change into opportunity. Systematic innovation therefore consists in the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic or social innovation”. Arduino et al. (2013), developed a more specific definition: “A technological or

organisational (including cultural as a separate sub-set) change to the product (or service) or production process that either lowers the cost of product (or service) or production process or increases the quality of the product (or service) to the consumer”.

Various definitions of innovation have been put out in scholarly literature, although commonalities can be discerned in two regards. Firstly, it is important to acknowledge that innovation plays a pivotal role in driving change. Secondly, there are different kinds of innovation. Nevertheless, the significance of the involvement, it is fundamentally unimportant whether the involvement is in a product or further process. Put otherwise, the definitions lack specificity regarding the specific input or output format (Vanelslander et al., 2019: 3).

2.2.1. Types of Innovationby Object: Product/Services, Organizational, Marketing and Business Process Innovation

Innovation aims encompass the discernible goals of a company that signify its reasons and underlying tactics in relation to its innovation endeavors. For these goals, different types of innovation are carried out for different needs. These appear as (a)Product innovation and (b)business process innovation according to OECD/Eurostat, 2018: 70). Although it is handled under 2 basic distinctions according to Oslo; Also, the existence of diverse innovation categories can be attributed to the complex and multifaceted character of innovation (Vanelslander et al., 2019: 5). The first Oslo Manual, published in 1992, included comparable innovation studies from Europe, Australia and Canada and focused on innovations in the manufacturing sector. The second Oslo Manual, published in 1997, included guidelines for measuring innovation activities in some service sectors in addition to the manufacturing sector and included innovation indicators for OECD countries. Both the first and second Oslo Manual limited innovation to new or significantly improved “technological” products and processes. The third Oslo Manual, published in 2005, expanded the innovation measurement framework: it placed greater emphasis on the role of linkages with other firms and institutions in the innovation process, recognized the great importance of innovation in traditionally less R&D-

intensive industries, and changed the definitions of innovation and innovation. The fourth Oslo manual, published in 2018, comprehensively covers organizational and marketing innovation. He also evaluated organizational innovation within the scope of business process innovation. Until the fourth manual, issues related to what can be measured and what should be measured have been emphasized (OECD/Eurostat, 2018: 28).

According to OECD/Eurostat, (2018):

Product innovation - “A product innovation is a new or improved good or service that differs significantly from the firm’s previous goods or services and that has been introduced on the market”.Also, Service innovation is defined as innovations that are considered intangible within product innovationOECD/Eurostat, (2018: 70-71).

Organisational innovation - “The use of novel approaches in company processes, workplace structuring, or external interactions” according to Oslo Manual 2013. But, currently, it takes place in business process innovation (OECD/Eurostat, 2018: 51).

Marketing innovation - According to OECD/Eurostat, (2005: 49), basic definition for marketing innovation:

It is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm’s product on the market, with the objective of increasing the firm’s sales(OECD/Eurostat, 2005: 49).

Business modelinnovation - “A business model innovation is a new or improved business process for one or more business functions that differs significantly from the firm’s previous business processes and that has been brought into use in the firm” (OECD/Eurostat, 2018: 72). Business model innovation is the reflection of collaborative and simultaneous changes within the ecosystem in which it is or wants to be, to its operational activities by increasing the value proposition of the organization, making the revenue generation mechanism and market segment unique (Chesbrough, 2010: 355). As seen on Table 14, business model innovations for companies can be summarized with 6 basic types (Chesbrough, 2007: 13-14).

Table 14: Types of Business Model Innovation Frameworks

Business Model Frameworks	
Type 1: Company has an undifferentiated business model.	A significant proportion of current businesses fail to clearly define their business model and lack a systematic approach for its management. <i>“Commodity trap”</i>
Type 2: Company has some differentiation in its business model.	The company has successfully established a certain level of distinctiveness in its products or services. <i>“Slightly different and less congested market segment”</i>
Type 3: Company develops a segmented business model.	The company is now capable of engaging in multiple segments of the market concurrently. Consequently, a larger portion of the market is effectively catered to, resulting in a commensurate increase in profitability derived from the market. <i>“Firm’s business model now is more distinctive and profitable”</i>
Type 4: Company has an externally aware business model.	In this business model, the company has initiated a process of embracing external ideas and technology to enhance the development and implementation of its operations. <i>“Internal roadmaps are now shared with suppliers, customers and some stakeholders on a frequent basis”</i>
Type 5: Company integrates its innovation process with its business model.	The business model of the corporation currently assumes a crucial integrative function inside the organization. Currently, suppliers and customers have established structured institutional access to the innovation process of the firm. This access is reciprocated by the suppliers and customers. <i>“Companies that are moving from offering products to offering services, and are bringing in external technologies”</i>
Type 6: Company’s business model is an adaptive platform.	In this theoretical framework, the capacity to adjust necessitates a dedication to engaging in experimentation with one or more iterations of business models. This experimental study can manifest in various formats. Certain corporations employ corporate venture capital as a strategy to investigate new business models within tiny start-up enterprises. <i>“Entering into relationships in which both technical and business risk may be shared”</i>

Source: Chesbrough, 2007: 13-14.

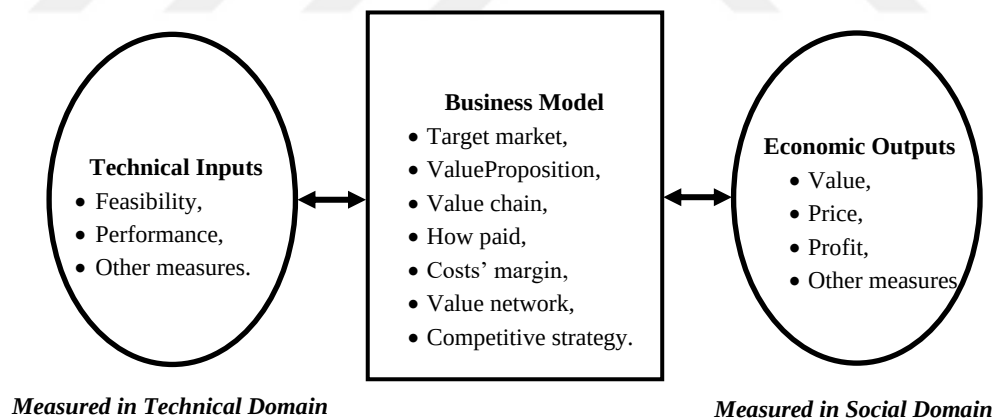
These 6 basic steps are connected to “articulating value proposition”, “identifying a market segment”, “defining the structure of the firm’s value chain”, “estimating the cost structure and target margin”, “describing the position of the firm within the value network linking the stakeholders”, and “formulating the competitive strategy” as seen on Figure 14 (Chesbrough, 2003a: 64-65).

When interacting with stakeholders throughout the supply chain, starting from a single approach to business model innovation, it provides access to innovation resources to differentiate in the market. When the market share begins to be increased relatively through business model innovation, it provides convenience for the business to transition to a sharper and more profitable phase. Steps are taken to be included in the ecosystem that will create value shared with all stakeholders

through stakeholder interaction and technology opportunities. With business model innovation, the business begins to integrate innovations more easily. When business model innovations are transformed into a platform model, risks begin to be shared with stakeholders (Chesbrough, 2007: 13-14).

However, the range of conceivable business models is vast and limitless. There are a multitude of possibilities for integrating channels with value propositions. The visual tools developed by Alex Osterwalder are crucial in assisting organizations in navigating intricate subjects such as business model innovation (Osterwalder and Euchner, 2019: 13). Figure 14 illustrates that the business model functions as an intermediary construct that establishes a connection between the technological and economic realms. Although technical managers may not fully grasp the advantages that consumers derive from enhancing the capability and performance of their technology, they may possess the ability to realize the implications of their actions on a specific value proposition targeted towards a selected client segment.

Figure 14: The Business Model as a Cognitive Map Across Domain



Source: Chesbrough, 2003a: 69

Marketing managers may lack knowledge about their consumers' preferences on various technical subjects; yet, they possess a solid understanding of how specific enhancements in the value offer can translate into increased prices, larger market shares, and bigger profitability. Figure 14 illustrates that the firm's ability to generate economic value from its technology is contingent upon its selection of a business

model, rather than being determined by any intrinsic attribute of the technology itself. It is also a striking element that the outputs measured in the social domain consist of economic outputs (Chesbrough, 2003a: 69).

Table 15: Overview of Business Model Components

Components	Authors
<i>“A business model is a unique blend of three streams that are critical to the business. These include the value stream for the business partners and the buyers, the revenue stream, and the logistical stream.”</i>	Mahadevan (2000: 59)
<i>“new customer value proposition(s); a value network configuration for that value creation; and sustainable returns that ensure the satisfaction of relevant stakeholders.”</i>	Voelpel et al. (2004: 40)
<i>“A business model consists of two essential elements -the value proposition and the operating model- each of which has three sub elements, value proposition: target segment(s), product or service offering, revenue model and operating model: value chain, cost model and organization.”</i>	Chesbrough (2007: 1)
<i>“Four integrated business model components: -Your customers, -Your value proposition, -Your infrastructure, -Your cost/revenue structure.”</i>	Osterwalder and Pigneur (2010: 29)
<i>“...we suggest two sets of parameters that activity systems designers need to consider: design elements - content, structure and governance - that describe the architecture of an activity system; and design themes - novelty, lock-in, complementarities and efficiency - that describe the sources of the activity system's value creation.”</i>	Zott and Amit (2010: 216)
<i>“Recapitulating, we use a business model framework that consists of three components: value proposition, value creation, and value capture.”</i>	Abdelkafi and Täuscher (2016: 76)

Source: Van Tonder et al. 2020: 110.

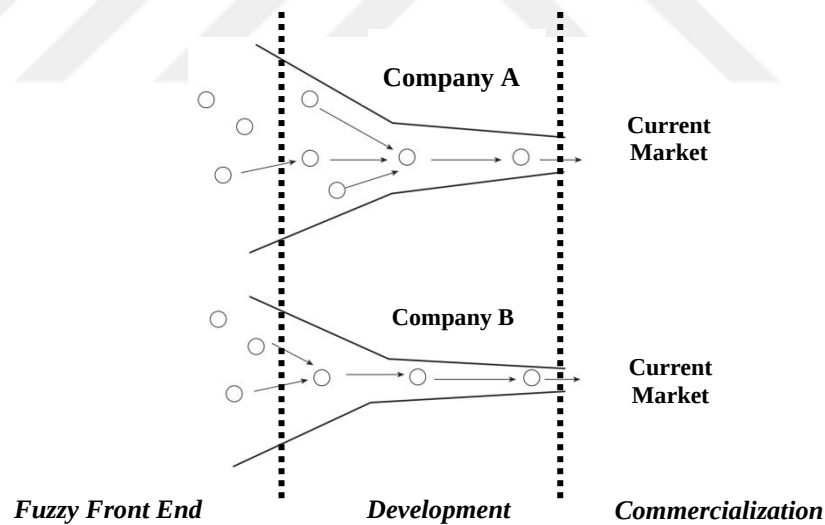
Business models that are successful and accepted social impacts can only reveal these social impacts with successful economic outcomes. In addition, the fact that the holistic value created includes elements such as accessible prices, effective profitability and creating benefits for everyone in measurements in the social domain indicates the connection of business models with social impact levels (Chesbrough, 2003a: 69). According to the business model components presented in Table 15, it is evident that the business model elements that have been frequently referenced in the

literature include value offering, value proposition, value creation, profit, customers, strategy, resources, processes and cost structure.

2.2.1.1. Closed Innovation

The closed innovation model proposes a concept of self-reliance in research and development (R&D) activities, and it was widely adapted or modified by numerous prominent industrial enterprises during the 20th century. This organizational philosophy holds significant importance for the organizations who embraced it. In order to achieve successful innovation, it is imperative to exercise control over research and development (R&D) operations (Chesbrough, 2003b: 36). In the traditional closed innovation paradigm, firms operated under the premise that they should maintain exclusive control over their innovation activities, necessitating a tightly regulated environment (Elmquist et al., 2009: 327).

Figure 15: Interactions Between Firms and Their Environments in Closed Innovation



Source: Adapted from Chesbrough, 2003a: 31; and Docherty, 2006: 14.

Consequently, corporations had to generate their own concepts as they bore the responsibility for various aspects such as development, manufacturing, marketing, distribution, and services. So, the promotion of self-reliance within the framework of closed innovation has been sometimes characterized as a do-it-yourself

approach (Chesbrough, 2003b: 36). However, the transformation of closed innovation into open innovation has been denoted by Chesbrough (2003a: 25) as “a shift in the knowledge landscape”. Knowledge and other related elements (technology, economic factors) interact with the company from a single point of view. This situation brings about blindness in innovation (Chesbrough, 2003a: 25).

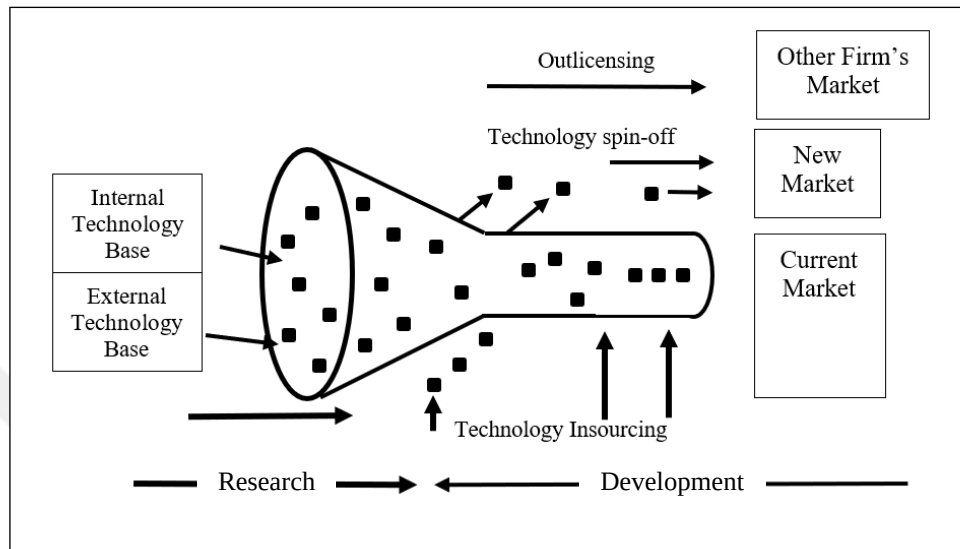
According to the “do-it-yourself” philosophy, closed innovation refers to the process of generating ideas for the purpose of organizational development. Firms are constantly trying to stay ahead of their competitors with their R&D activities in their innovation activities, which they put forward with their own implicit knowledge. The protection of the intellectual capital employed for R&D seems to be more attractive in closed innovation and creates an advantage for intellectual property. However, the significant increase in the amount and mobility of knowledge workers, coupled with the increasing availability of private venture capital, has played a crucial role in facilitating the financing of emerging businesses and stimulating the commercialization of ideas generated in research labs. Thus, in the last years of the 20th century, closed innovation lost its power with globalization, rise of internet, (Chesbrough, 2003b: 36).

2.2.1.2. Open Innovation

The term “open innovation” has acquired multiple meanings. In Chesbrough (2012: 20) own view, “the open innovation paradigm can be understood as the antithesis of the traditional vertical integration model in which internal innovation activities lead to internally developed products and services that are then distributed by the firm” (Chesbrough, 2012: 20). The vertically integrated model is what He term a closed innovation model. According to Chesbrough (2006: 1) open innovation may be simply defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation”. Chesbrough’s exposition on the open innovation model have underscored the imperative of facilitating the outward flow of ideas from corporations to identify more optimal avenues for their monetization, while

simultaneously fostering the inward flow of novel offerings and business models into the organization (Chesbrough, 2003a: xi).

Figure 16: Open Innovation Model

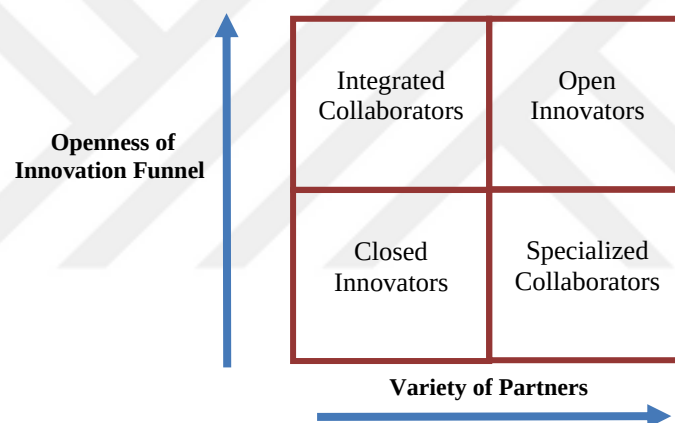


Source: Chesbrough, 2012: 23.

As seen on Figure 16, within the framework of the open innovation paradigm, initiatives have the flexibility to enter or quit at different stages and by different means. In this context, initiatives have the potential to be initiated through either internal or external technology sources, and the infusion of novel technology might occur at different points of the process, representing the external influence on the model. Moreover, projects have several avenues to reach the market, including outlicensing, spin-off ventures, and the utilization of the company's internal marketing and sales channels. This component of the model pertains to its internal structure or inner workings. The model has been designated as “open” by Chesbrough, because to its capacity to facilitate the inflow of ideas into the process and the outflow of ideas into the market through several channels. Also, on the service sector perspective, innovation is an element that negotiates the tension between standardization and customization (Chesbrough, 2012: 22-25). In summary, open innovation is the process of discovering, testing, and using appropriate differentiation strategies that allow the use of external information resources to eliminate the resource constraints for integrating the firm's new market initiatives

and other firm's markets with the existing market, while balancing cooperation and competition (Chesbrough and Bogers, 2014: 31). In the context of the open innovation paradigm, Lazzarotti and Manzini (2009: 622-623) have proposed various classifications to assess the level of openness within the innovation funnel. These classifications have been categorized into four distinct domains, as depicted in Figure 17, each possessing unique characteristics. The initial category is referred to as closed innovators. This category encompasses companies that utilize external knowledge sources, such as access to external prototyping services, in order to develop new products. The second category consists of colleagues with particular expertise.

Figure 17: Four Levels of Open Innovation



Source: Lazzarotti and Manzini 2009: 622-623

This category pertains to enterprises that demonstrate a willingness to engage in partnerships with other entities, with a specific emphasis on their collaborative efforts inside a singular stage of the innovation process. The third category pertains to integrated collaborators. Also, it pertains to enterprises that adopt an open innovation approach, wherein the innovation funnel and process involve collaborative contributions from various partners. The fourth category comprises those who engage in open innovation practices. This category is associated with organizations that oversee a diverse range of technology partnerships. In summary, the open innovation paradigm posits that firms ought to include ideas from external sources, such as the market, in order to enhance their internal ideas and improve their

value-creation methods (Docherty, 2006: 13). Innovation models consisted of technology-push innovation models (linear process) between the 1950s and 1960s, market-pull innovation models (R&D on customers' needs) emerged in the 1960s (e.g. Myers and Marquis, 1969). coupling models (interaction of function) emerged in the second half of the 1970s (e.g. Mowery and Rosenberg, 1979) and interactive innovation models (interaction with research institutions and market) and emerged in the late 1970s such as Rothwell and Zegveld (1985). Integrated innovation models (simultaneously feedback loop process) emerged in the late 1980s and early 1990s such as Kline and Rosenberg (1986). Network models (system integration) began to be established in the 1990s such as Rothwell (1992). In the 2000s, open innovation models (innovation collaborative structure) came to the fore with Chesbrough (2003a). Open innovators (Focus on conditions that will make it innovative) emerged after 2010 (Kotsemir and Meissner, 2013a; 2013b).

Factors affecting open innovation -The efficacy of the open innovation strategy is contingent upon many aspects that can be categorized as either “exogenous” (external) or “endogenous” (internal) to the organization. The literature examines several exogenous variables, including industry type, industry speed, the trend of globalization, and the diffusion of new technologies (Verbano et al., 2015: 1054-1055). Open innovation is a comprehensive and multifaceted notion that spans various dimensions (Van de Vrande et al., 2009: 428) In the context of open innovation processes, the permeability of organizational barriers increases, leading to heightened interaction between enterprises and external actors (Lichtenthaler and Ernst, 2009: 231). The measurement of the opening of corporate boundaries can be assessed using many methodologies. One aspect to be taken into account is to the extent of external partners that firms depend on for their inventive endeavors. Another metric to consider is the degree to which companies extensively utilize various external sources (Laursen and Salter, 2006: 146; Gassmann and Keupp, 2007: 363; Elmquist et al., 2009: 340; Enkel et al., 2009: 313). Verbano et al. (2015: 1053) characterized the external partners as the “external search breath” and “the external sources” as external search depth. Dahlander and Gann (2010: 706) have identified three distinct factors pertaining to openness in open innovation process.

Figure 18: Open Innovation Determinants

Determinants	Authors
Type of Sector and Technological Turbulence	Nelson and Winter (1982); Cohen and Levinthal (1990); Levinthal and March (1993); Klevorick et al. (1995); Chesbrough (2003a); Enkel et al. 2009); Lichtenthaler and Ernst (2009); Parida et al. (2012).
Industry Speed	Gassmann and Enkel (2004); Gassmann and Enkel (2010).
Globalization Trend	Anderson and Tushman (1990); Gassmann (2006); Fortuin and Omta (2008); Huizingh (2011).
Relationship Network	Fritsch (2001); Fabrizio (2009); Kathan et al. (2014).
University - Industry Interaction	Jain and George (2007); Freitas et al. (2013); Padilla-Meléndez, (2013).
Patent Protection	Mazzoleni and Nelson (1998); Arora et al. (2001); Chesbrough (2003b); Gassmann (2006); Herstad et al. (2008); Sousa (2008); Enkel et al. (2009); Gassmann et al. (2010); Huizingh (2011).
Diffusion of New Technology	Chesbrough (2003a); Nobellius (2004); Chesbrough et al. (2006); Dodgson et al. (2006); Gassmann (2006); Lichtenthaler (2008a); Tidd and Bessant (2009); Parida (2009); Chiaroni et al. (2010); Hrastinski and Kviselius (2010); Schilling (2010).
Firm Size	Arora and Gambardella (1994); Teece (1998); Arora et al. (2001); Chesbrough and Crowther (2006); Gassmann (2006); Herstad et al. (2008); Bröring and Herzog (2008); Lichtenthaler (2008b); Van de Vrande et al. (2009); Tidd and Bessant (2009); Lichtenthaler and Ernst (2009); Gassmann et al. (2010); Bianchi et al. (2010).
Organizational Structural and Support Mechanisms	Rothaermel and Deeds (2004); Van der Meer (2007); Tidd and Bessant (2009); Van de Vrande et al. (2009); Asakawa et al. (2010); Schilling (2010); Petroni et al. 2012).
Core Competence and Cognitive Distance	Hamel (1991); Chesbrough et al. (2006); Laursen and Salter (2006); Calantone and Stanko (2007); Grönlund et al. (2010)
Corporate Culture	Gassmann and Enkel (2004); Christensen et al. (2005); Gassmann (2006); Van der Meer (2007); Tidd and Bessant (2009); Dahlander and Gann (2010); Gassmann et al. (2010).
Existence of Corporate Venturing Unit	Chesbrough (2003a); Gassmann and Enkel (2004); Keil (2004); Lichtenthaler (2008a); Tidd and Bessant (2009).
The Role of a Champion	Lichtenthaler and Ernst (2009).
Intensity of R&D	Chesbrough (2006); De Jong et al. (2008); Herstad et al. (2008); Lichtenthaler (2008a); Keupp and Gassmann (2009); Lichtenthaler and Ernst (2009); Lazzarotti and Manzini (2009); Dahlander and Gann (2010).
Geographical Area	Van der Meer (2007); Herstad et al. (2008).
Product or service Characteristics	Nelson and Winter (1982); Levinthal and March (1993); Smith (2000); Gassmann and Enkel (2004); Christensen et al. (2005); Cassiman and Veugelers (2006); Herstad et al. (2008); Keupp and Gassmann (2009); Gassmann et al. (2010); Schilling (2010).
Technological Aggressiveness	Arora et al. (2001); Lichtenthaler, and Ernst (2005); Lin et al. (2006); Lichtenthaler (2009); Tidd and Bessant (2009); Lazzarotti et al. (2010); Schilling (2010).
Development of Radical Innovation	Lichtenthaler and Ernst (2005); Perrons et al. (2005); Chesbrough et al. (2006); Laursen and Salter (2006); Lettl et al. (2006); Lichtenthaler (2008a); Tidd and Bessant (2009).
Technological and Product Diversification and Internationalization	Cesaroni (2004); Lichtenthaler (2008b).

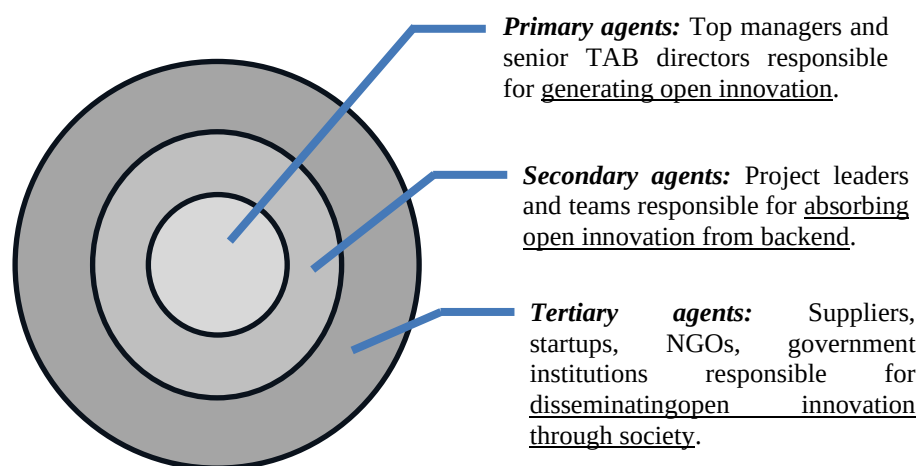
Source: Adapted from Verbano et al. 2015: 1057-1058.

As seen in Figure 18, there are a wide variety of open innovation determinants on which researchers agree. These determinants are structures that are frequently encountered in research and should also be included in the general innovation ecosystem. However, the most important determinant for open innovations is that the organizational structure and support mechanisms must be created with an attitude that paves the way for open innovations (Spender and Grant, 1996:5; Denktas-Sakar et al., 2014: 28).

The dimensions related to these determinants include the quantity of external innovation sources, the extent to which enterprises depend on both informal and formal interactions with external actors, and the varying levels of formal and informal protective mechanisms.

The structure of open innovation stakeholder governance -There exists a clear correlation between open innovation and stakeholder theory. Stakeholder theory posits that both ex-ante incentives (in the form of rewards) and ex-post monitoring (controls) are necessary to protect the cospecialized investments made by the primary, secondary, and tertiary stakeholders involved in open innovation (Shaikh and Randhawa, 2022: 5).

Figure 19: Open Innovation Stakeholder Governance Structure



Source: Shaikh and Randhawa, 2022: 5.

Stakeholder management offers a robust framework for mitigating the dangers associated with mismatched managerial objectives that impede the process

of open innovation (Brunswick and Chesbrough, 2018: 44). The different stakeholder levels seen in Figure 19 have duties in directing and implementing open innovations, using the resulting outputs and disseminating them correctly. Additionally, the reforms required to mainstream open innovations at each of the different stakeholder levels are seen in Figure 20 (Shaikh and Randhawa, 2022: 5-11).

Figure 20: Reforms Needed to Realize Open Innovation Stakeholder Management in the Future



Source: Shaikh and Randhawa, 2022: 12.

Innovation assists researchers and managers in stakeholder management in examining and designing corporate governance practices to more effectively realize the many benefits and reduce the risks of misaligned managerial drives and stakeholder asymmetries associated with open innovation (Shaikh and Randhawa, 2022: 12).

Figure 21: Typology of Innovation in Terms of Magnitude of Impact

		Components/Core concepts	
		Reinforced	Overtured
System/Linkages	Unchanged	Incremental Innovation	Modular Innovation
	Changed	Architectural Innovation	Radical Innovation

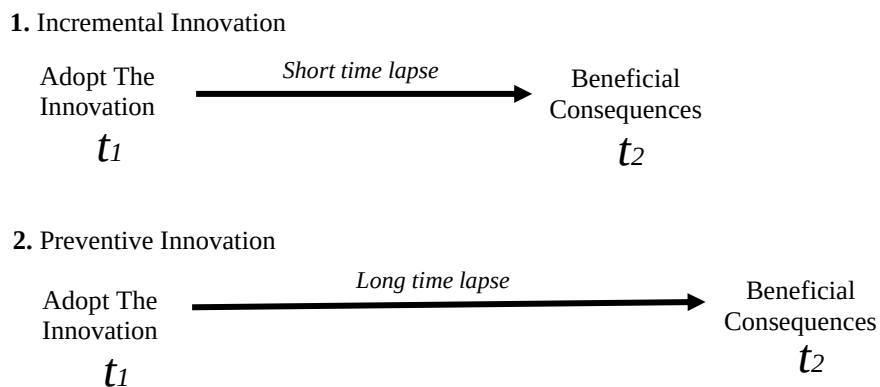
Source: Henderson and Clark, 1990: 12.

The structuring in Figure 21 will enable the future generation, adoption and diffusion of open innovation across the stakeholder ecosystem, allowing for the creation of Shared societal value (Shaikh and Randhawa, 2022: 12).

2.2.2. Types of Innovation in the context of Its Impacts

An additional categorization of innovation pertains to the extent or scale of its impact, which can be characterized as “incremental”, “modular”, “radical” and “disruptive” (Christensen, 1997: 10-60; Crozet, 2010: 2-9-17; Bourreau et al., 2012: 2; Hemphälä and Magnusson, 2012: 7). This categorization includes two dimensions that one of them is Components/Core concepts and the other one is System/Linkages. Components/Core concepts include reinforced and overturned levels. System/Linkages include changed and unchanged levels (Henderson and Clark, 1990: 12). The analysis of the impact of innovation on system knowledge and component knowledge, as well as the magnitude of this influence, results in a two-dimensional matrix consisting of four distinct categories, as seen in Figure 21. The two opposing ends of the spectrum are characterized by “incremental innovation” in the upper-left quadrant and “radical innovation” in the lower-right quadrant. According to Henderson and Clark (1990: 12), “architectural” and “modular innovation” can be classified as intermediate typologies.

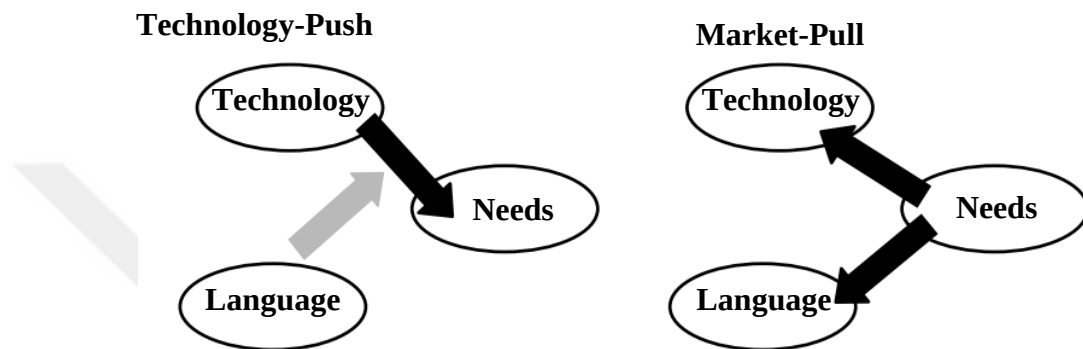
Figure 22: Rate of Incremental and Preventive Innovations



Source: Rogers, 1962: 301.

As seen on Figure 22, Rogers (1962) exemplifies the rate of innovation adoption by comparing incremental innovation with preventive innovation, which is a construct she introduced herself. Namely, “Preventive innovations are new ideas that require action at one point in time in order to avoid unwanted consequences at some future time” (Rogers, 2002: 991).

Figure 23: Knowledge Drivers in Different Modes of Innovation



Source: Verganti, 2003: 38.

As seen on Figure 23, while “technology-push innovation” arises from the availability of new technology principles and devices of innovation; “Market-pulling innovation” occurs when innovation seeks to respond to clear and urgent customer needs. Furthermore, language (it emphasize the corporate culture and communication channels) has a crucial role in either facilitating the development of technology (technology-push) or being influenced by technology (market-pull) in order to convey messages, so significantly impacting the design of innovation (Verganti, 2003: 37).

Innovation project selection criteria -After the external factors that drive innovations, innovation selection criteria are another factor taken into consideration. The value differentiation (Fahrni and Spating, 1990; Verbano and Nosella, 2010; Mitchell et al., 2014; Smith et al., 2008; Lerch and Spieth, 2012; Doorasamy, 2017) and competitive advantage potential (Archer and Ghasemzadeh, 1999; Verbano and Nosella, 2010; Hoonsoon and Ruenrom, 2012; Mitchell et al., 2014) of the innovation to be selected is taken into account. Their ability to strategically

alignment to the organization is another element that should be taken into consideration (Archer and Ghasemzadeh, 1999; Cooper et al., 1999; 2001; Meade and Presley, 2002; Smith et al., 2008; Verbano and Nosella, 2010; Mitchell et al., 2014; Patanakul, 2015). Another factor taken into consideration is their ability to influence the market and the customer and their fit with the internal customer experience (Verbano and Nosella, 2010; Hoonsopon and Ruenrom, 2012; Mitchell et al., 2014), supply chain fitting of the initial innovation (Chien, 2002; Verbano and Nosella, 2010; Mitchell et al., 2014; Cooper et al., 1999; Patanakul, 2015). In terms of cost and financials, time to break even point (Mukherjee and Bera, 1995; Tritle et al., 2000; Poh et al., 2001; Verbano and Nosella, 2010; Braga, A. and Braga, V. 2013; Bayarçelik et al., 2014; Mitchell et al., 2014; Kaliappen and Hilman, 2017) and net present value (Mukherjee and Bera, 1995; Poh et al., 2001; Verbano and Nosella, 2010; Mitchell et al., 2014; Yakovleva, 2014; Braga, A. and Braga, V. 2013; Bayarçelik et al., 2014; Jia, 2019) are economic criteria. The impact of the innovation to be chosen on the brand image (Mitchell et al., 2014), the risk of the innovation and the level of uncertainty (Fahrni and Spating, 1990; Ghasemzadeh and Archer, 2000; Tritle et al., 2000; Poh et al., 2001; Meade and Presley, 2002; Dodgson et al., 2008; Bowonder et al., 2010; Sniukas, 2010; Verbano and Nosella, 2010; Braga, A. and Braga, V. 2013; Varadarajan, 2018) are among the criteria that need to be evaluated.

2.2.3. Diffusion of Innovation Theory

The diffusion of innovation theory aims to provide an explanation for the process, factors, and pace at which novel ideas and technological advancements are disseminated. The theory of diffusion of innovations gained prominence through the work of Everett Rogers, who introduced it in his seminal book titled “Diffusion of Innovations”, initially released in 1962. In summary, Rogers (1962: 48) defined the diffusion of innovation as “the process by which an innovation is communicated through certain channels over time among the members of a social system”. The diffusion of innovation consists of four main elements. These four elements are: (1)the innovation, (2)communication channels, (3)time, and (4)the social system.

Innovations that are perceived to be consistent and compatible with current values, past experiences, and the needs of potential adopters (compatibility) by creating relative advantage (relative advantage), and which can be easily grasped by most members of a system (complexity), tried to reduce uncertainty by trial (trialability), and whose results are easily seen and understood by other individuals and organizations (observability), are suitable for diffusion (Rogers, 1962: 52-54).

Communication channels initiate the diffusion of innovation by transferring an individual/organization who has knowledge or experience of using an innovation or other individuals or organizations that have not yet adopted another adoption unit.

Time is difficult to directly measure the impact of time on the diffusion of innovation. However, for the diffusion of innovation, it must be present together with other elements.

The social system establishes a boundary within which innovation spreads. Here, how the social structure of the system affects diffusion, the effect of norms on diffusion, the roles of opinion leaders and change agents, the types of decisions and the results of innovation affect the spread of innovation.

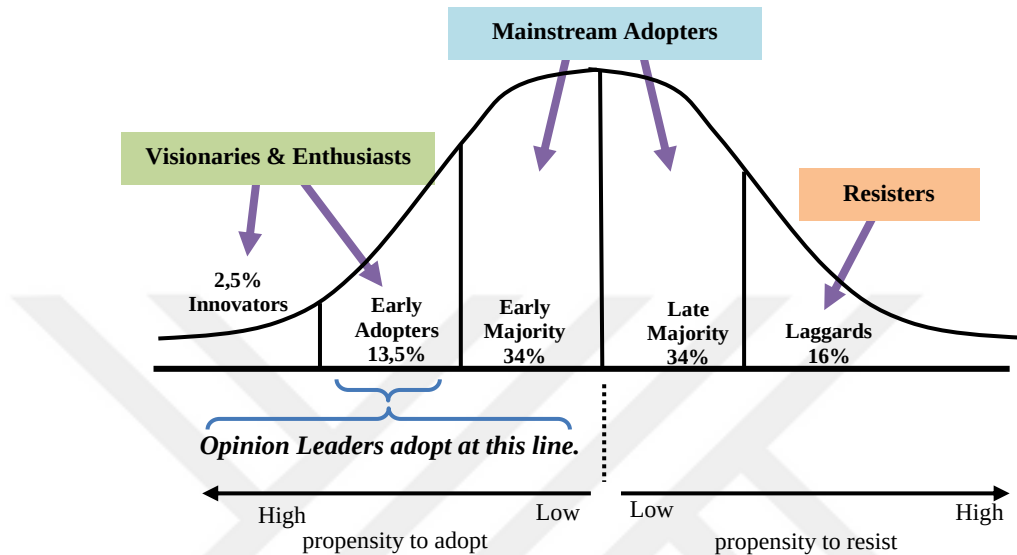
2.2.4. Innovation Adoption

Rogers (1962) discussed innovation adoption in 5 parts in the process of innovation diffusion and acceptance below Figure 24. These are:

Innovators: Innovators exhibit a propensity for risk-taking and a keen curiosity towards novel concepts. Individuals exhibit a decreased level of attachment to their own local peer networks, instead fostering more cosmopolitan interactions with geographically distant innovators. In order to bolster their inclination towards innovation, uncertainty, and danger, individuals necessitate enough financial means, a comprehensive comprehension of technical principles, and the ability to effectively manage ambiguity. In the process of disseminating inventions, innovators assume a significant role. The individuals' cosmopolitan connections, particularly their associations with fellow innovators, enable them to introduce novel concepts and perspectives into their immediate social circles. This also positions them as

gatekeepers or intermediaries who possess authority over the dissemination of innovations throughout social systems.

Figure 24: Innovation Adoption Lifecycle



Source: Adapted from Rogers 1962: 353; Robinson 2009: 5.

Early adopters: In contrast to the innovators, early adopters exhibit a greater inclination towards their immediate peer networks within their local community. The individuals in question are held in high regard by their colleagues, who frequently seek their guidance and expertise over a novel concept. Early adopters have a crucial role in influencing and inspiring other individuals within a social structure. After the adoption of an invention, individuals engage in the process of communicating their appraisal of said innovation to their peers. This communication serves the purpose of assisting peers in diminishing their own doubt over the innovation in question. This method facilitates the support of early adopters in propelling an innovation towards the attainment of critical mass, hence facilitating its broader adoption.

Early majority: The early majority segment comprises approximately one-third of the adopters within a given social system. They embrace novel concepts shortly before to the typical individual. Although they may not assume leadership roles in the process of adopting innovations or act as influential figures, their

interconnection within the social system renders them a significant intermediary in the dissemination of new ideas.

Late majority: The late majority, similar to the early majority, comprises around one-third of the adopters within a given social system. They assimilate novel concepts after to their adoption by the typical constituent. The rationales behind adoption frequently stem from economic imperatives or the mounting influence of peer pressure. Due to their limited resources, those belonging to the late majority segment exhibit a certain degree of skepticism towards novel ideas. They possess a strong inclination to ascertain the potential return on investment before committing to any new venture.

Laggards: Laggards exhibit a propensity to draw upon past experiences as a frame of reference while making judgments. They engage in social interactions only with those who share similar traditional beliefs and values, hence creating a sense of isolation from the broader social network. The cautious adoption behavior of the laggards is frequently influenced by their constrained resources. Prior to adopting an innovation, it is imperative for individuals to ascertain its potential for success and ensure its avoidance of failure.

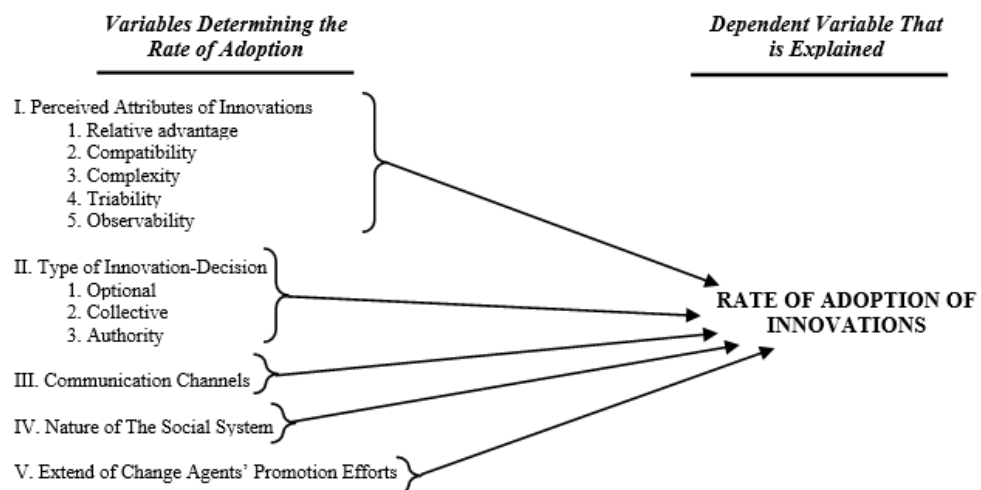
2.2.5. Factors Affecting Innovation Adoption

In general, innovations that allow individuals to decide whether or not to embrace them tend to be adopted more quickly compared to innovations that are adopted by organizations. The rate of adoption tends to decrease as the number of individuals involved in the decision-making process for an innovation increases. One strategy for expediting the pace of adoption of an innovation is the endeavor to modify the decision-making unit in order to reduce the number of individuals engaged. The adoption rate of innovations may be firstly attributed to five key criteria, namely relative advantage, compatibility, complexity, trialability, and observability, which together account for a significant portion of the variance, ranging from 49 to 87 percent (Rogers, 1962: 286). At this point, it can be stated that the existence of organizational resource capabilities is effective in the adoption of innovations in terms of relative advantages (Dickson, 1992). These can be revealed

by defining information as a critical resource (Spender and Grant, 1996:5; Denktas-Sakar et al. 2014: 28), providing innovation activities that will increase market share (Denktas-Sakar and Karatas-Cetin, 2012: 304; Denktas-Sakar et al. 2014: 28), and protecting organizational resources (Denktas-Sakar et al., 2014: 28). In addition, another factor that is effective in the adoption of innovations with relative advantages is the organizational reputation of the organization as perceived by internal and external stakeholders (Wartick, 1992: 34; Yoon et al., 1993: 215; Petrick et al., 1999: 63; Carmeli and Tishler, 2005: 13). When the factors that are effective in the adoption of innovations are considered in terms of compatibility, the innovation climate (Amabile et al., 1996; Voelpel et al., 2004: 40; Adams et al., 2016: 190), the existence of organizational learning and collaboration (Warren et al., 2018: 1787-1791; Braga, A., Braga, V. 2013: 44), and the culture of continuous improvement (Dooms et al., 2004: 16; Pérez-Rave et al., 2023: 126) are the first factors that attract attention. In addition, directing employees to areas compatible with their abilities and offering development opportunities are effective factors in the adoption of innovations by employees (Braga, A., Braga, V., 2013: 338-346; Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197). Reducing complexities is another attribute that is effective in the adoption of innovations. In this sense, in addition to formal roles, employees' assuming strong informal roles for innovations (Awazu, 2004: 2; Markham et al., 2010: 402; Hemphälä and Magnusson, 2012: 6; Hall et al., 2013: 87; Lee and Law, 2016: 167; Goodman et al., 2017: 742; Dedeheyir et al., 2018: 22), exhibiting market-oriented work behavior (Vanelslander et al., 2019: 616), having process-based work teams (Rashid and Chalab, 2007: 10-18; Hansen et al., 2009a: 687; Nafei, 2015: 130), and having a clear and harmonious structure in internal communication (Rogers, 1962: 162; Jaworski and Kohli, 1993: 67; Verganti, 2003: 37; Adams, 2016: 191) and inter-organizational communication (Bos-Brouwers, 2010: 430; Basov and Wuehr, 2012: 279; Adams, 2016: 191) are helpful in the adoption of innovations. In addition, introducing lean and agile principles into the organization is another facilitating factor in the adoption of innovations (Power et al., 2010: 1; Bushuyeva, 2019: 77-78). These factors can be summarized as structural and process characteristics. In terms of trialability in the adoption of innovations, the support of the top management (Bowonder, et al., 2010: 20; Gyau and Stringer,

2011: 135; Dedehayir, 2018: 22; Erlandsson and Gaylong, 2019: 39) to make and adapt innovations and the encouragement of new ideas (Govindarajan and Trimble, 2005: 54; Bressan and Pedrini, 2020: 508-510) can be expressed. Considering the observability attribute in the adoption of innovations, creating a quality culture (Adams, et al., 2012: 12; Adams et al., 2016: 185) and performance culture (Marques and Monteiro-Barata, 2006: 124; Bos-Brouwers, 2010: 430; Elsanhawy and Badway, 2023: 117) will help discover the obstacles to the adoption of innovations and take precautions. Additionally, employee resistance to change in terms of observability and compatibility is the biggest challenge to the adoption of innovations (Reichers et al., 1997: 48-52; Dent and Galloway-Goldberg, 1999: 25; Bordia et al., 2004: 525; Ford et al., 2008: 365).

Figure 25: Variables Determining the Rate of Innovation Adoption



Source: Rogers, 1962: 286.

According to Figure 25, relative advantage, compatibility, complexity, triability, observability are the factor affecting innovation adoption in terms of perceived attributes of innovations (Rogers, 1962: 286). Also, being generally open to change in organizations and succeeding in coming together on common ground will reduce employees' resistance to change (Chesbrough, 2003a: IX-XXIV; Lazzarotti and Manzini, 2009: 622-623; Adams et al., 2016: 181-192). In this sense, employee resistance to change is an important attribute of the factors regarding the adoption of innovations. The factors affecting employees' resistance to change and

the relevant basic assumptions were also emphasized. Table 16 shows the main reasons why employees resist change. Employee resistance to change has been introduced as a system concept by Kurt Levin. It is a forcing power for managers and employees equally (Dent and Galloway-Goldberg, 1999: 25). There are a variety of reasons why employees resist change.

Table 16: Basic Causes and Strategies for Employee Resistance to Change

<i>Authors</i>	<i>Kreitner (1992)</i>	<i>Griffin (1993)</i>	<i>Aldag and Stearns (1991)</i>	<i>Schermerhor (1989)</i>	<i>Dubrin and Ireland (1993)</i>
<i>Causes of resistance</i>					
<i>Surprise</i>	✓				
<i>Inertia</i>	✓				
<i>Misunderstanding</i>	✓	✓	✓	✓	
<i>Emotional side effects</i>	✓	✓	✓	✓	
<i>Lack of trust</i>	✓	✓	✓	✓	
<i>Fear of failure</i>	✓				✓
<i>Personality conflicts</i>	✓	✓	✓	✓	
<i>Poor training</i>	✓				
<i>Threat to job status/security</i>	✓	✓	✓	✓	✓
<i>Work group breakup</i>	✓	✓	✓	✓	
<i>Fear of poor outcome</i>					✓
<i>Faults of change</i>					✓
<i>Uncertainty</i>		✓	✓	✓	
<i>Strategies for overcoming</i>					
<i>Education</i>	✓	✓	✓	✓	
<i>Participation</i>	✓	✓	✓	✓	✓
<i>Facilitation</i>	✓	✓	✓	✓	
<i>Negotiation</i>	✓	✓	✓	✓	✓
<i>Manipulation</i>	✓	✓	✓	✓	✓
<i>Coercion</i>	✓	✓	✓	✓	
<i>Discussion</i>					✓
<i>Financial benefits</i>					✓
<i>Political support</i>					✓

Source: Dent and Galloway-Goldberg, 1999: 25.

As can be seen in the Table 16, these basic reasons and the strategies to be applied to prevent them are seen in the situations that expert researchers in the field have identified in practice. When we look at the Table 16, misunderstanding, emotional side effects, distrust, personal conflicts, fear of being unemployed, concern about the disintegration of the working group and the existence of

uncertainties stand out as important factors among the reasons for resistance to change (Dent and Galloway-Goldberg, 1999: 28). The most common strategies that can be applied to prevent resistance to change are training support, encouraging action areas where employees will contribute to the change and encouraging participation, arranging the facility infrastructure in an acceptable manner for the elements subject to change, positive manipulation by prioritizing the positive effects of the change, conditional and Conducting encouraging negotiations and taking ethically and morally challenging measures to accept change when necessary are among the important strategies. In this sense, preventing people's fear of change will be effective in eliminating the problem to a large extent (Dubrin and Ireland, 1993). In order to successfully implement the mentioned strategies and prevent resistance to change, the benefits of changes made in business processes for employees should be highlighted (Lazzarotti and Manzini, 2009: 622-623). Preventing or reducing resistance to change will support the encouraging efforts required to adopt the activities subject to change, and the rate of innovation adoption and diffusion will increase (Rogers, 1962: 286). The delay or failure of change and innovation activities, which will provide serious benefits to organizations, due to employee resistance may prevent the realization of visionary changes and cause situations that may lead organizations that want to be early adapters or early majority to failure (Rogers, 1962: 353; Robinson, 2009: 5).

2.2.6. Innovation Assessment

Assessing innovation is not an easy task. A number of innovation indicators are recognized in the literature. Many of these are technology-based indicators that perform well in high-tech industries, but may be ineffective in other industries where patenting is uncommon or where R&D budgets are low or not formalized. Therefore, there are a wide variety of factors that affect the evaluation of innovations and their innovation capabilities. A consistent theme in the academic literature on innovation management revolves around the examination of business innovativeness using perceptual evaluations (Alegre and Pasamar, 2018: 421-422). Considerable emphasis has been placed on the examination of the product and service portfolio within the

literature, particularly with regards to its novelty in relation to the firm (new to firm), its novelty in relation to the market (new to market) and its novelty in relation to the industry (new to the industry) (OECD/Eurostat, 2005: 9-16; Alegre and Lapiedra, 2009: 536).

Table 17: Factors Affecting Innovation Capabilities

Factors	Authors
Technological capabilities	Bowonder et al. (2010); Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Jaruzelski et al. (2014); Gaubinger et al. (2015); van de Poel et al. (2017); van Tonder et al. (2020); Wolf et al. (2021)
Technical capabilities	Gaubinger et al. (2015); Pisano, (2019); Wolf et al. (2021)
Competition and cooperation capabilities	Bowonder et al. (2010); Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Lertxundi et al. (2019); Wolf et al. (2021)
Leveraging new business models	Gao et al. (2017); Chen et al. (2018a); Jia (2019); Pisano, (2019); van Tonder (2020); Müller et al. (2021)
Networking	Mohanbir et al. (2006); van Tonder et al. (2020)
Imitation existence	Wanasika and Conner (2011); Müller et al. (2021)
R&D investment	Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Gaubinger et al. (2015); van de Poel et al. (2017); Wolf et al. (2021)
Innovation leadership	Bowonder et al. (2010); Carmeli et al. (2010); Adjei (2013); Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Gaubinger et al. (2015); van de Poel et al. (2017); Lertxundi et al. (2019)
Talented employees	Braga, A and Braga, V (2013); Briganti and Samson (2019); Lertxundi et al. (2019); van Tonder et al. (2020)
Best practices tracking	Leavengood and Anderson (2011)
Company culture	Bowonder et al. (2010); Naranjo-Valencia et al. (2011); Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Jaruzelski et al. (2014); Ikeda and Marshall (2016); Chen et al. (2018a); Briganti and Samson (2019); Lertxundi et al. (2019); van Tonder et al. (2020)
Customer needs determination	Mohanbir et al. (2006); Bowonder et al. (2010); Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Jaruzelski et al. (2014); Gaubinger et al. (2015); Kaliappen, and Hilman (2017); Lertxundi et al. (2019); van Tonder et al. (2020); Geng et al. (2021)
Incremental improvements	Jaruzelski et al. (2014); Gao et al. (2017); Chen et al. (2018a); Jia (2019); Müller et al. (2021)
Risk acceptance level	Dodgson et al. (2008); Bowonder et al. (2010); Sniukas (2010); Braga, A and Braga, V (2013); Varadarajan (2018)
Cost Leadership	Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Kaliappen, and Hilman (2017)
Product and Service differentiation	Kaliappen, and Hilman (2017)
Market timing	Bowonder et al. (2010); Bayarçelik et al. (2014); Gaubinger et al. (2015); Wolf et al. (2021)
Agility	Bowonder et al. (2010); Varadarajan (2018); van Tonder (2020)
Platform strategy acceptance	Mohanbir et al. (2006); Bowonder et al. (2010);
Clear communication channel	Varadarajan (2018); Lertxundi et al. (2019)
Open innovation existence	Bowonder et al. (2010); Ikeda and Marshall (2016); Bogers et al. (2019); van Tonder et al. (2020); Wolf et al. (2021)
Flexible organizational structure	Katz et al. (2010); Braga, A and Braga, V (2013); Ikeda and Marshall (2016); Varadarajan (2018); Briganti and Samson (2019); van Tonder et al. (2020)
Return on investment	Braga, A and Braga, V (2013); Bayarçelik et al. (2014); Jia (2019)

Source: Compiled by Author.

In fact, the concept of being new to an institution, or being new to the sector was also expressed before by Myers and Marquis (1969: 30), and it is important in terms of determining the degree of innovation in the assessment of innovation (Myers and Marquis, 1969: 30).

2.2.7. Role Classification in Innovation Ecosystems

Role theory, emerging from a theatrical metaphor, is the definition of role concept as a “scenario” in which the actor or “expectations of behavior understood and adhered to by all are part of a social system or identity recognized by others in that system” (Biddle, 1986: 68). In summary, the interaction of roles in innovation ecosystems is revealed by defining a characteristic set of behaviors or activities undertaken by the actors in the innovation ecosystem with the concept of “role”. However, innovation roles are shaped as formal and informal roles (Lee and Law, 2016: 167; Dedehayir et al., 2018: 18). Formal roles are effective in contributing to the innovation capabilities of companies in terms of maintaining “institutional quality” and informal roles in terms of benefiting from social capital. In addition, Lee and Law (2016: 167), in their study on innovation success and roles in the innovation ecosystem, while informal roles (social capital) alone contribute 10% to the success of innovation activities; they have found that formal roles (institutional quality) contribute 50%. However, it has been revealed that the construction of formal and informal roles in harmony is much more effective on innovation success. Dedehayir et al. (2018: 22), in their study on the roles of actors and their actions in the innovation ecosystem, has thematically revealed key roles under four groups. These are identified as leadership roles, direct value creation roles, value creation support roles and entrepreneurial ecosystem roles. The examination conducted by Markham et al. (2010: 402) have focused on three informal roles that are important in the innovation process. These roles include champions, sponsors, and gatekeepers. Champions possess the ability to discern and recognize novel concepts that hold the potential to evolve into future marketable items. In order to catalyze this process, Champions ultimately engage in internal marketing by strategically presenting the

concept to garner approval from other members within the organization (Howell and Higgins, 1990: 41-49).

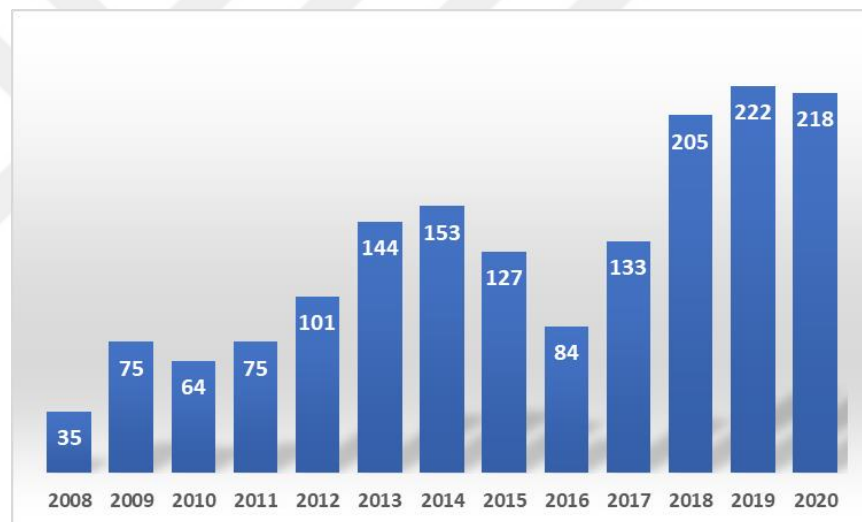
2.2.8. Innovations in Maritime Industry in Terms of Seaports

As in other areas of business research, innovation is recognized as a crucial factor in maintaining competitiveness in the maritime business research. In this sense, in the field of maritime logistics chains, the importance of innovation is increasingly recognized as a crucial factor in achieving success (Acciaro and Sys, 2020: 1045). For example, one of the most influential innovations to achieve sustainable competitive advantage in the maritime industry, with the invention and use of the container by Mclean in 1958, the innovation not only marked the era of containerization for freight management and freight transport, but also one of the critical drivers in the surge towards global integration have retained its position. Mclean took the innovation he made in 1958 under patent protection with Patent US2853968A, under the title “Apparatus for shipping freight”, and broke new ground by introducing a uniform cargo container for the entire transportation industry, especially for Maritime. Also, the radical innovation of the standard shipping container has had a profound impact on global commerce, leading to significant transformative effects in the transportation industry. Additionally, numerous incremental innovations have been implemented to facilitate this process of change. (Levinson, 2006: 128). The containerized transport segments of liner shipping and terminal operations have seen an increased utilization of technological capabilities. This has been facilitated by the application of superior knowledge and skills in order to develop more efficient methods of conducting business. Additionally, there has been a growing demand for carriage and handling services, which has contributed to the concentration of incumbent players in both markets (Luo et al., 2014: 171-172; Notteboom and Rodrigue, 2012: 277). As the potential cost reducing in maritime transport as well as port dimension become increasingly limited, coupled with the intensification of worldwide competition, there is a mounting imperative to enhance resource efficiency through the adoption of fresh ideas (Rodrigue, 2010: 3-5).

After mentioning the possible effects of innovation management in the field of maritime and port management, if the situation of the subject in the academic field is mentioned, the first innovation-based studies on maritime trade and ports in the academic field are Based on three studies by Jenssen and Randoy (2002), Jenssen(2003) and Jenssen and Randoy (2006). In their study, Jenssen and Randoy (2002: 119), conducted research on 63 companies headquartered in Norway to identify the factors that encourage innovation in shipping companies. This study, which focuses on service/product innovations, market innovations and production method innovations in maritime businesses, revealed that organizational and interorganizational variables are important for innovation. From the variables set forth in the study, it has been determined that differentiation strategies increase the formation and success of innovations in maritime companies. Jenssen (2003: 93) has conducted research on how the maritime industry can be innovative and concludes that maritime companies need to develop their skills and competences through stronger interaction between organizations within and outside the maritime cluster. Thus, by increasing their total capacity and innovation, it has been revealed that they will create distinctive competitive advantages that are difficult to imitate. Jenssen and Randoy (2006: 327) has conducted an exploratory study of how innovation contributes to company performance in Norwegian shipping and which organizational and interorganizational factors influence innovation in shipping companies. In the study, it has been aimed to determine how innovation contributes to firm performance through a survey conducted with 46 Norwegian shipping companies. In this sense, it has been found that a conscious strategy, strategy engagement, external relations, especially market relations and productivity abundance have a significant positive effect on the degree of innovation. The researchers furthermore has established that the outcomes are contingent upon the level of differentiation among firms and the nature of the innovation. However, in an academic structure where theoretical and empirical research on innovation in maritime and port studies is limited, a new literature flow has emerged that addresses this issue after the 2008 global economic crisis (Guellecand Wunsch-Vincenti, 2009: 5-8-9). The subject of patents, which is another determining factor of innovation activities, is an important issue in the field of maritime management, as in all other

sectors. In this sense, although patenting and intellectual property protection, another topic for innovation, is nothing new even in transport chains, a deep study of patents granted to maritime transport actors and their effects has not yet been done in the maritime and port literature (Styliadis, 2022: 197). However, Styliadis laid the groundwork for a discussion on the quantitative examination of innovation and patenting in containerized transport chains. In his doctoral thesis, Styliadis investigated the innovation level of firms in the maritime businesses and terminal operations markets, as well as the sectors and specific sectors in which these transport actors pursue new innovations according to their patent classifications has tried to identify areas (Styliadis, 2022: 205).

Figure 26: Number Patents Granted in Liner Shipping Companies



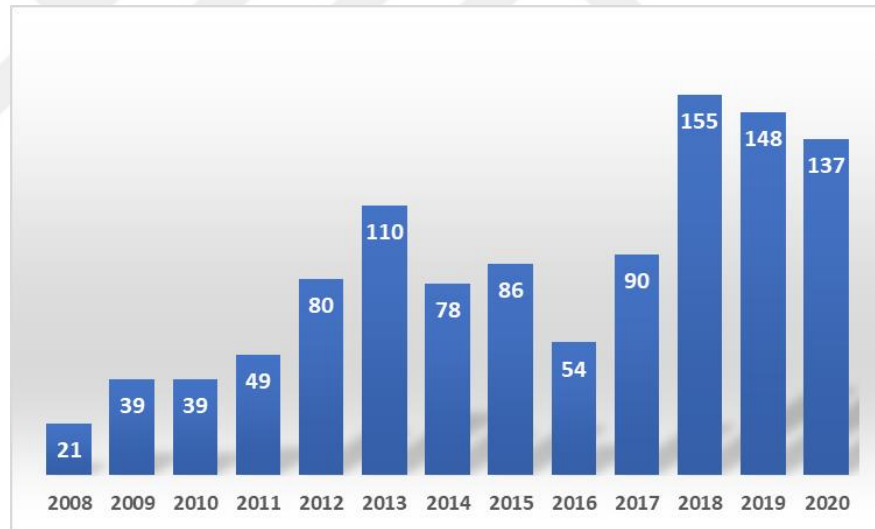
Source: Styliadis, (2022: 209) adapted from EPO (2021).

As seen on Figure 26, There has been a serious increase in the number of patents obtained by liner shipping companies after the 2008 crisis. This situation, Guellec and Wunsch, (2009: 5-8-9) has brought along a structure that would pave the way for maritime innovation studies, which were limited until 2008. While the number of patents granted in the field in 2008 was 35; In 2020, this number has reached 218.

In the case of line transportation companies, when looking at the total number of patents granted to each company annually, as well as the total number of patents

of all companies in a year, at the firm level, ONE forming the 'K' Line; Mitsui O.S.K. Lines and NYK Line stand out as the most innovative line transport company with a large number of annual publications (excluding 2008) and a total of 180 patents (32.7% of the sample) in the period 2008-2020. However, Maersk, Cosco and HMM are also quite innovative with 148 (26.9%), 112 (20.4%) and 108 (19.6%) patents, respectively. While differences are observed in annual patent output, the results show that each of these companies has relied heavily on and increasingly used the patent system, especially in recent years, to protect their intellectual property rights. In addition, when 5 companies named AP Moeller-Maersk, Cosco Shipping, HMM, ONE, CMA-CGM are taken into account on an annual basis, the average number of patents per company increased between 2008 and 2014; After falling by half in 2015, it broke the record set in 2014 by 2020 (Styliadis, 2022: 209-210).

Figure 27: Number Patents Granted in Terminal Operating Companies



Source: Styliadis, 2022: 211.

As seen on Figure 27, according to the data of EPO (2021), when the patents obtained by the port operators are examined, it is seen that there is an increase between the years 2008-2020, as in the liner companies; but the number of patents obtained by the terminal operators is about 66% of the one granted by liner shipping companies (Styliadis, 2022: 211).

As seen on Table 18, when we look at the classification of the patents taken by the terminal enterprises, it is seen that the first three areas with the most patents are Cargo Handling Equipment & Devices, Terminal Ancillary Equipment, and Information Exchange, Monitoring & Control Systems/Devices respectively. Following these three classifications, while Cargo Management Systems has a relatively high number of patents Terminal Design, and Container Design are relatively few patented areas. As can be seen, patent and intellectual property rights regarding innovation activities are also important and can make a difference in the field of maritime and port operations.

Table 18: Terminal Operating Companies' Patent Classification Number

<i>Patent Classification</i>	<i>Number</i>
<i>Cargo Handling Equipment & Devices</i>	380
<i>Terminal Ancillary Equipment</i>	239
<i>Information Exchange, Monitoring & Control Systems/Devices</i>	290
<i>Cargo Management Systems</i>	148
<i>Terminal Design</i>	23
<i>Container Design</i>	6

Source: Styliadis, 2022: 211.

In addition, according to WIPO (2021) data, when the total number of patents worldwide is considered, although there has been an increase every year since 1995; In 2002, 2009, and 2019, there was a relative decrease of 0.9%, 3.8% and 3%, respectively; This decrease in the terminal management sector was only 4.5% in 2019. However, the decrease in general patent purchases in 2009 showed its effect by staying constant rather than decreasing in terminal operations. However, the number of patents received by the line enterprises moved parallel to the increase and decrease in the number of general patents and simultaneously.

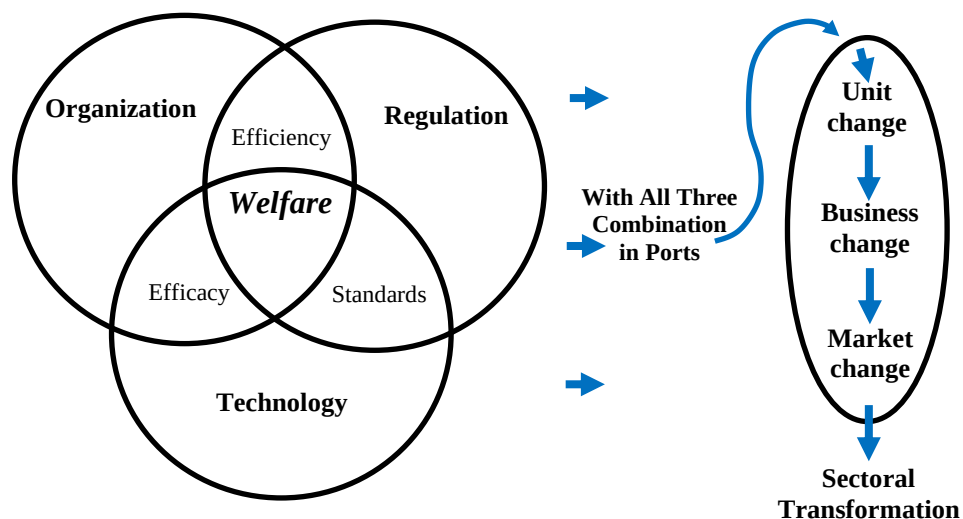
After addressing the development of the innovation and patent relationship in the maritime and port industry, again if we look at the evaluations of the effects of innovation in the academic environment, the maritime and port industry, throughout the past twenty years, the maritime and port sectors have frequently been perceived

as resistant to change and exhibiting a lower attitude towards innovation. The technology and operational methods that have been used so far are often described as outdated. Until recently, scholars in the academic literature have shown limited interest in examining how innovation is incorporated into the strategic processes of transport firms or in evaluating the innovation process itself. Furthermore, in the sector, there has been a lack of research on the factors that contribute to or hinder the successful adoption of innovative ideas (Acciaro and Sys, 2020: 1045; Arduino et al. 2013: 106). However, this situation, along with the pandemic, has brought the issue of barriers and durability to innovation in ports (Port Technology, 2020; UNCTAD, 2022: 4).

As in all other business management fields, innovations in the maritime and port industry are also examined in terms of their effects and usage areas. For example, In the multi-facet nature of innovation (Şen et al., 2018:1; Vanelslander et al. 2019: 5), Arduino et al. (2013: 98) have proposed the following classification, which is commonly observed in the broader field of transportation practice:

- Purely technology innovation,
- Managerial, organizational, and cultural innovation,
- Technology, managerial, organizational, cultural innovation,
- Public policy innovation (Vanelslander et al., 2019: 615).

Figure 28: Interrelation of the Major Types of Maritime Innovation and Sectoral Transformation



Source: Adapted by Author from Vanelslander et al. 2019: 616-620.

According to Figure 28, Vanelslander et al. (2019: 616) port industry innovations include Regulatory innovation encompasses various forms, such as institutional innovation, policy innovation, and related sorts of innovation. The other main categories of innovation are Organizational, which encompasses management systems and comparable sorts of innovation, and Technological, which encompasses product and process innovation. It is quite likely that technical advancements will necessitate or prompt innovation in several processes, including but not limited to management, operational, and cultural aspects.

In summary, Vanelslander et al. (2019: 616) argues that with the interaction of organization and technology, the borders between countries and regions are removed and cultural harmony is achieved and it creates a harmony effect. With the harmony of technology and regulations, for example, innovations that will create a suitable business environment that port workers will benefit from are paving the way in the context of social innovations. In addition, they stated that innovations that will create efficiency will be revealed through organizational and regulatory interaction. All this interaction will bring development by triggering the sectoral transformation after providing unit change, market change, and business change for the ports.

Table 19: The Most Common Innovation Trends in Seaports

<i>Innovation Trends in Ports</i>	<i>Percentage of Most Popular projects in Trends (implemented or planned)</i>
<i>Innovative business models in ports and terminals for global competitiveness</i>	65%
<i>Servitisation and the sharing economy</i>	65%
<i>Smart management - Smart Port</i>	65%
<i>Traceability of products and means of transport throughout the value chain</i>	64%
<i>Low-emission technologies</i>	63%
<i>Advanced production of goods and services</i>	62%
<i>Workplace innovation and the silver economy</i>	60%
<i>Smart objects</i>	59%
<i>Internet of Things (IoT)</i>	59%
<i>Economics of cooperation and designing for social innovation</i>	54%
<i>Space-enabled applications, space technology and services as well as big data</i>	51%
<i>Public-private partnerships (PPP)</i>	45%
<i>Advanced materials</i>	26%

Source: Szymanowska et al. 2023: 5.

As seen on Table 19, Szymanowska et al. (2023: 5) in their study on identifying port innovations on a global scale, Innovative business models in ports and terminals for global competitiveness; servitisation and the sharing economy; smart management - smart port. For each of these trends, it has been determined that 65% of the sector is implemented or planned.

Following these, tracking and tracing ability of products related to transportation are one of the popular trends with a rate of 64%. Low emission technologies, advanced product and service production, smart objects, IoT, collaboration and designs for social innovation, big data and space-supported technologies, public private partnerships and studies on advanced materials are other innovative trends of interest in ports.

2.3. SUSTAINABILITY-ORIENTED INNOVATION

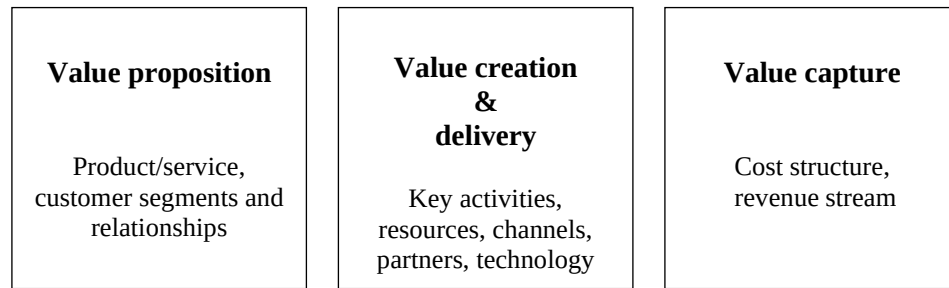
Within the current body of literature, there is a considerable amount of ambiguity surrounding the precise definition of sustainability and the methods by which it can be effectively attained. This lack of clarity is further compounded by the existence of numerous conceptualizations, such as circular, green, eco, environmental (Ulvenblad et al., 2019: 5). Consequently, the relationship between innovation and sustainability is an ever-changing phenomenon (Neutzling et al., 2018: 3448). With this ever-changing phenomenon, the successful implementation of innovation that incorporates sustainability necessitates a deliberate examination of the fundamental attributes that define sustainability (Wilkerson and Trellevik, 2021: 2). At this point, in innovations that include sustainability, sustainability and innovation are not considered separately; It has become an umbrella structure by being considered as a whole (Zvezdov and Schaltegger, 2013: 2363). This umbrella structure is sustainability-oriented innovation (Adams et al., 2012: 17-20-21; Zvezdov and Schaltegger, 2013: 2363; Adams et al., 2016: 185). Traditional innovations consist of technically improved products and services or completely new product and service, process, organizational and marketing innovations. However, while traditional innovations are crucial, they alone cannot solve overall sustainability challenges, especially increasing absolute resource consumption and

waste. Additionally, the problems arising from sustainability challenges are interrelated and need to be addressed holistically for solving these problems (Hansen and Große-Dunker, 2013: 2411). For this reason, it became necessary to focus on sustainability-oriented innovation (SOI), which is one of the two key points of this thesis study. The other key point is the role and management of stakeholders in sustainability, innovation and sustainability-oriented innovations. The concept of SOI and its relationship with the business model framework, the relational dimensions and levels of sustainability-oriented innovation, roles in SOI processes, categories and levels of innovation activities in SOIs have been emphasized.

The concept of sustainability-oriented innovation (SOI) offers a more precise and targeted approach than traditional innovations for companies aiming to advance their sustainability efforts (Adams et al., 2016: 180). Based on this, to address the definition of sustainability-oriented innovation, It is expressed as “the deliberate management of economic, social and ecological aspects”. What is meant by this deliberate management is that sustainability-oriented innovations take into account economic and social efforts in environmental innovations, take into account environmental and social efforts in economic innovations, and take environmental and economic efforts into account together in social innovations (Klewitz and Hansen, 2014: 57).

Also, SOI's have common points related to business model innovations in terms of being precise and targeted too. These common points are that SOI's and business model innovations are similar in the importance of collaboration with key stakeholders and global pressures in value proposition, value creation and delivery (Bocken et al., 2014: 43). According to Figure 29, value creation is a fundamental aspect of business models, whereby businesses commonly acquire value through the identification and pursuit of novel business prospects, untapped markets, and additional sources of revenue. However, value capture refers to the strategic consideration of generating income by extracting value from the delivery of goods, services, or information to users and consumers (Teece, 2010: 172-174).

Figure 29: Conceptual Business Model Framework



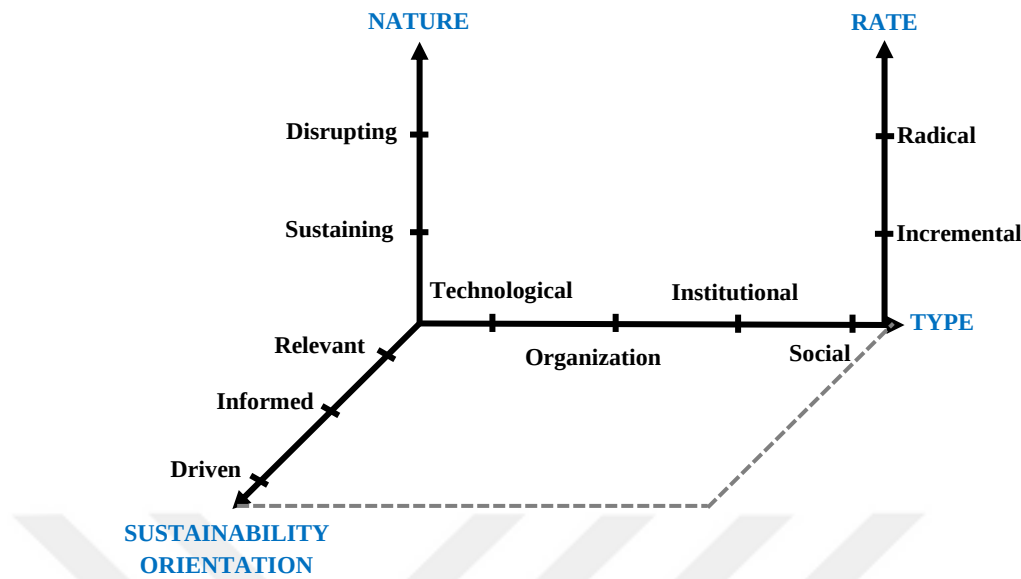
Source: Bocken et al., 2014: 43.

From this point of view, the business model in an enterprise based on sustainability-oriented innovations is also characterized by the provision of ecological and social value, rather than focusing only on the provision of products and services and economic returns. SOI based Business models also integrate new business opportunities and untapped markets with social and environmental efforts unlike traditional business models. Consequently, business models turn into sustainability-oriented business model innovations if they take into account economic, environmental and social goals for the common well-being of all stakeholders (Boons and Lüdeke-Freund, 2013: 9).

2.3.1. Concept of Sustainability-Oriented Innovation

The discussion about companies driving sustainability through innovation was initially focused on eco-innovations. Also, environmental challenges have been acknowledged as catalysts for strategic change and as motivators for the development of innovation initiatives. Eco-innovations encompass novel or enhanced processes, organizational structures, and goods or technology that yield environmental benefits by mitigating or averting adverse ecological consequences (Klewitz and Hansen 2014: 58). Jay and Gerard (2015: 16) evaluated sustainability-oriented innovation through four different dimensions. They identified these as the relational dimensions, nature, type and rate of sustainability-oriented innovations.

Figure 30: Sustainability Oriented Innovation Dimensions



Source: Jay and Gerard, 2015: 16.

After sustainability-oriented innovation manifests itself with eco-innovation, sustainability orientation dimensions occurred themselves in different ways with the levels, types, nature and ratio of orientation dimensions (Jay and Gerard, 2015: 6).

2.3.2. Relational Dimensions of Sustainability-Oriented Innovation

The dimensions encompassing sustainability-oriented innovation can be categorized as Sustainability-Relevant Innovation (SRI) (Wagner and Llerena, 2008; Jay and Gerard, 2015: 17), Sustainability-Informed Innovation (SII) (Jay and Gerard, 2015: 17), and Sustainability-Driven Innovation (SDI) (Little, 2005; Jay and Gerard, 2015: 17). However, the best structure regarding the dimensions and classification of sustainability-oriented innovation is provided by Jay and Gerard, (2015: 16) as seen on Figure 30.

Sustainability-relevant innovation (SRI): According to Kemp and Foxon (2007: 4), sustainability related innovations (SRI) are defined as “environmentally beneficial normal innovations”. In summary, they are innovations where Sustainability is a “gratis side effect”. One example instance of such innovation is the Uber on-demand automobile service. One potential positive impact of Uber on

sustainability is the potential reduction in consumer vehicle ownership due to the improved quality and reliability of transportation services. Nevertheless, it is evident that sustainability does not constitute the fundamental principle of the company's business model. As a result, the invention may potentially have unintended consequences on the environment (Jay and Gerard, 2015: 17).

Table 20: Comparison Table of Sustainability-Oriented Innovation' Dimensions

<i>Sustainability-Relevant Innovation (SRI)</i>	<i>Sustainability-Informed Innovation (SII)</i>	<i>Sustainability-Driven Innovation (SDI)</i>
The most broadly applicable form of SOI; but, the least discussed.	The most common form of SOI.	The most specific form of SOI for aiming to solve a public problem.
SRI can also act as a facilitator for SII and SDI projects.	A well-defined customer need can be met by sustainability considerations.	All sustainability dimensions improve together.
SRI It facilitates the spread of SOIs' across industries.	Innovation processes that do not take sustainability issues as a primary goal.	Innovation occurs first and foremost to solve a societal and/or environmental problem.
Sustainability occurs as a positive side effect.	Sustainability is one of the inputs.	Sustainability is the core purpose.
Discovering and leveraging hidden sustainability benefits.	Consumption channels and shifts in industry impact.	Sustainability tends to push the envelope and be very specific in focus.

Source: Compiled by Author from Hansen et al., 2009a; Jay and Gerard, 2015: 17; Jay et al. 2015; Jay, 2015.

Sustainability-informed innovation (SII):The concept of sustainability-informed innovation (SII) is being defined in accordance with the description provided by Blowfield et al.(2007: 1), SII refers to “innovation processes, which do not have sustainability issues as their primary target, but which try to adhere to sustainability targets during their development, production and use”. For example, the Patagonia sportswear firm aimed to improve the social and environmental profiles of its new and existing products by evaluating the innovation process, this approach is also a way for the company to differentiate itself and enter new customer segments and markets (Hansen et al., 2009a). For this reason, this type of innovations are classified as sustainability-informed innovation (SII) (Jay and Gerard, (2015: 18).

Sustainability-driven innovation (SDI): Sustainability-driven innovation (SDI) refers to a form of innovation that is explicitly oriented towards achieving sustainability objectives. The primary objective of the innovative entity is to contribute to economic opportunities in the field of innovation. Economic sustainability is a key aspect that is included into the sustainable development agenda. However, it is important to note that the main purpose of innovation in this context is to address social and/or environmental challenges (Jay and Gerard, (2015: 18). One illustration sustainability-driven innovation can be observed in the case of Sanergy, a company that endeavors to develop a sustainable sanitation system inside the urban slums of Kenya. Sanergy engages in the development and construction of affordable toilet units, which are subsequently distributed to indigenous entrepreneurs who serve as franchise partners. Franchisees are responsible for the maintenance of the unit and generate revenue through the implementation of fees for toilet usage. Sanergy engages in the daily collection and transportation of garbage to a centralized facility, where it undergoes a process of conversion into both energy and organic fertilizer. Subsequently, Sanergy engages in the sale of the fertilizer to local farms in Kenya, offering a significantly more affordable option in comparison to existing petrochemical-based alternatives (BFI, 2014).

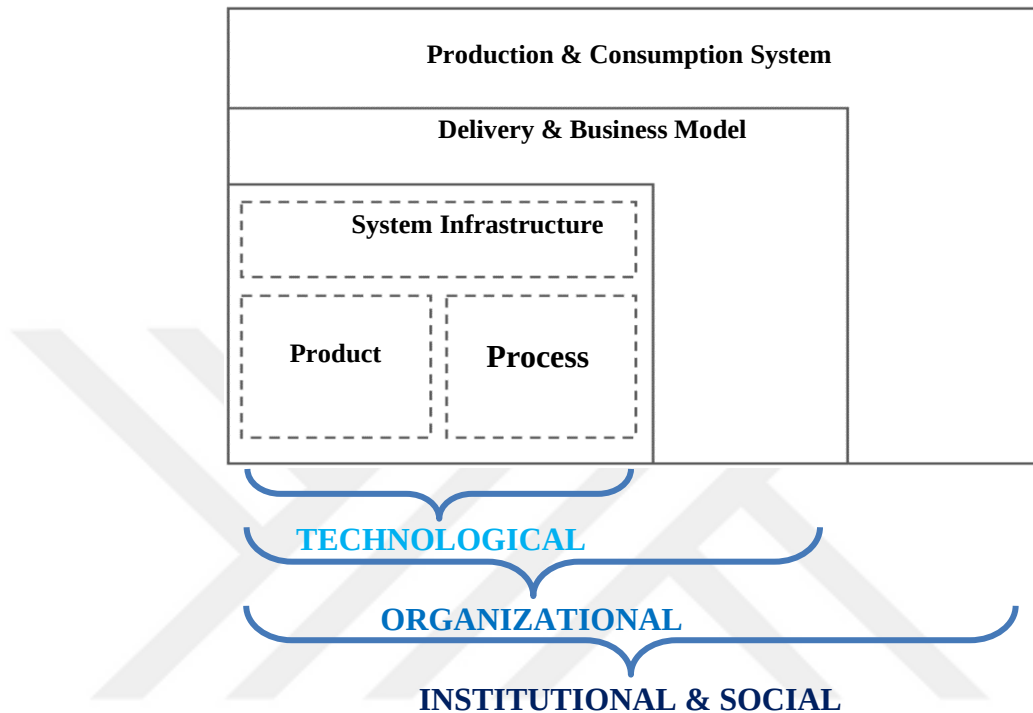
2.3.3. Level of Sustainability-Oriented Innovation Types

Technological innovation, from Ashford and Hall (2011)'s point of view, is in fact only one of four types of innovation to be considered. Jay and Gerard (2015: 19) provide a brief overview of these four main types of innovation (technological, organizational, corporate and social) and specifically considers how each type of innovation can be adapted to sustainability, and considers these innovation types as levels of sustainability-focused innovation as seen on Figure 31.

Technological level in sustainability-oriented innovation -Technology, which is the driving force and the most basic element in innovations (Adams et al., 2016: 182), is not only an innovation (technological innovation), but also a level of sustainability-oriented innovations. Innovations related to products and services,

process and system infrastructure are handled at this level in their most basic form (Jay and Gerard, 2015: 19).

Figure 31: Levels of Sustainability-Oriented Innovation Types



Source: Jay and Gerard, 2015: 19.

As seen in Figure 31, sustainability-oriented innovations consist of technological, organizational, institutional and social levels. SOIs at the technological level occur in products, processes and system infrastructures. SOIs at the organizational level also include business models. SOIs at the Institutional and Social levels include those in production and consumption systems, also (Jay and Gerard, 2015: 19). Additionally, when SOI levels are matched with SOI dimensions (Jay et al., 2015):

- Innovations at the technological level are in the dimensions of sustainability-relevant innovation and sustainability-informed innovation.
- Innovations at the organizational level are in the dimensions of sustainability-relevant innovation, sustainability-informed innovation and sustainability-driven innovation.

- Innovations at the institutional level are in the dimensions of sustainability-relevant innovation and sustainability-driven innovation.

- Innovations at the social level are sustainability-driven innovations.

Organizational level in sustainability-oriented innovation-When examining the concept of organizational innovation, which can serve as a supplement to technological innovation and can also be assessed independently, Ashford (2011) provides a categorization of organizational innovation levels as encompassing “R&D, product development, marketing, environmental and government affairs, industrial relations, occupational health and safety, and customer and community relations”. The present study examines the modifications that occur within different organizational dimensions of a company's operations. The Zipcar car sharing model for “sustainable mobility” is an example of innovation at the organizational level. Zipcar's success is based on existing structures and technologies, as well as a business model innovation that consists of expanding car “*pickup*” points throughout the city with convenient “on the go”, “hourly” rental options as well as a product innovation (Jay and Gerard, 2015: 22).

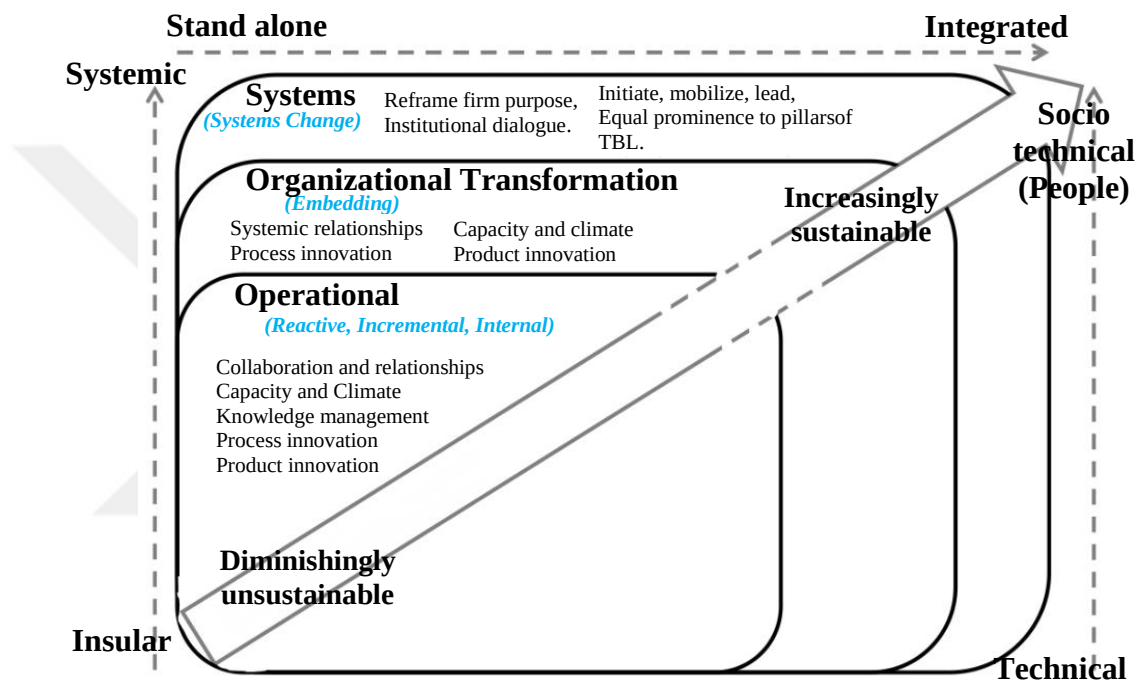
Institutional And social level in sustainability-oriented innovation - Ashford and Hall (2011) define institutional innovation level as “the corresponding concept to organizational innovation level inside government organizations”. Additionally, social innovation level refers to “alterations in the preferences of consumers, citizens, and workers, as well as modifications in the procedures through which these preferences are influenced”. As seen in the figure, in the sustainability-oriented innovation, the institutional level and the social level are handled one after the other and intertwined. According to Jay and Gerard (2015: 23), while the institutional level SOIs reveal innovations related to social preferences in sustainability-oriented innovations, they direct the social level SOIs.

2.3.4. Categories and Levels of Innovation Activity in the SOI

The concept of sustainability-oriented innovation has also been studied by Adams in the literature, and he is one of the first researchers to consider the concept as “sustainability-oriented innovation” as seen on Adams et al. (2012), Hansen et al.

(2012), Klewitz and Hansen (2014), Jay and Gerard (2015), Adams et al. (2016), Neutzling et al. (2018). However, unlike other researchers, Adams et al. (2012; 2016) in their studies discussed sustainability-oriented innovation as multidimensional in terms of its nature, impact, outputs and the role of innovation in relations between competitors and collaborators (in the context of stakeholder perspective).

Figure 32: Categories of Innovation Activity in the Three Contexts of Sustainability-Oriented Innovation



Source: Adapted from Adams et al. 2012: 17-21 and Adams et al. 2016: 185.

Essentially, the difference from the SOI model made by Jay and Gerard (2015: 16), Adams et al. (2012; 2016) discussed the SOI model in terms of the creation of developing capabilities. According to the view, which argues that innovations related to sustainability activities will gradually cease to be sustainable if they remain only at the operational level, climate issues arising from capacity-based activities will turn into a reporting system by going beyond just being monitored, as collaborative relations become systematic (De et al., 2020: 420). In addition, innovation activities will go beyond targeting impact and consumption reduction and transform into a measurable innovation access platform where disruptive innovations can be realized. However, if innovation activities reach the level of system building,

they will create a network of values and create institutional dialogue areas that will change the rules of the game in the business environment and in the sector. Thus, the effects of sustainability will be increased with an innovation ecosystem in which all dimensions of sustainability will be applied equally (Adams et al., 2012: 20-21). However, SOI risks introducing products and services that are much more expensive than those of competitors compared to conventional innovation. This brings market risk: non-appropriability of the returns on investment in innovation (Andreas et al., 2009: 29). Also, the uncertainty (De et al., 2020: 420) in the environmental and social impacts of SOI poses directional risk: externalized environmental costs (Andreas et al., 2009: 29) in innovation (Hansen and Klewitz, 2012: 255).

2.3.5. Roles in the SOI Process

It is recognized that the SOI process, unlike the conventional innovation process designed in linear terms, is constantly evolving towards a systemic process consisting of dynamic interactions between users, producers, incumbents and startups each with competing considerations (Carrillo-Hermosilla et al., 2010: 1082). According to Jay and Gerard (2015: 16-42), the sustainability-oriented innovation process is in terms of actors are: “private-problem holders” including both “customers/users” who hold private needs, and “corporate problem holders” who hold strategic priorities; “public-problem holders” that are the main add-on actor to conventional forms of innovation; Innovation champions that are entrepreneurs and intrapreneurs. “Knowledge holders” that are Academic or research institutions, “infrastructure holders” (Enablers) that are government entity, corporate entity, public policy maker, financiers, foundations and NGO’s. Another accepted classification of stakeholder roles in sustainability-oriented innovation is Goodman et al. (2017) was with the classification put forward. The analysis of Goodman et al. (2017: 731) have identified eight roles that stakeholders play in sustainability-oriented innovation processes. These roles were identified as “stimulator, initiator, broker/mediator, concept refiner, legitimator, educator, context enabler and impact extender”. While more traditional roles such as legitimator and educator are less

common in related study; Emerging roles such as stimulator, concept refiner, context enabler and impact extender were also identified and highlighted as being particularly valuable for sustainability-oriented innovation. If the innovation process is evaluated in terms of innovation stages as well as roles, Hoyer et al. (2010) discussed the innovation process in four stages as ideation, development, commercialization and post-launch. Although these processes seem to be linear conceptually (Goodman et al. 2017: 734); they are handled within the non-linear nature of sustainability-oriented innovation process (Carrillo-Hermosilla et al. 2010: 1082), which is shaped differently from conventional innovations (Goodman et al. 2017: 734). It has been mentioned that stakeholders have roles in SOI processes, as in traditional sustainability and innovation activities, since SOIs are linked to stakeholder theory, just like traditional innovation and sustainability processes, in terms of revealing the dynamic capabilities of organizations (Teece, 2007: 1319-1342; Adams et al., 2016: 194; Inigo and Albareda, 2019: 334-348-349; Klewitz and Hansen, 2014: 57-70-71; Gonera et al., 2022: 10). In regard of this, in the model proposed by Gonera et al. (2022: 10), the “sensing dimension” of dynamic capabilities (Teece 2007: 1319; Murphy and Wilson, 2022: 211) aligns with the “operational optimization level” of the SOI model (Adams et al., 2016: 185-194) and is also associated with the “adaptive dimension” of SOI-integrated dynamic capabilities (Klewitz and Hansen, 2014: 57). Similarly, the seizing dimension of Dynamic capabilities (Teece 2007: 1319; Murphy and Wilson, 2022: 211) corresponds to the “organizational transformation level” of the SOI model (Adams et al., 2016: 185-194), and is conjugated with the “expanding dimension” of SOI-integrated dynamic capabilities (Klewitz and Hansen, 2014: 57). Lastly, the “reconfiguring dimension” or other mean of “transforming” according to Murphy and Wilson (2022: 211) of Dynamic capabilities (Teece, 2007: 1319) corresponds to the “system building level” of SOI model (Adams et al., 2016: 185-194), and is also linked to the “transforming dimension” of SOI-integrated dynamic capabilities (Klewitz and Hansen, 2014: 57). In summary, all these interaction levels in SOIs are effective in stakeholders benefiting from dynamic capabilities and in the development of SOIs (Teece, 2007: 1319-1342; Adams et al., 2016: 194; Inigo and

Albareda, 2019: 334-349; Klewitz and Hansen, 2014: 57-71; Gonera et al., 2022: 10).



CHAPTER THREE

AN ANALYSIS OF THE ROLE OF INNOVATION AND SUSTAINABILITY IN TERMS OF SUSTAINABILITY ORIENTED INNOVATIONS IN PORT LOGISTICS

3.1. MOTIVATION

Under this title, the relationship of sustainability, innovation and stakeholder concepts in the context of sustainability-oriented innovation is discussed as the research motivation for the thesis study. In this sense, first of all, the transformation of sustainability into sustainability-oriented innovation and the role of stakeholders in SOIs (Hansen et al., 2009b: 702; Amini and Bienstock, 2014: 12; Adams et al., 2016: 185), have been discussed as the motivation of the study. Then, the role of stakeholders in the context of sustainability-oriented innovations in port management (De Langen, 2006: 460; Panayides and Song, 2008: 563; Denktas-Sakar and Karatas-Cetin, 2012: 301-308; Hall et al., 2013: 87; Büyüksaatçi-Kiriş and Yılmaz-Börekçi, 2018: 209; Dooms, 2019: 66; Eskafi et al., 2019: 229) has been evaluated in terms of the motivation of the research.

3.1.1. Sustainability, Innovation and Stakeholder Context Related to SOI

Sustainability is a growing driver of business change and future perspectives. For this purpose, there is a need for being future directed. So, it is clear that sustainability issues will require massive change in products, services, processes, marketing, economy, management and other many areas and approaches, the underlying business models which frame them (Seebode et al., 2012). The last assumption is towards the year of 2020, the system of innovations move towards sustainability issues rather than singular issues and this movement is called the 6th wave of innovation (Moody and Nogrady, 2010; Desha and Hargroves, 2011; Seebode et al., 2012; Nair and Paulose, 2014; Silva and Di Serio, 2016). Together with all these elements, it is seen that sustainability is an issue that should be handled together with innovation. Numerous studies have shown that innovation makes

serious contributions to institutional success (Totterdell et al., 2002; Radnor and Noke, 2006). In addition, innovations have a very important place in terms of providing and protecting gains in the economic, environmental and social dimensions of sustainability (Hansen et al., 2009b: 686). In this sense, the creation of a potential synergy between innovation and sustainability will bring sustainability-oriented innovations with it (Amini and Bienstock, 2014: 12). In fact, Hansen et al. (2009b: 687), have come up with an idea they call sustainability-oriented innovation, which they describe as “innovation that has an overall positive net effect on an organization’s capital stock”. In addition, sustainability-oriented innovation covers aspects such as the physical product lifecycle and the involvement of various stakeholders (e.g. suppliers and customers) in the innovation process in terms of affecting the organization's capital stock. Thus, an organization undertaking sustainability-oriented innovation will involve not only multiple units within its own organization but also its suppliers, customers, regulation authorities. In addition, sustainability-oriented innovation efforts will consider the entire physical product lifecycle, not only the procurement of production and service inputs, but also the processes of design, manufacture, packaging, distribution, use, maintenance, reuse, recycling and disposal. Highly complex organizations tend to involve multiple stakeholders, such as the supply network, in their sustainability and innovation efforts. These organizations take a zero-waste approach to sustainability, engaging in genuine sustainability-oriented innovation involving multiple stakeholders (Amini and Bienstock, 2014: 16-17). Hansen et al. (2009b: 702) has suggested some practical implications for managing sustainability innovations. These implications appear as determining sustainability criteria, making appropriate product-service developments for sustainability innovations, integrating stakeholders into the process, raising awareness for sustainability, and promoting sustainability activities. The most important of these implications are integrating stakeholders into the process, making appropriate product-service expansions, and raising the sustainability awareness. Also, according to Hansen et al. (2009b: 703), handling these implications in a coordinated routine will be effective in turning sustainability innovations into sustainability-oriented innovations. From these implications, the integration of stakeholders emerge as a very important element as it will help to

increase the sustainability potentials of the activities for the changing expectations of important stakeholder groups. The sustainability-oriented innovation activities required by the legislation and regulative systems may not provide added value, but the establishment of a relationship with the key stakeholders of the business can positively affect the SOI of that business (Ayuso et al., 2011). Sustainability-oriented innovations are not linear; they require a systemic perspective. Sustainability-oriented innovations are not only driven by “technology-push R&D activities of public or private entrepreneurs”; it should be carried out as a whole with the demand-pull activities of the market and the “regulatory-push activities of governments or other stakeholders” such as non-governmental organizations (Jay and Gerard, 2015: 27). In this context, Christensen (1997) and Ashford (2011) identified four networks that include different intra-organizational departments, supply chains, competitors and regulators as potential sources of corporate innovation.

3.1.2. Maritime Transportation, Port Management and SOI Context

After explaining the connection of sustainability, innovation and stakeholder concepts with sustainability-oriented innovation. The connection of maritime transport and port management with these concepts have been also mentioned in relation to SOI. Based on this, first of all, when the sustainability of transportation is expressed, sustainable transportation is the provision of passengers and cargo throughout one or more transportation networks in a safe and secure way, accessible and uninterrupted, without creating a burden on the environment, societies and economies, or in a way that minimizes the harm by eliminating this burden (Chenget al., 2015). The growth of maritime transport has continued uninterrupted for centuries. After the emergence of safer navigation applications, maritime transport has become more efficient and widespread for governments and commercial organizations, with improved technology and reduced operating costs. However, constraints of resources, environmental degradation, climate change, depletion of raw materials, increased energy consumption, air pollution, waste disposal, increased unemployment, social and economic inequalities are common problems in many countries (Rockström et al., 2009: 473). Therefore, the low freight rates and handling

fees experienced in the maritime transport sector were also insufficient for effective and efficient operations after a certain point. With the rapid development of economic activities and unlimited waste of natural resources (Shan Lu et al., 2016b: 924), this certain point turns the world to an environment where is facing serious economic, social and environmental deterioration. These three deteriorations lead us to the importance of the concept of continuity. Continuity depends on the balance in sustainability. In the context of continuity, sustainability requires the simultaneous balancing of economic, environmental and social dimensions in policy, decisions and the overall management of any organizational function (Cheng et al., 2015: 1).

In the context of maritime sector, sustainable shipping is regarded as one of the greatest challenges of the 21st century (Lirn et al., 2013: 445). This situation is reflected in increasing international regulations such as the Energy Efficiency Design Index, the Ship Energy Efficiency Management Plan and the Ballast Water Management System to reduce greenhouse gas emissions or reduce the impact of invasive marine biological species from shipments (Albert et al., 2013: 298; Tzannatos and Stournaras, 2015: 315). In addition, self-regulating or market-oriented initiatives, technologies or measures, such as ISO 14000, ISO 26000, slow steaming, renewable fuel alternatives, have been adopted by the shipping companies reduced operating cost to lower levels and differentiated their services and business models in the context of continuity and sustainability (Ballini and Bozzo, 2015: 96; Maloni et al., 2013: 168; Moon and Woo, 2014: 447).

Another important aspect of sustainability in maritime transport is considered in terms of ports and port management. When sustainability activities are examined in terms of ports, studies on pollution and energy efficiency for the protection of the ecosystem, sustainability policies, green port, environmental, social and economic impact studies, policy and regulation, environmental, social and economic evaluation, sustainability indices and benchmarking consist of studies on models (e.g. Wooldredge et al., 1999; Gupta et al., 2005; Peris-Mora et al., 2005; Hakam and Solvang, 2009; Saengsupavanich et al., 2009; Ng and Song, 2010; ESPO, 2012a; 2012b; Lirn et al., 2013; Chiu et al., 2013; Acciaro et al., 2014a; Bergmans et al., 2014; Puig et al., 2014; Anne et al., 2015; Asgari et al., 2015; Shiau and Chuang, 2013; Hakam, 2015; Puig et al., 2015a; Puig et al., 2015b; Hou and Gerlings, 2016;

Shan Lu et al., 2016c; Roh et al., 2016; Santos et al., 2016; Laxe et al., 2017; Puig et al., 2017; Carpenter et al., 2018; Tseng and Pilcher, 2019; Moeis et al., 2020; Hossain et al., 2021; Caliskan, 2022; Santos et al., 2022; Spinelli and Benevolo, 2023; Okşas, 2023; Valenza and Damiano, 2023).

As can be seen in the sustainability-based studies on port and terminal management, the regulatory nature of maritime transport also manifests itself in sustainability-based activities in port and terminal management (e.g. ENTEC, 2010; IMO, 2015; GLEC, 2019; Joung et al., 2020; IMO, 2021). However, the sustainable port theme is the biggest challenge of the world's ports (Peris-Mora et al., 2005: 1659; Muangpan and Suthiwartnarueput, 2019: 13). Port operators apply various green and sustainable practices aimed at reducing the environmental and social impacts of shipping and port activities (Hou and Gerlings, 2016: 449; Roh et al., 2016: 107). The concept of sustainability has gained momentum in the field with the developments in maritime transport and port management (Lam and Notteboom, 2012: 1). Sustainable port management in port management is a concept realized with a triple bottom line approach that includes economic, environmental and social dimensions (Muangpan and Suthiwartnarueput, 2019: 2). The sustainable port concept is used in business strategy with a triple bottom line approach and takes into account the interrelationship of these three pillars. The purpose of this triple structure is to meet stakeholder needs while advocating the sustainability of social and natural resources (Denktas-Sakar and Karatas-Cetin, 2012: 301). Ports are important organizations in terms of stakeholder management as they are a channel member between different transport operators and end customers and are associated with many stakeholders (Panayides and Song, 2008: 563; Denktas-Sakar and Karatas-Cetin, 2012: 301). In port management, stakeholder interests are an issue that needs attention from both economic, environmental and social perspectives, and it is an issue that needs to be emphasized in terms of operational and sustainability activities (De Langen, 2006: 460; Denktas-Sakar and Karatas-Cetin, 2012: 308; Büyüksaatçi-Kiriş and Yılmaz-Börekçi, 2018: 209; Dooms, 2019: 66; Eskafi et al., 2019: 229-232-233-234). There are basically five issues that need to be intertwined with and taken into account with stakeholders in port management. These issues appear as the interaction between environmental protection-port development, residential

protection-port development, labor conditions-port development, residents' quality of life-port development, and general economic development-port development. These five basic issues can also be the subject of conflict between the stakeholders and the port. In addition, these issues include conflicts or situations that need improvement regarding environmental, economic and social dimensions. For this reason, stakeholder management has an important place in sustainability activities in port management (DeLangen, 2006: 461). There is a growing interest in ports and port activities in response to the fluctuating demands of the market for efficiency and cost-effective services in contemporary supply chains (Haezendonck and Notteboom, 2002; Bichou and Gray, 2004: 47). In order to meet this increasing demand for ports, economic improvement demands from customers, suppliers and competitors, environmental improvement demands from government agencies, environmental organizations and international associations, occupational health and safety solutions that will increase social welfare, and competent operational improvements, in other words, sustainability regulations are needed (Wang et al., 2017: 59). Innovation management is a necessary element to deliver sustainable port operations that are consistent with stakeholder interests regarding the triple bottom line approach (Song and Ravesteijn, 2015: 307-309-313). As a matter of fact, innovation activities in ports include new technologies and processes necessary for the handling and transportation of cargo, planning and the establishment of policy-making mechanisms, as well as the newness power required for financing, implementation, upgrade, management and operation of infrastructure systems. In summary, facilitating stakeholder collaboration through formal and informal institutional arrangements in the era of the global supply chain is an essential element in innovation management for the successful launch and implementation of sustainability activities in ports (Hall et al., 2013: 87). In addition, stakeholder management and innovation management are issues to be considered for sustainability activities of the ports (Dooms and Macharis, 2003: 7; Acciaro et al., 2014a: 482). In addition, in terms of port sustainability, the damage caused to the environment by the emissions of ships calling at ports during their hoteling and anchoring is much greater than the damage caused by the port and other stakeholders to the environment by emissions during port operation activities (Deniz et al., 2010:

226; Tokuslu, 2022: 17). This is another important sustainability problem that arises from stakeholder interactions during the conduct of operations in port management and should be examined in the context of sustainability and innovation.

As can be seen, sustainability activities are a set of processes that concern not only the port itself but also the port's stakeholders. In addition, the establishment of the sustainability of the port and the structure that will continue this can be achieved by innovation management. For this purpose, the main motivation of this doctoral thesis consists of examining the sustainability activities in port management with stakeholder management and innovation management. In the literature, it couldn't be come across the studies in which the subject of port management and port business is directly related to the concept of innovation focused on sustainability. This thesis deals with sustainability activities in relation to innovation management and stakeholder management in order to associate port management and port business activity with the concept of sustainability-oriented innovation (SOI).

3.2. PROBLEM DEFINITION AND RESEARCH GAPS

Human activities create pressures on the environment and cause changes in the state of the environment or in the quality and quantity of the resource used through emission generation and consumption (Singh et al., 2009: 189). The effects of these pressures on the environment have necessitated the creation of a comprehensive set of indicators and measurement for environmental targets (Spangenberg and Bonniot, 1998: 13; GRI, 2002: 9; Labuschagne et al., 2005: 375; Ness et al., 2007: 500). In addition, addressing environmental issues has brought with it the necessity of addressing regulatory measures across a wide range of sectors, including the transport and energy sector (Rogers et al., 2007: 88-96). However, the regulation needing is not limited to environmental issues; manifested itself in social issues (Lam and Yap, 2019: 2). As a matter of fact, sustainability has become a multidisciplinary issue with the need to examine the social, economic and ecological dimensions or variables of human activity, product or system as a whole (Salas-Zapata and Ortiz-Munos, 2019: 155). Scholars have utilized many theoretical frameworks to elucidate these dimensions.

The maritime and port management sector is a sector in which regional, cultural and ecosystem-specific differences come to the fore in terms of operational and management (Li and Yang, 2010: 175; Dinwoodie et al., 2012: 263; Lie, 2018: 55). In addition, the sustainability literature presents findings on how to effectively solve sustainability issues through innovation and especially through the open innovation ecosystem (Shaikh and Randhawa, 2022: 12). The literature shows that the port management sector offers a good research area for sustainability, innovation and stakeholder studies.

Research gap 1 - Rules introduced at the regulatory level have made practices related to sustainability efforts mandatory. With the increasing negative effects of global warming, the emission trading system has been on the agenda in the European Union since 2005. In 2020, the European green deal has been signed by the European Union due to the negative effects of greenhouse gas emissions. The European green deal requires the emissions trading system to be tightened and cover all sectors (TCTB, 2022: 11). With the green deal, a carbon border adjustment mechanism (CBAM) has been established. This mechanism will be implemented in two stages, the first of which is the transition period. The first phase has started on October 1, 2023. At this stage, greenhouse gas emissions embedded in the cargo and goods imported by the EU will be identified and reported. Phase 2 will start on January 1, 2026. From this stage, CBAM declarants must purchase certificates corresponding to the embedded emissions they have calculated. CBAM is initially valid for six sectors: cement, electricity, fertilizer, iron and steel, aluminum and fertilizer (EU, 2023). The European Commission has announced the “fit for 55” program with the decision taken on July 14, 2021. With this program, greenhouse gas emissions will be reduced by 55% compared to 1990 levels by 2030. If this program is not followed, taxation policies will be applied in a number of areas with which the European Union has commercial relations, including the transportation sector (EU, 2021). For this reason, the fact that emission measurement and SKDM are mandatory for sectors such as cement, iron-steel and aluminum and for the supply chains of these sectors is an important coercive force (Kang, 2021: 45). The supply chains of these sectors also include maritime transportation and port management. For this reason, emission measurements and SKDM compliance are important for the transition to a green port

(EU, 2023). Additionally, 35 studies addressing greenhouse gas emissions and decarbonization strategies in port areas and navigation areas within the borders of the Republic of Turkey have found in the literature. Of these, 29 studies have discussed the emission calculations of vessels in port and during cruising together with decarbonization strategies: Keskin and Vardar (2001: 1868), Deniz and Durmuşoğlu (2008: 259-260), Kılıç (2009: 129-132), Deniz et al. (2010: 223-224), Deniz and Kiliç (2010: 111-113), Kiliç and Deniz (2010: 229-230), Öztürk and Turan (2010: 1542), Saraçoğlu et al. (2010: 1), Peksen (2013: 75-92), Alver et al. (2018: 824-825), Yıldırım-Pekşen and Alkan (2018: 311), Yigit and Acarkan (2018: 127-130), Bayırhan et al. (2019: 240-241), Kılıç et al. (2020: 195-199), Kuzu et al. (2021: 299-302), Tokuşlu (2020a: 26-28), Tokuşlu (2020b: 214-215), Tokuşlu et al. (2020a: 149), Tokuşlu (2021: 745), Tokuslu and Burak (2021: 64-65), Bilgili (2022: 204-205), Ekmekçioğlu et al. (2022: 4457), Kose and Sekban (2022: 5-7), Savaş and Bilgili (2022: 82-83), Seyhan et al. (2023: 238-239), Tokuslu (2022: 18), Toz et al. (2022: 71-72), Yüksel (2022: 41-42), Kanberoğlu et al. (2023: 1). Three studies have aimed to determine the preference levels of decarbonization strategies for vessels in port and while underway: Konur et al. (2019: 101-102), Bucak et al. (2021: 26), Zincir et al. (2022: 67). One study has focused on determining the preference levels of decarbonization strategies for port equipment and vessels: Bucak (2022: 90-91). 2 studies have addressed port equipment emissions and ship emissions with a decarbonization strategy: Kose et al. (2022: 261-263), Okşas (2023: 7-8). Decarbonization studies in port equipment emissions and vessel emissions have been encountered only in two studies. This situation points to research gap 1 in Table 21. In summary, the impact of regulations was the first guiding factor in identifying research gap 1. Only the studies of Köse et al. (2022: 261-263) and Okşas (2023: 7-8) have been found on the application of emission decarbonization techniques in ports in Turkey to overcome the requirements of becoming green ports. This situation was the second guiding factor in identifying research gap 1. Additionally, it has been seen that a lot of studies have been done in this field about ports in different parts of the world. However, there are 221 ports and piers on Turkey's 8333 km coastline. While some of these ports are specialized in a single type of cargo, others have conventional type ports equipped with different equipment that can serve many

different types of cargo (DTO, 2023; Turklim, 2023a). Mersin-Taşucu, İzmir-Çandarlı, Rize-İyidere and Zonguldak-Filyos port projects, which are still under construction, are not included in this number. Starting from this point, it can be seen that decarbonization studies in the field of port management are still very few compared to the number of existing ports in Turkey.

Research gap 2 -SOIs provide a suitable innovation framework for multi-stakeholder port management (Notteboom and Winkelmanns, 2002: 3). SOIs help create an effective framework to eliminate negative impacts on ports when port-city integration is achieved (Bottasso et al., 2013: 32; Carpenter and Lozano, 2020: 37). However, in the sustainability-oriented innovation literature, linking the sustainability-oriented innovation framework for port management industry has received scant attention in the extant literature. This situation has been effective in identifying research gap 2.

Research gap 3 - Interaction with the right stakeholders is required for sustainability and innovation activities to be carried out together and for the success of sustainability-oriented innovation processes. In order to interact with the right stakeholders, it is necessary to identify the stakeholders and determine their salience level (Teece, 2007: 1319-1342; Adams et al. 2016: 194; Inigo, and Albareda, 2019: 334-348-349; Klewitz, and Hansen, 2014: 57-70-71; Gonera et al. 2022: 10). In the port management literature, it has been observed that studies examining the relationship between sustainability and innovation activities and stakeholder participation in terms of the roles of stakeholders have not received sufficient attention. While studies in the port management literature have addressed the issue of stakeholder identification only in terms of operational activities as seen on the studies of Lie (2018), Eskafi et al. (2019), Balci and Surucu-Balci (2021: 12); it couldn't be come across the study that empirically questions the roles of stakeholders in sustainability and innovation activities in the port management literature. This situation has been effective in identifying research gap 3.

Research gap 4 - It is imperative to afford equal attention to all three dimensions in order to effectively produce sustainable results (Rogers et al., 2007: 42). In order to give equal importance to all dimensions of the sustainability issue in the literature, stakeholder participation has been emphasized and it emphasizes the

need to be effective and compatible with stakeholders. (Tanzil and Beloff, 2006: 44). There is a multilateral stakeholder structure in port management. The needs of ports that interact with many national and international stakeholders must be met holistically together with the stakeholders. This integrity has stakeholder-related positive and negative effects on the port (Notteboom and Wilkensman, 2002: 3). Ensuring port-city integration is another important issue. For this reason, stakeholder interaction comes to the fore (Bottasso et al., 2013: 32; Carpenter and Lozano, 2020: 37). In summary, in port management, the roles, responsibilities and acceptance limits of internal and external stakeholders, especially for operation processes and SOI processes, should be determined. In the literature review, 1 study by Denктаş-Şakar et al. (2014: 22) has been found regarding the situation of stakeholders in the open innovation processes of the Maersk Container Line company. In the literature, it hasn't seen sufficient attention that evaluates the roles, responsibilities and acceptance limits of internal and external stakeholders for operational processes and SOI processes. This situation has been effective in identifying research gap 1.

Research question 1 -Research question 1 has been established with the support of research gap 2. Sustainability-oriented innovations manage the sustainability and innovation phenomenon through open innovation. In summary, sustainability-oriented innovation models require open innovation capabilities (Klewitz and Hansen 2014: 57; Adams et al., 2016: 180). The relevant model related to research question 1 is shown in Figure 44. Based on this, the first question has been created regarding how the SOI development process takes place in a terminal/port business. In answering research question 1, the SOI model of the port has been created by examining the relations of Borusan port with other group companies and other internal and external stakeholders.

Table 21: Research Questions, Literature Gaps and Requirements for the Analysis

Question 1.	How does the SOI development process take place in a terminal/port business?
Question 2.	Who are the key stakeholders involved in SOI activities of a terminal/port business?
Question 3.	How do sustainability-oriented innovations on different dimensions of sustainability evolve in a terminal/port business?
<i>The Identified Gaps</i>	<i>Fundamental Inquiries and Requirements for The Identified Gaps and Problems</i>
Gap 1. Few studies have been found on how to address greenhouse gas emissions resulting from port operations at the coastal borders of the Republic of Türkiye with decarbonization strategies.	• Measurement of GHG emissions from field operations in the context of a port's sustainability innovations and revealing the sensitivity levels in the formation of port operations' emissions. Determining the sensitivity of GHG reduction improvement of equipments.
Gap 2. Linking the SOI framework for port management industry has received scant attention in the extant literature	• Qualitatively determining the level of a port in terms of sustainability-oriented innovations. • Identifying the obstacles and drivers in the sustainability-oriented innovation projects in the ports. • Identifying the priorities in the sustainability-oriented innovation activities of the ports.
Gap 3. Despite the fact that stakeholder management, sustainability and innovation issues have been examined in the port management industry, the roles and salience level of stakeholders in sustainability and innovation activities in port management have largely been ignored in the extant literature.	• Empirically determining salience level of internal and external stakeholders in the operational and commercial activities of the ports. • Empirically determining salience level of internal and external stakeholders in the sustainability and innovation activities of the ports.
Gap 4. Assessing the stakeholder participation in SOI activities by determining the port stakeholders based on their characteristics have not received deserved attention in scholarly studies.	• Qualitatively determining the role of internal and external stakeholders in the sustainability-oriented innovation activities of the ports.

Research question 2 -“Who are the key stakeholders involved in SOI activities of a terminal/port business?” has been examined for determining the salience levels and stakeholder roles of stakeholders in both the operational and

commercial activities of port operators and their sustainability and innovation activities. Secondly, the roles of internal and external stakeholders in SOI activities of ports at different levels have been evaluated in terms of duties, responsibilities and expectations through research question 2.

Research question 3 -“How do sustainability-oriented innovations on different dimensions of sustainability evolve in a terminal/port business?” has been examined through the support of research gaps 1, 2 and 4. With the emission trading system and green deal coming into force (TCTB, 2022: 11), the effects of the CBAM obligation (EU, 2021) will also be seen in the maritime transportation and port management sectors in the supply chains (Kang, 2021: 45; EU, 2023). In addition, innovations that address sustainability and innovation together first emerged as preventive innovations at a time when they were not yet conceptualized as SOI (Rogers, 2002: 902). Emission reduction and decarbonization strategies created within the scope of the green deal and MEPC (80) are essentially the result of preventive innovations, namely SOIs (Borusan Holding Report, 2022). Therefore, first, support has been received from research gap 1 to answer research question 3 is that the amount of emissions resulting from the ports’ own activities and the activities of the ships in the port have been calculated. The sensitivity analysis of the emission reduction that will be achieved if decarbonization strategies are implemented has been calculated based on equipment and years. Secondly, a support has been received from research gap 2 to answer research question 3, Two different SOI models have been used through designed by the studies of Adams et al. (2016) and Jay and Gerard (2015) to answer the question 3. Both the SOI models of Adams et al. (2016) and Jay and Gerard (2015) have been used and examined in some studies for evaluating SOIs in the different sectors other than port management. Especially the study of Adams et al. (2016) attract attention with their high citation in the literature. These two SOI models have been used in the SOI project assessment in this dissertation. In this regard, thirdly, a support has been received from research gap 4 to answer research question 3. To determine the importance levels of the port's stakeholders and how they behave in SOI activities, the stakeholders involved in SOI activities have been evaluated by taking into account their salience levels.

Regarding matching research questions and research gaps:

- Research gap 1 is associated with research question 3.
- Research gap 2 is associated with research questions 1 and 3.
- Research gaps 3 are associated with research question 2.
- Research gap 4 is associated with research questions 2 and 3.

3.3. AIM AND SCOPE OF THE STUDY

This thesis focuses on examining the involvement of stakeholders in realization of sustainability-oriented innovations within the port management sector. Also, it has explored how sustainability requirements contribute to the development of such innovations and evaluates their performance through a scenario-based case analysis of an ecosystem centered around sustainability-oriented innovations in a port business. According to Table 21, this study aims to elucidate various fundamental inquiries and requirements in order to provide support for the identified problems in terms of gaps in the literature through the case of Borusan Port located in Gemlik Bay of Türkiye.

3.4. METHODOLOGICAL APPROACH

Methodology in research is “the structure of the research design and the expression of the methods used in the research process” (Sarantakos, 2005: 30). In order to explain the relationship between the purpose, questions and results of the research, the philosophical approach and method in the research should be determined. Hence, after evaluating the perspectives mentioned below, the appropriate research approach should be determined to obtain an effective and consistent result in the research.

3.4.1. Philosophical Understanding

Historically, there has been a great deal of understanding of how scientific research should be managed (Collis and Hussey, 2009: 4). However, two approaches

come to the fore in business and management research, namely positivism and interpretivism (Greener, 2008: 16; Collis and Hussey, 2009: 62).

3.4.1.1. Positivism

The understanding of positivism; expressed by Collis and Hussey (2009: 55-56) by saying “roots in the philosophy known as realism”, is based on observation and experiment, aiming to discover theory and independent of the individual that It is a supported is philosophical understanding. Positivism, in perspective of being independent of the individual, is based on the approaches used in natural science research. The accuracy and reliability of the results related to the research hypotheses should be proven by statistical methods. Thus, by introducing new theories, new rules and laws are opened. Researchers advocating the positivist understanding consider social behaviors as objective facts that can be explained by quantitative tests (Greener, 2008: 16; Saunders et al., 2009: 113).

3.4.1.2. Interpretivism

Interpretiveness is based on idealism, which accepts that thought is fundamental in knowledge and that existence is created by human thought. Interpretiveness, as it is based on thought, is not objective of social realities; on the contrary, it is an understanding supported by the belief that it is highly subjective and accepting that social behavior is an integral part of the human mind and is shaped by the perceptions of individuals. Collis and Hussey, (2009: 56-57). Positivism and interpretivism are theoretical frameworks that pertain to the logical structure of research, specifically in relation to the deductive and inductive approaches. The deductive approach in research relies on theoretical frameworks and employs statistical analysis to test ideas (Greener, 2008: 16; Collis and Hussey, 2009: 8-51).

The inductive technique, however, involves the researcher adopting a perspective that allows for a comprehensive understanding of the world by considering the viewpoints of others. This strategy entails conducting a study to get diverse perspectives on reality (Greener, 2008: 17).

Table 22: Comparison of Positivism and Interpretivism Concepts

	<i>Positivism</i>	<i>Interpretivism</i>
<i>View to the Reality</i>	Reality is evaluated as objective, singular and separate from the researcher.	Reality is subjective, plural and evaluated from the perspective of the research participants.
<i>View to The Information and Knowledge</i>	The researcher is independent of the element being researched.	The researcher interacts with the researched element. This makes it easier to understand how and why.
<i>Research Logic</i>	The research process is mostly based on the deductive approach. Generalizations give direction to guesswork, explanation, and understanding.	The research process is based on the inductive approach. Examples and subjective patterns are created to build understanding.
<i>Research Process</i>	These are cause-effect study with an unchanging design, the classification of which was determined before the research process. The accuracy and reliability of the results is ensured by validity and reliability analysis.	These are studies in which factors and variables whose classification is determined during the research process are developed mutually and simultaneously within the research process. The accuracy and reliability of the findings are verified by investigation.

Source: Altunışık et al., 2007: 56; Greener, 2008: 16-17; Collis and Hussey, 2009: 8-57; Saunders et al., 2009: 119.

The philosophical insights and approaches to the research process outlined in Table 22 provide a helpful link in the process of using qualitative or quantitative data collection methods of research.

3.4.2. Qualitative and Quantitative Research Methods

The philosophical insights and approaches to the research process outlined above provide a helpful link in the process of using qualitative or quantitative data collection methods of research. In addition, qualitative research can have very rich content in terms of providing opportunities to explore a subject in the most realistic way possible. The collected qualitative data includes expressions related to indirect speech (implied discourses) by nature. For this reason, since the collected qualitative data is of a non-standard and complex structure, it is necessary to summarize, classify and even restructure it with a narrative approach in order to analyze it in a

meaningful way (Saunders et al., 2009: 482). Qualitative studies can have a major impact on research, data collection, analysis and interpretation of results. In addition, these studies should be well designed, and the objectives and procedures of the study should be determined meticulously. However, the study should have predetermined methods to override research bias (Pathak et al., 2004: 192).

Quantitative research, on the other hand, is mostly associated with the deductive approach in terms of handling the research process, as they are often carried out using numerical data and numerical realities. In addition, they are studies with objective content in terms of including statistical analyzes based on numerical data. It is used by researchers who accept the positivist approach due to its objective nature (Greener, 2008: 17).

3.4.3. Methodology Selection: Mixed Approach

The mixed method is used to create a combination of methods that require the application of qualitative and quantitative research procedures at different stages of the research process (Tashakkori and Teddlie, 1998: 19). The researcher carries out the study by using the characteristics of the qualitative and quantitative paradigm in the introduction of the study, the use of literature, theory, the preparation of research questions, and the formulation of data collection and analysis methods (Creswell, 1994). According to Rossman and Wilson (1985), mixed method studies offer three distinct advantages, namely: corroboration, elaboration, and initiation. Corroboration refers to the phenomenon of results converging, whereas elaboration involves the provision of more richness and detail. Initiation, on the other hand, entails the act of turning ideas around (Greener, 2008: 17).

3.5. THE RESEARCH DESIGN AND MODEL

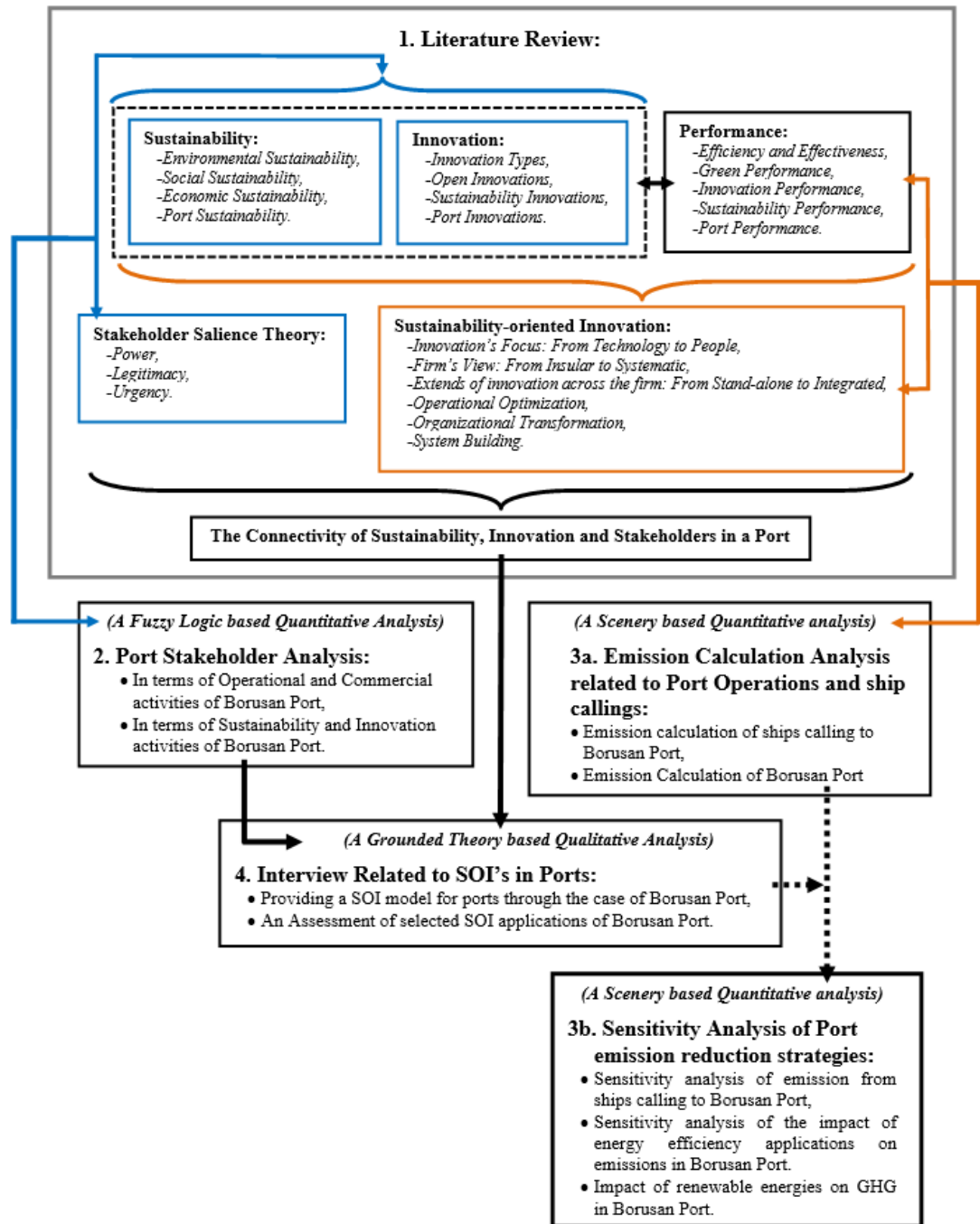
The research in the dissertation has been completed with three interconnected analyzes after literature review as seen on Figure 33. In the first part of the literature review, stakeholder concept and related theories and stakeholder salience in port management have been discussed. Furthermore, stakeholder management and

identification in port management have been emphasized. In the second part, sustainability and innovation literature in general and in port management have been discussed in relation to open innovation and stakeholder management. Lastly, the concept of sustainability-oriented innovation, its development, purpose, levels, dimensions and processes involved are explained. In summary, stakeholder management, stakeholder salience and identification, sustainability and innovation with performance in ports and sustainability-oriented innovation are included throughout the literature review.

In this sense, first of all, the stakeholders in the port's operational and commercial activities, sustainability and innovation activities, and the class and salience levels of these stakeholders have been determined through a survey form applied to the top and middle level managers of Borusan Port through the possible stakeholder list created for Borusan Port. In addition, the inclusion of Borusan Port's sustainability and innovation efforts in Borusan Holding reports and in the press has been the main reason why the Port has been chosen as a case study.

Semi structured Interview questions regarding the Port's SOI activities have been prepared by interpreting the findings obtained in the stakeholder analysis and the determined stakeholder structures and their salience levels. The findings obtained from the stakeholder analysis have been used to verify the SOI interview findings, and likewise, the findings obtained from the SOI interview have been used to verify the stakeholder analysis findings. In addition, after the stakeholder analysis and before the evaluation interview of Borusan Port SOI applications, the emissions arising from the operational activities of the port and ships calling to the port have been calculated. A sensitivity analysis of the improvements made by Borusan Port regarding emissions, possible improvements that can be made, and sustainability-oriented innovation solutions on emission formation has been made.

Figure 33: The Research Model and the Place of the Analyzes in the Research Model



After the Basic Emission calculation was made, interviews have been held with Port managers to evaluate SOI applications of Borusan Port. Based on some findings regarding emission formation during the SOI meeting, the impact of current and possible operational improvements and SOI applications on the emissions in the port has been determined by sensitivity analysis. These three analyzes used in the

research and the connection between these three analyzes reveal the integrity of the study both in terms of literature and related analyses.

3.5.1. The Multilevel and Multistakeholder Action Structure of Borusan Port

As seen in Table 23, the decision policy regarding the strategic, tactical and operational actions of Borusan Port is summarized by associating the vision, mission and value policies of Borusan Port with the SOI model created in this research. Strategic actions are focused on value creation, continuous improvement and Borusan Port being a strategic business partner for its stakeholders. Tactical actions of Borusan Port include practices that protect and support the environment and society, focused on information security, energy and workforce efficiency for all stakeholders.

Table 23: The Action Structure of Borusan Port in Terms of Management Level

Vision	<i>To be a strategic business partner for our customers with our holistic logistic approach in port management.</i>
Mission	<i>To create sustainable value for all our stakeholders as a port company providing world-class services in container, general cargo and vehicle handling operations with our understanding of continuous improvement and efficiency.</i>
The Stakeholders in Borusan Port's Multi-Party Action Structure	Employees, Managers, Board Members, Shareholders, Business Actors, Central Government Actors, Local Government Actors, National and International Sectoral Organization Actors, Other Regulatory Actors, Trade Union Actors, Chambers and Commerce Commodity Exchanges Actors,
Top-level Management: Strategic actions	• Creating Sustainable Value. • Focusing on Efficiency and Continuous Improvement. • Being a Strategic Business Partner as Borusan Port.
Mid-level Management: Tactical actions	• Planning practices that support the protection of the environment and society. • Considering all stakeholders as business partners and attaching importance to information security. • Planning of energy and labor efficiency. • Following technology and digitalization and adapting them to work. • Determining risk management priorities and giving importance to Health and Safety culture. • Planning of long-term and trustworthy relationships. • Monitoring the compliance of business processes with ethical principles and rules. • Incurring and planning costs for promising areas and jobs. • Planning for stakeholder interaction and cooperation in contributing to the business and society.
Front-line Management:	• Keeping the guidelines up to date within the scope of PDPL and PACS for existing and new applications.

Operational actions	• Providing information, training and guidance to employees and other stakeholders about new products, services, and processes. • Ensuring that employees and other stakeholders are included at the representative and implementer level in projects that concern them. • Coastal and seabed cleaning of Gemlik coast twice a year. • Accurate and detailed reporting of labor force, equipment usage and other operations to eliminate possible risks and identify improvement opportunities in sustainability activities and OHS practices. • Calculating carbon footprint for climate change. • Conducting operations by keeping current and potential environmental impacts under control. • Reporting for fair and equal planning of employees' shifts, duties and responsibilities. • Measuring and reporting stakeholder satisfaction. • Reflecting all kinds of reporting and feedback accurately and in detail. • Using and reporting company and stakeholder resources in a way that prevents waste. • Carrying out representation duties in reputable NGOs and professional organizations to share and interact for sustainability, efficiency and other value-creating areas. • Carrying out awareness and circular economy activities in line with the tactical targets determined in line with the strategic goals of the Top management.

Source: Compiled by Author inspired by the multistakeholder structure of Popper et al. (2017) according to Borusan Port Policy (2021) in the light of SOI assessment interview.

In addition, following technology and digitalization and adapting them to business processes, determining and implementing risk management priorities, health and safety culture, and maintaining long-term and safe relationships are taken into account. Carrying out stakeholder interaction to ensure business and society cooperation and adopting ethical principles is another tactical action element. Operational actions consist of fulfilling the instructions, workforce responsibilities and all other operational activities in coordination with OHS and sustainability targets.

3.5.2. Reasons for Investigating of Borusan Port

Regarding Borusan Port and Borusan Holding, within the scope of this dissertation, 12 sustainability reports with a total of 1044 pages that published by the Borusan holding between 2009-2022 (Borusan Holding Report, 2010; 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2020; 2021; 2022), 25 pages of Borusan Holding sustainability guide (Borusan Sürdürülebilirlik Rehberi, 2021) and 9 pages of Borusan Port group sustainability report have been examined. In this sense, Borusan Port innovation model has been created as a result of literature review, reports

published by the relevant company and interviews with senior employees of the company. Findings indicate that this model is a sustainability-oriented innovation model. For this reason, the relevant model is named Borusan Port sustainability-oriented innovation model. To demonstrate this proof, first of all, the findings, regarding the structure of the Borusan Port sustainability-oriented innovation model, have been presented in Figure 44.

Borusan Port must have innovative capabilities to carry out SOI activities. Therefore, the innovation capabilities of Borusan Port are explained below:

- In terms of technological capabilities (Bowonder et al., 2010); Braga, A and Braga, V., 2013; Bayarçelik et al., 2014; Jaruzelski et al., 2014; Gaubinger et al., 2015; van de Poel et al., 2017; van Tonder et al., 2020; Wolf et al., 2021), it has the ability to produce the software it needs within its own structure.
- In terms of technical capabilities (Gaubinger et al., 2015; Pisano, 2019; Wolf et al., 2021), the ability to design and produce all kinds of equipment needed for operations in the machine maintenance, repair and technical workshops unit. For example, multiple handling equipment for bigbag operations.
- Sharing some of its projects, such as 3D Coil product and system SOI projects, with rival ports and developing cooperation with different sectors in SOI projects indicate the Port's competition and cooperation capabilities (Bowonder et al., 2010; Braga, A and Braga, V., 2013; Bayarçelik et al., 2014; Lertxundi et al., 2019; Wolf et al., 2021).
- Borusan sustainable benefit program is carried out to support entrepreneurs and researchers in producing products and services that will create business models (Gao et al., 2017; Chen et al., 2018a; Jia, 2019; Pisano, 2019; Van Tonder, 2020; Müller et al., 2021).
- For horizontal and vertical integration and sharing opportunities in the sector, importance is given to networking capabilities (Cabello-Medina et al., 2011: 390; Mohanbir et al., 2006; Van Tonder et al., 2020) such as regularly meeting working groups within Turklim.
- The technical affairs department of the port shows that imitation capabilities (Wanasika et al., 2011; Müller et al., 2021) are used by revising some

sensors in the equipment with sensors used in different areas to increase OHS standards.

- Making regular R&D investments (Braga, A and Braga, V., 2013; Bayarçelik et al., 2014; Gaubinger et al., 2015; Van de Poel et al., 2017; Wolf et al., 2021) in line with the theme of people, climate and innovation is another innovation capability of the port.

- The port has received 3 international innovation awards in 2022 through its innovative activities together with solution partner company of SafeCard. These are RFID Journal SafeCard IOT award in may 2022, Industry of things Award in September 2022 and IOT Innovator Award in October 2022. In addition, the committee structure implemented by the port for business development reveals its innovation leadership capabilities (Bowonder et al., 2010; Carmeli et al., 2010; Adjei, 2013; Braga, A. and Braga, V., 2013; Bayarçelik et al., 2014; Gaubinger et al., 2015; Van de Poel et al., 2017; Lertxundi et al., 2019).

- As is done in the E-RTG positioning system, employees can meet needs with non-traditional methods. This situation shows the capabilities of talented employees (Braga, A and Braga, V., 2013; Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197; Van Tonder et al., 2020).

- The SafeCard SOI system project, developed by Borusan Port, is actually an advanced version of a basic Wi-Fi tracking system. In doing so, the port has demonstrated its ability to follow best practices as other means the scanning the external environment (Leavengood and Anderson, 2011).

- Port employees have freedom for new applications. For example, when Technical workshop employees used some sensors used in a different sector in the 3D Coil SOI project, bridge cranes turned into completely different equipment. In addition, the pilot application of solar energy and wind energy is a sign of the pursuit of innovation. This situation is an example of the existence of an innovative corporate culture (Bowonder et al., 2010; Naranjo-Valencia et al., 2011; Braga, A. and Braga, V., 2013; Bayarçelik et al., 2014; Jaruzelski et al., 2014; Ikeda and Marshall, 2016; Chen et al., 2018a; Briganti and Samson, 2019; Lertxundi et al., 2019; Van Tonder et al., 2020).

- The port designs handling equipment for new cargo types in accordance with customer needs. For example, the process of designing an apparatus that helps handle wind blades via a single crane is a good example of this. In summary, their ability to identify customer needs is important to be innovative (Mohanbir et al., 2006; Bowonder et al., 2010; Braga, A. and Braga, V., 2013; Bayarçelik et al., 2014; Jaruzelski et al., 2014; Gaubinger et al., 2015; Kaliappen and Hilman, 2017; Lertxundi et al., 2019; Van Tonder et al., 2020; Geng et al., 2021).

- Even the port's large-scale innovation projects make some additions from time to time. For example, the SafeCard system SOI project, developed for basic OHS requirements, was used for flight tracing during the pandemic period. This indicates incremental improvement capabilities (Jaruzelski et al., 2014; Gao et al., 2017; Chen et al., 2018a; Jia, 2019; Müller et al., 2021).

- The Port also pays attention to ensure that SOI projects are compatible with the requirements of the day. However, they are piloting some projects that they see a future in, such as solar energy and wind energy. This indicates that the port is trying to determine risk taking levels for new initiatives (Dodgson et al., 2008; Bowonder et al., 2010; Sniukas, 2010; Braga, A. and Braga, V., 2013; Varadarajan, 2018).

- The port implements practices that will provide support in terms of cost leadership. For example, Borusan Port stated that it is preparing to switch to artificial intelligence-supported self-diagnostic solutions in equipment in order to prevent unnecessary maintenance costs at a later date with the SafeCard SOI system project. This is a result of the port's emphasis on cost leadership capabilities (Braga, A. and Braga, V., 2013; Bayarçelik et al., 2014; Kaliappen and Hilman, 2017).

- The 3D coil process and product SOI project and the SafeCard SOI system project are the first and only examples of the port's differentiation capabilities in products and services (Kaliappen and Hilman, 2017).

- The port monitors new products and processes through some pilot trials to ensure that they are launched at the right time. This points to market timing capabilities (Bowonder et al., 2010; Bayarçelik et al., 2014; Gaubinger et al., 2015; Wolf et al., 2021). This capability is also intertwined with the port following best practices.

- The port carries out SOI-based business development processes through a virtual department without establishing an innovation department. Tasks related to SOI activities are carried out alongside routine work. This provides agile mobility (Bowonder et al., 2010; Varadarajan, 2018; Van Tonder, 2020).

- The port's committee structure shows that platform strategies for different themes and areas are accepted. Platform strategy capabilities are another important element for innovations (Mohanbir et al., 2006; Bowonder et al., 2010; Yoon: 2020: 3).

- The development stages of SOIs are supported by meetings and trainings that include employees. In addition, monitoring employees' expectations for SOI projects implemented shows their ability to use open communication channels (Varadarajan, 2018; Lertxundi et al., 2019).

- The port has launched a sustainability benefit program to reach start-ups. Additionally, as of January 2023, it has established a company in Silicon Valley in America and is following start-ups that will innovate. The Port cooperates with businesses from different disciplines and sectors and different government institutions in all its SOI projects. This points to the open innovation capabilities of the port (Bowonder et al., 2010; Ikeda and Marshall, 2016; Bogers et al., 2019; Van Tonder et al., 2020; Wolf et al., 2021).

- The port includes employees from group companies for some SOI projects through its committee structure. Likewise, the port's employees act in a similar way to convey their capabilities to group companies. Additionally, when authorizing, informal roles are paired with formal roles in order to facilitate actions due to the nature of the work. This situation points to the flexible organizational structure capabilities of the port (Katz et al., 2010; Braga, A. and Braga, V., 2013; Ikeda and Marshall, 2016; Varadarajan, 2018; Briganti and Samson, 2019; Van Tonder et al., 2020).

- The port generally considers ROI for SOI projects. This shows that the port directs its innovation capabilities to economic projects (Braga, A. and Braga, V., 2013; Bayarçelik et al., 2014; Jia, 2019). However, the port prioritizes ROI in SOI projects that concern human contact. This indicates that the port pays attention to OHS and social-based measures when making SOIs, which are also considered

preventive innovations (Rogers, 2002: 902). This finding was identified from the SOI evaluation interview and the port's sustainability reports.

3.6. METHODOLOGY FOR THE PORT STAKEHOLDER ANALYSIS IN THE CONTEXT OF IDENTIFICATION AND CLASSIFICATION

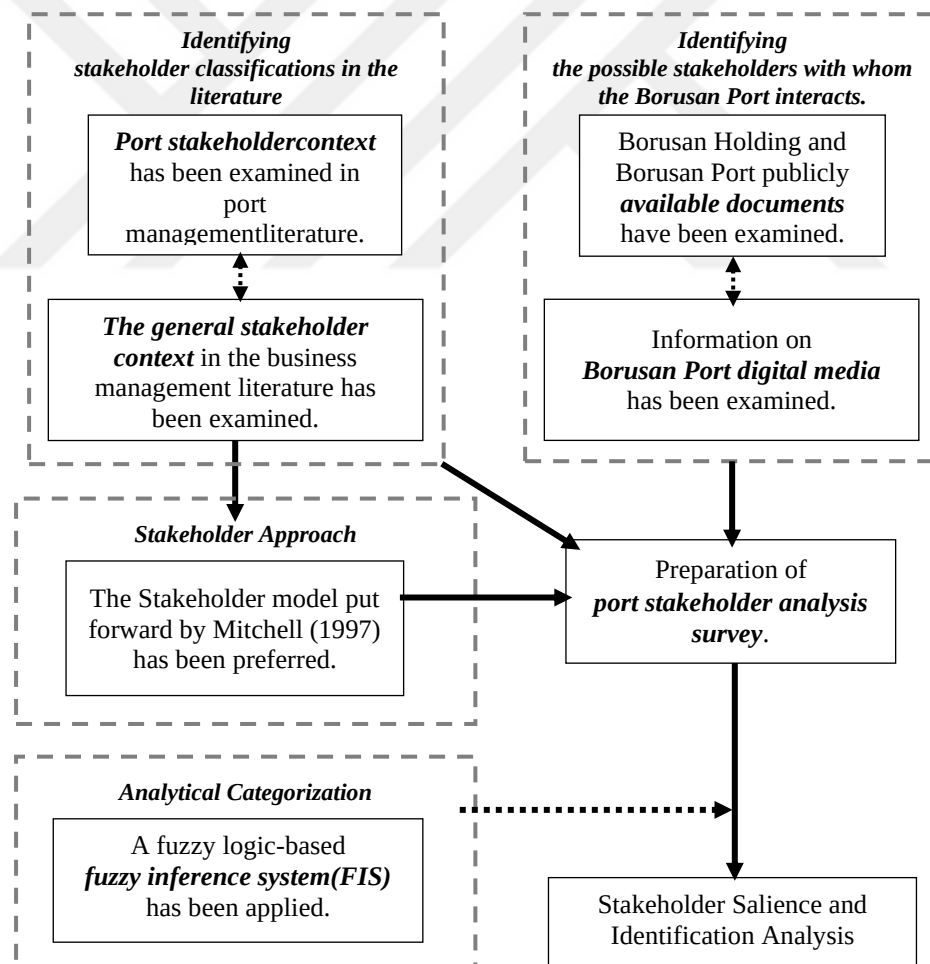
The first analysis carried out within the scope of this doctoral thesis has been based on the stakeholder analysis of Borusan Port. Stakeholder analysis aims to determine the legitimacy, power and urgency in terms of the Borusan Port's operational and commercial activities and sustainability and innovation activities. For this purpose, an algorithmic ranking has been established with the fuzzy inference system, which is a quantitative analysis method. In addition, the reason why stakeholder analysis has been the first analysis carried out within the scope of the thesis is that the sustainability and innovation activities of businesses are shaped by internal and external environment interaction, just like other basic business activities, and stakeholders and stakeholder communication are important elements in sustainability and innovation activities. There are a wide variety of studies related to the status of stakeholders in port competitiveness (e.g. Notteboom and Winkelmanns, 2002; Cerit, 2013; Da Cruz et al., 2013; Ibrahim, 2017), the impact of stakeholders on port sustainability (e.g. Denktas-Sakar and Karatas-Cetin, 2012; Videira et al., 2012; Shiao and Chuang, 2013; Dooms, 2019; Lam and Yap, 2019; Cerreta et al., 2020), the status of stakeholders in environmental issues of ports (e.g. Hall et al., 2013; Le et al., 2014); stakeholder interaction is taken into account, such as regional maritime area and port management planning (e.g. Vancea et al., 2017; Mannan, 2019). In this sense, it has been deemed necessary to first conduct a stakeholder analysis of the port in order to create an innovation model of Borusan Port and to evaluate sustainability-oriented innovation activities. Exploratory questions that will be useful in examining SOI activities have been created based on the findings obtained by analyzing the level of relations of the port with which stakeholders within the elements of power, legitimacy, and urgency. In addition, verification has been provided by evaluating the findings obtained in the stakeholder

analysis and the findings of the semi structured interviews with top management and middle management of Borusan Port.

3.6.1. Research Model and Design of the Port Stakeholder Analysis

For the design of stakeholder analysis, Mitchell et al. (1997: 874)’s approach, one of the widely discussed stakeholder analysis approaches as expressed in Table 3 in the literature section, has been preferred. Unlike other approaches, this approach has shaped the qualifications of the stakeholders through the concepts of power, legitimacy, and urgency, which are three important elements.

Figure 34: Research Model of The Stakeholder Analysis of Borusan Port



In addition, it has classified stakeholder roles (Dormant stakeholders, discretionary stakeholders, demanding stakeholders, dominant stakeholders, dangerous stakeholders, dependent stakeholders, definitive stakeholders, non-stakeholders) in 8 different situations that contain these three qualities at different levels in the stakeholders' relations with the relevant public and private structures and organizations. This diversified structure is the reason why Mitchell et al. (1997: 874)'s stakeholder classification approach has been preferred for Borusan Port stakeholder analysis through its 3-dimensional (power, legitimacy, urgency) structure, unlike other 2-dimensional stakeholder classification approaches. Another important reason for choosing Mitchell et al. (1997: 874)'s approach is that it is suitable for linking environmental management issues with other business activities and stakeholder participation (Guðlaugsson et al., (2020: 172). When using data on stakeholders' qualifications, evaluating with two-dimensional matrices is not a strong enough classification approach (Eskafiet al., 2019: 226; Guðlaugsson et al., 2020: 172). Therefore, we have found the structure regarding the importance of stakeholders in fuzzy logic was used to develop the stakeholder identification and classification approach of Mitchell et al. (1997: 874). For this reason, in this dissertation, fuzzy logic has been used to develop the structure regarding the importance of stakeholders according to Mitchell et al. (1997: 874)'s stakeholder identification and classification approach. In addition, it is frequently used in the literature to determine the opinions of multiple parties and/or stakeholders regarding different qualities (such as power, legitimacy, urgency). For example, some of these studies are: in decision making in environmental risk management: Akter and Simonovic (2005); stakeholder prioritization in project management: Bendjenna et al. (2012), and Zarghami and Dumrak (2020); determining the level of salience of stakeholders in stakeholder relations: Susnienė and Purvinis (2015); determining stakeholder effects in corporate social responsibility: Poplawska et al. (2015); Stakeholder prioritization and stakeholder analysis in software engineering: Elsaid et al. 2017; Stakeholder prioritization and classification in project management: Perez-Vera and Bermudez-Pena (2018); determination of stakeholder levels in the port master planning process: Eskafi et al. (2019); determination of stakeholders of the

Icelandic energy system: Guðlaugsson et al. (2020) belonging to the fuzzy logic family Fuzzy inference system method has been preferred for analysis.

3.6.2. Population and Sampling for the Port Stakeholder Analysis

Since the research of this dissertation includes a case-oriented analysis, a population such as “employees who are in managerial positions in the field of port management in the world or in Türkiye” has not been determined. Instead, just why Borusan port has been preferred for the case analysis is explained under the title 3.5. The sample for the case-oriented stakeholder analysis has included one manager from the top management of Borusan Port and eight middle-level managers working at the port. When the participants whose work experience periods at the port are included in Table 24 are evaluated in terms of their contributions to the stakeholder analysis, it is seen that all participants, except one participant, have been working at Borusan port for a long time.

Table 24: Industry Experience of Those Participating in the Stakeholder Analysis

<i>Industry Experience Duration of Participants</i>	
Participant 1	9 years
Participant 2	5 years
Participant 3	19 years
Participant 4	7 years
Participant 5	17 years
Participant 6	9 years
Participant 7	21 years
Participant 8	11 years
Participant 9	2 years

In addition, in the online meeting held before making the stakeholder analysis, a participant who is a top management level manager at the Borusan Port stated that the employees have a good command of the ecosystem, as most of the employees had worked in Borusan group companies before starting to work at Borusan Port. In this regard, it is thought that the fact that the research participants have been working in Borusan group companies and Borusan port for a long time is effective in reaching meaningful results in terms of research.

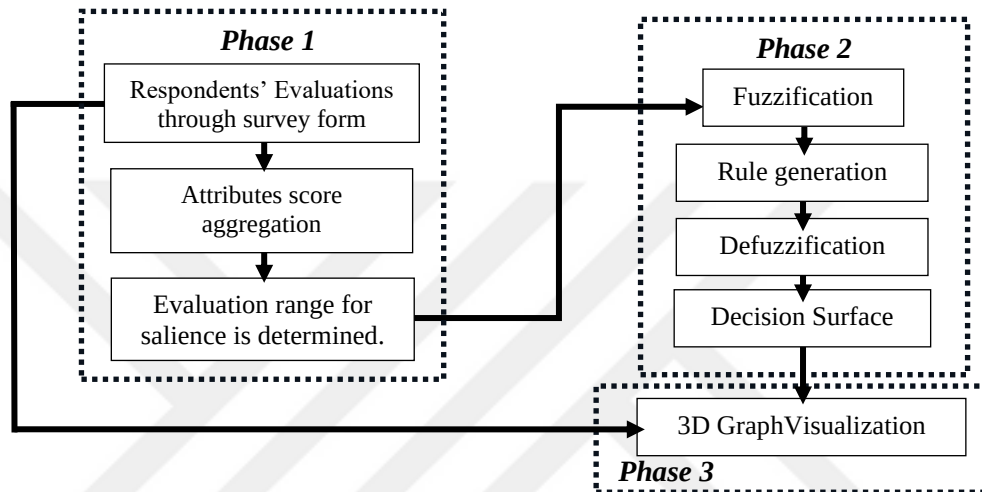
3.6.3. Data Collection and the Analysis Process of the Port Stakeholder

A survey form has been created for stakeholder analysis for this dissertation. While creating this survey form, first of all, as seen in Figure 34, studies in the literature dealing with port stakeholders or port stakeholder management have been examined. The studies taken into account regarding stakeholders in ports: Frankel (1989), Notteboom and Winkelmanns (2002), Dooms and Macharis (2003), Moglia and Sanguineri (2003), De Langen (2006), Dooms (2010), Denktas-Sakar and Karatas-Cetin (2012), Bergqvist and Egels-Zanden (2012), Videira et al. (2012), Da Cruz et al.(2013), Cerit (2013), Deveci (2013), Dooms et al. (2013), Hall et al. (2013), Lam et al. (2013), Parola and Maugeri (2013), Parola et al. (2013), Satta et al. (2014), Aerts et al. (2015), Becker and Caldwell (2015), Notteboom et al. (2015), Shiau and Chuang (2013), Afreen and Kumar (2016), Ibrahim (2017), Vancea et al. (2017), Lozano et al. (2018), Lie (2018), Ignaccolo et al. (2018), Dooms (2019), Eskafi et al. (2019), Lam and Yap (2019), Lawer (2019), Mannan (2019), Ashrafi et al. (2019; 2020), Cerreta et al. (2020), Schrobback and Meath (2020), Zarghami and Dumrak (2020), Balci and Surucu-Balci (2021). Firstly, the stakeholder context for the ports, as seen in Table 4 and Table 5, has been determined. Secondly, possible stakeholders for Borusan Port have been listed, taking into account the structure determined in the literature regarding the general stakeholder context, as seen in Table 2 and Table 3. In addition, by examining the 10 sustainability reports, consisting of 1044 pages, published by Borusan Holding between 2009-2022, the Borusan Holding sustainability guide consisting of 25 pages and many digital media elements reflected in the online media such as news, promotions, information, columns. related to Borusan Port. So, An up-to-date evaluation opportunity has been created for the Borusan Port's stakeholders. The list of identified Borusan Port's potential stakeholders is in Appendix 2, and 3; and the stakeholder analysis survey form is in Appendix 1. In summary, in determining the possible stakeholders of Borusan Port, the parties that are thought to be related to the port have been determined by reviewing publicly available documents based on the literature and scanning about Borusan Port in digital media.

3.6.3.1. Analysis Process for Stakeholder Profile and Saliency Measurement

Stakeholder identification and saliency level analysis has been carried out in three phases as seen in the Figure 35.

Figure 35: Analysis Process Regarding the Methodology



In the first stage, in order to determine who the stakeholders in Borusan Port's activities are and their saliency levels, the opinions of the participants have been collected with the attached stakeholder identification survey, answered by 9 top and middle management level employees of Borusan Port. Then, the score values in the collected surveys have been collected as lower, upper limits and average values. In addition, the distribution of the answers to the attributes in the data set to be analyzed has been taken into account in order to determine the membership functions of the fuzzy inference system consistently and within logical limits. The constraints subject to membership functions are listed in Table 25.

Table 25: Descriptive Information for Membership Functions

	<i>Input Attributes</i>		
	<i>Power</i>	<i>Urgency</i>	<i>Legitimacy</i>
Lowest value	0	0	0
Highest value	3	3	3
Mean			
<i>(Weighted)</i>	2,041	1,976	2,004
<i>(Arithmetic)</i>	2.059	2,030	2,032
Std. Deviation			
<i>(for weighted)</i>	0,646	0,762	0,647
<i>(for arithmetic)</i>	0,826	0,829	0,834
%95 Confidence Interval			
<i>(for weighted)</i>	$1,84 \leq x \leq 2,16$	$0,81 \leq x \leq 1,19$	$1,84 \leq x \leq 2,16$
<i>(for arithmetic)</i>	$1,93 \leq x \leq 2,06$	$1,93 \leq x \leq 2,07$	$1,93 \leq x \leq 2,07$

Membership functions are within the confidence intervals in Table 25 and according to Mitchell et al. (1997)'s stakeholder identification model, membership functions have been determined for each attribute as seen in Table 26. Membership functions of the features have been determined by taking into account the weighted averages in the data set. The reason for this is that, as suggested by Ross (2004), the defuzzification process is done by taking into account weighted averages.

Table 26: The Linguistic Attribute Importance Scale (Membership Functions Ranges)

<i>Criteria for inputs' importance</i>	
Power & Urgency	
<i>Low importance</i>	[0 ; 0 ; 0,6 ; 2.1]
<i>High importance</i>	[0,6; 2,1; 3 ; 3]
Legitimacy	
<i>Absent legitimacy</i>	[0 ; 0 ; 1.1; 1,6]
<i>Present legitimacy</i>	[1,1; 2 ; 3; 3]

The salience level, which is the output variable in the model established to evaluate stakeholders within the fuzzy inference system, is the numerical results of the linguistic expressions of the criteria indicating the importance of the stakeholder. The transformation of the membership functions of this output variable has

been made as “no salience”, “low salience”, “moderate salience” and “high salience” as seen in the Table 27.

Table 27: The Linguistic Value Scale for Saliency Level (Membership Functions Ranges)

<i>Criteria for stakeholders' importance</i>	
<i>No salience</i>	[0 ; 0 ; 0 ; 0]
<i>Low salience</i>	[0 ; 0 ; 0,6 ; 1,2]
<i>Moderate salience</i>	[0,6 ; 1,2 ; 1,8 ; 2,4]
<i>High salience</i>	[1,8 ; 2,4 ; 3 ; 3]

After creating membership functions by determining appropriate numerical value ranges for linguistic expressions in the input (attributes) and output variables, the researcher determines the appropriate rules by which the linguistic values included in the membership functions will be matched over different combinations of linguistic expressions. Since the number of rules, linguistic expressions, structure of the membership function, and the requirements of the field of study depend on the choice of the researcher, the performance of the fuzzy inference system largely depends on the correct choice of the researcher (Çelik, 2012: 24). In general, when creating the Rule base, the “if then” part is called the premise; The part after “if” is called the result. For example, rules are created such as “if” it rains “and” if it is nighttime, the streets dry late. In general, input variables (attributes) are associated with each other with the expressions “and”, “or”. After the “if” statement, the rule base is established with the output (result) variable (Yalçın, 2014: 37). The number of rules is determined by the combination between the number of states in the input variables and the number of input variables. In other words, in the fuzzy inference system analysis in this thesis study, there are three input variables: power, urgency and legitimacy. Let the input variables be “k”. There are 2 states for each input variable. Let the states be “n”. Thus, the number of Rules is created with n^k (Ödük, 2022: 63). In addition, the creation of the rule base can be created by expert opinions on the subject under investigation, technical constraints and capabilities in the user manuals, and literature reviews. In this sense, the Rule base created in the

stakeholder analysis has been created by taking into account the stakeholder profile determination features put forward by Mitchel et al. (1997).

Table 28: IF-THEN Rules for the Fuzzy Inference System (FIS)

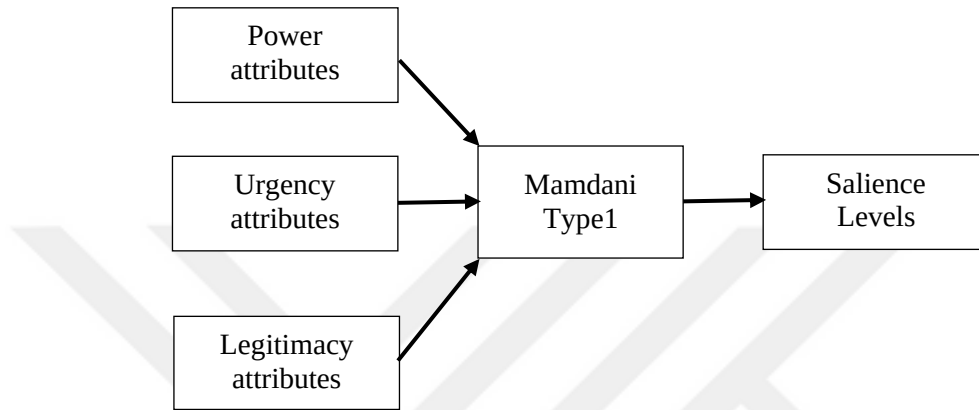
<i>Salience Group</i>	<i>Rule No</i>	<i>Input Part</i>	<i>Output Part (Salience Profile)</i>
Low	1	If legitimacy is absent and power is high and urgency is low	Then stakeholder is dormant
	2	If legitimacy is present and power is low and urgency is low	Then stakeholder is discretionary
	3	If legitimacy is absent and power is low and urgency is high	Then stakeholder is demanding
Moderate	4	If legitimacy is present and power is high and urgency is low	Then stakeholder is dominant
	5	If legitimacy is absent and power is high and urgency is high	Then stakeholder is dangerous
	6	If legitimacy is present and power is low and urgency is high	Then stakeholder is dependent
High	7	If legitimacy is present and power is high and urgency is high	Then stakeholder is definitive
None	8	If legitimacy is absent and power is low and urgency is low	Then stakeholder is non stakeholder

Source: *Adapted from Poplawska et al. (2015)(*:Rule ratios have been updated for the study according to Table 24, 25 and 26)

In summary, based on attributes (power, urgency, legitimacy), rules (absent, present, low and high) have been established that define the allocation of stakeholders to the interest group. According to Table 28, stakeholders' saliency levels are based on Mitchell et al. (1997)'s saliency profile levels. Accordingly, as seen in Table 28, the output (result) variables within the Saliency profile levels: have been accepted as low levels for latent stakeholders and their outputs are determined as dormant, discretionary and demanding. These output variables are expressed as stakeholder class or saliency profile in the context of stakeholder analysis. It has been accepted as moderate for the expected stakeholders and its outputs have

beendetermined as dominant, dangerous and dependent. For definitive stakeholders, the stakeholder specificity level is accepted as high and the output is determined as definitive. Finally, for stakeholders whose salience level did not occur, it has been accepted as none and the output has been determined as non-stakeholder.

Figure 36: Fuzzy Inference System Input and Output (Attributes) Variables Interaction Model

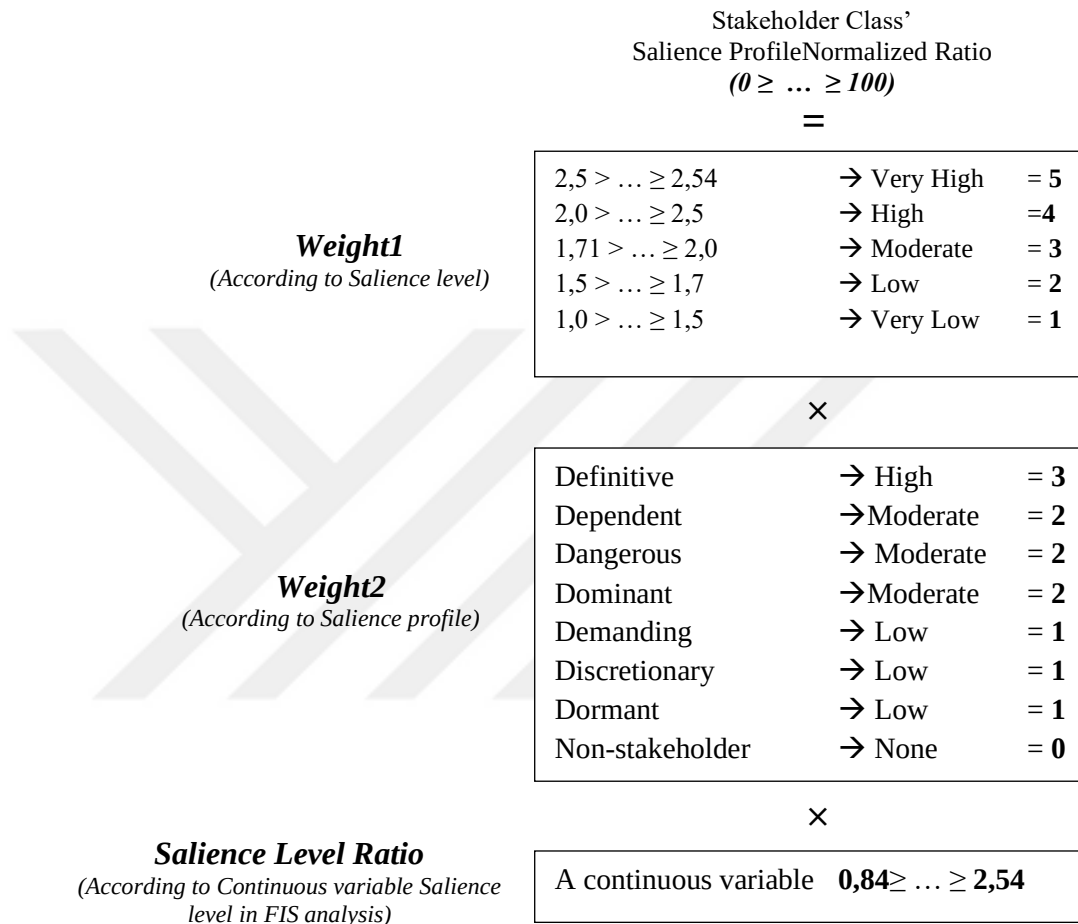


MATLAB 2023b program, obtained through the Academic using license of Dokuz Eylül University, has been used to conduct the stakeholder analysis. As seen in Figure 36, the interaction model established in the fuzzy toolbox module of the relevant program of stakeholder analysis includes the input variables power, urgency and legitimacy, as well as the output variable stakeholder salience class in accordance with the stakeholder model of Mitchell et al. (1997). When calculation of the fuzzy inference system, Mamdani inference method and Sugeno inference method are mainly used to perform the fuzzification and defuzzification process through the created membership functions and rule base. While Sugeno inference is computationally efficient, works well with linear techniques such as PID control, works well with optimization and adaptive techniques, guarantees output surface continuity, and is well suited to mathematical analysis (Sugeno, 1985). However, the Mamdani inference method is much better suited to human input and is widely accepted, because its rule base is more interpretable (Mamdani and Assilian, 1975: 1; Zadeh, 1996). In the stakeholder analysis carried out in this dissertation, the Mamdani inference method has been preferred since an inference has been made on people's perceptions of organizational structures. Additionally, the type-1 standard

model of the Mamdani inference method has been preferred for the study. While the Type 1 Mamdani inference method does not specify the uncertainty coefficient for membership functions; The type 2 inference system creates additional bounds for uncertainties in establishing membership functions (Mendel and John, 2002: 117). In this respect, the Mamdani type 2 inference method also gains the physical sciences-based capabilities of the Sugeno inference method. Additionally, membership curves are used to create membership functions. Membership curves used vary depending on the study analyzed (such as automation control systems, psychology research, studies based on human perceptions and understanding). Membership curves can be used as linear, S-curve, triangular, trapezoidal or bell shape (Cox, 1994: 61). However, triangular and trapezoidal curves are used due to ease of calculation (Lin et al., 2007: 942; Munoz et al., 2008: 832; Ordoobadi, 2009: 318). In addition, the trapezoidal curve function is used in fuzzy inference system analyzes established in research on sustainability (Andriantiatsaholainaina et al., 2004: 149). In the final stage of the analysis, stakeholder salience profiles have been determined by entering the salience scores, rule bases and membership functions created with the weighted average values from the collected surveys, into the inference system model with determined membership functions. The analysis has been completed by interpreting the 3D graphic visualization. As a result of the analysis made with the fuzzy inference system, the weight values as seen in Figure 37 have been created. Among these weight values, weight 2 has been taken into consideration based on the values accepted by Mitchell (1997) in their stakeholder classification. If the weight is 1, the continuous distribution values formed by the salience ratio have been determined in accordance with the distribution of the analyzed data seen in Table 24. The determination of two different weight values is consistent with Mitchell et al. (1997) to ensure that the distinction between stakeholder classes that are intertwined but have different characteristics is determined numerically more clearly. In addition, since it was created with the fuzzy inference system by taking into account the Salience level ratio power, urgency and legitimacy attributes simultaneously, the calculation seen in Figure 37 is included. The findings of the analysis are included in the Tables in Appendixes 2 and 3. Additionally, in the images in Appendixes 4 and

5, Mitchell et al. (1997)'s stakeholder classification model, Borusan Port stakeholders have been visualized.

Figure 37: Calculation of Stakeholder Class' Saliency Profile Ratio.



The findings of the stakeholder analysis will be conveyed under the next title based on Appendixes 2, 3, 4 and 5. In this sense, the relevant stakeholder analysis has been analyzed and interpreted in terms of the operational and commercial activities of Borusan Port and its sustainability and innovation activities. Numerical results of the analysis and their interpretation are included separately for both activity areas of the port in the findings section. Additionally, decision surface graphics have been created regarding the formation of the findings. This decision surface graph showing how the stakeholder class saliency ratio is formed and resulting from the relationship between power, urgency and legitimacy is included in Appendix 6, 7, and

8 with 3D visualization. These decision surface graphs are the graphical results of the membership functions and Rule bases created for stakeholder analysis.

3.6.4. Findings of the Analysis Process of the Port Stakeholder

Under this title, salience levels and stakeholder classes regarding the stakeholder profiles of Borusan Port are presented separately for the port's operational and commercial activities and sustainability and innovation activities. The findings are presented by analyzing the analysis model, membership functions and rule base under the title 3.6.3.1. To make the analysis more interpretable, the stakeholder class salience profile ratio seen in Figure 37 has been created. The findings are explained in support of this salience profile ratio.

3.6.4.1. Salience Level and Class of Stakeholders in Terms of the Operational and Commercial Activities of the Borusan Port

Considering the operational and commercial activities of Borusan Port, definitive, dependent, dangerous, dominant, demanding, dormant stakeholders and non-stakeholders have been determined. In terms of operational and commercial activities, discretionary stakeholders have not been identified at Borusan Port. This points to an important element in terms of the port's stakeholder management capabilities. The fact that the port does not have optional stakeholders regarding its main areas of activity is an indication that it has determined its stakeholder positioning well. Under this title, stakeholder findings regarding operational and commercial activities will be presented respectively.

Definitive stakeholders in terms of operational and commercial activities -

Considering the operational and commercial activities of Borusan Port, as seen in Table 29, it has been determined that there are 27 structures whose stakeholder class (salience profile) is a definite stakeholder. What is noteworthy here is that since it is structured in a similar way to the literature, the salience rate of management and board members has been 100 full points. Additionally, shareholders are often included in the literature as definitive stakeholders or dominant stakeholders. In this

sense, Borusan Port shareholders emerged as the dominant stakeholder with a salience ratio of 66.67.

Table 29: Definitive Stakeholder List of Borusan Port in Terms of Operational and Trade Activities.

<i>Definitive Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Management</i>	Very High	100
<i>Board Members</i>	Very High	100
<i>Container Line Operators</i>	Very High	100
<i>Wind Turbine Manufacturers</i>	Very High	100
<i>Other Project Cargo Owners or Representatives</i>	Very High	100
<i>Importers</i>	Very High	100
<i>The Ministry of Treasury And Finance</i>	Very High	100
<i>The Ministry of Environment, Urbanization And Climate Change</i>	Very High	100
<i>The Ministry of Trade</i>	Very High	100
<i>The Ministry of Industry And Technology</i>	Very High	100
<i>The Ministry of Health</i>	Very High	100
<i>The Ministry of Interior</i>	Very High	100
<i>International Maritime Organization (IMO)</i>	Very High	100
<i>The Ministry of Foreign Affairs</i>	High	77,17
<i>Classification and Survey Societies or Representatives</i>	High	76,22
<i>Port Suppliers</i>	High	76,22
<i>Inner or Outside Port Waste Acceptance Facilities</i>	High	74,96
<i>Industrial Establishments in the Port Foreland (Overseas)</i>	High	74,65
<i>Major Port Operators Overseas</i>	High	74,33
<i>Wind Turbine Cargo Owners or Representatives</i>	High	74,33
<i>Forwarders</i>	High	73,39
<i>Other 3rd and 4th Party Logistics Service Providers</i>	High	73,07
<i>Road Transport Companies</i>	High	69,92
<i>Ship Agents</i>	High	67,09
<i>Pilotage and Towage Enterprises</i>	High	65,83
<i>Overseas Transshipment Port Operators</i>	Moderate	43,94
<i>Ship and Container Repair and Maintenance Enterprises</i>	Low	12,28

However, employees, who are often seen as dependent stakeholders or dangerous stakeholders with low salience in the literature, emerged as the dominant stakeholder for Borusan Port with a salience ratio of 52.28. Essentially, the fact that employees have been identified as the dominant stakeholder can be explained by the fact that Borusan Port prioritizes employees in all its processes. This interpretation has been also supported in the SOI evaluation and provided verification for the validity of the stakeholder analysis. Again, the fact that shareholders are identified as the dominant stakeholder coincides with the findings of the SOI evaluation. In terms of operational activities for official authorities, The Ministry of Treasury And Finance, The Ministry of Environment, Urbanization And Climate Change, The Ministry of Trade, The Ministry of Industry And Technology, The Ministry of Health, The Ministry of Interior and The Ministry of Foreign Affairs, with a salience ratio of 100 full points. Affairs emerged as the Ministries that are seen as definitive stakeholders in operational processes by Borusan Port. Since ports are commercial gates opening abroad and organizations that are affected by the balances in international relations, the definitive stakeholder formation with The Ministry of Trade, The Ministry of Industry and Technology, The Ministry of Interior and The Ministry of Foreign Affairs is logical in terms of the findings. In addition, since ports are important businesses in terms of environmental issues, it is another logical finding that The Ministry of Environment, Urbanization And Climate Change are definitive stakeholders. In the SOI assessment, it has been determined that Borusan Port acted sensitively on issues related to the Ministry of Environment, Urbanization and Climate Change. The emergence of the Ministry of Health as a definitive stakeholder can be expressed by the Borusan Port's introduction of a series of innovative solutions for occupational safety. Other stakeholders whose stakeholder salience score has been determined as 100 full points are container line operators, wind turbine manufacturers, other project cargo owners and representatives and importers. Borusan Port makes serious investments and innovations specifically for wind turbine cargo and project cargo. This situation has been also detected in the SOI analysis. In this sense, stakeholder analysis findings revealed logical inferences. From the importers' perspective, Borusan Port is also an important port in terms of importing wind turbines, other project cargoes, and finished vehicles and heavy

vehicles. In this sense, the formation of importers' salience level is logical in terms of findings. Again, this situation coincides with the SOI assessment findings created through interviews with Borusan Port after the stakeholder analysis was completed. The container terminal is one of the three terminals of Borusan port, and it has been determined in the SOI evaluation that Borusan Port has made serious improvements and innovations in this area. Therefore, identifying container line operators as definitive stakeholders is another finding that yields logical and consistent results. Again, major port operators overseas, wind turbine cargo owners or representatives, forwarders, other 3rd and 4th party logistics service providers, road transport companies, ship agents and pilotage and towage enterprises have been identified as other definitive stakeholders.

Dependent stakeholders in terms of operational and commercial activities - Considering the operational and commercial activities of Borusan Port, it has been determined that there are 5 structures whose stakeholder class (salience profile) is dependent stakeholder as seen on Table 30. The salience rates of these stakeholders identified as dependent are below 50 points. Additionally, Stakeholder Class Salience Level Groups have been determined to be medium. This situation reveals that these stakeholder structures are dependent on Borusan port.

Table 30: Dependent Stakeholder List of Borusan Port in Terms of Operational and Trade Activities.

<i>Dependent Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Ship/Cargo Brokers</i>	Moderate	47,66
<i>Port Operators Association of Türkiye (TÜRKLİM)</i>	Moderate	43,67
<i>Turkish Industry & Business Association</i>	Moderate	30,08
<i>Stevedore Enterprises</i>	Moderate	27,09
<i>General Directorate of State Hydraulic Works</i>	Moderate	25,67
<i>Ship Chandlers and Supply Enterprises</i>	None	0

However, it is seen that this dependence is at a medium level and the salience rates are low. It can be concluded that Borusan Port has a similar level of dependence on relevant stakeholder structures. Regarding this, as Participant R-1 stated in the

SOI evaluation has stated that Turklim is a civil society organization where the issues for the solutions are sought for both Borusan Port and other member ports are put forward. In this sense, it can be stated that both Turklim and Borusan Port are interdependent stakeholders, and this dependence has also been detected in the stakeholder analysis. It has been determined that the salience rate in the Borusan port of the General Directorate of State Hydraulic Works has been almost non-existent at 9.78. In this sense, the General Directorate of State Hydraulic Works has no dependence on the port. On the contrary, it can be interpreted that since it is a public institution, it will be the dominant stakeholder through the relevant ministry to which it is affiliated. However, due to the very low salience rate obtained, it is not the dominant stakeholder directly and with its own capabilities vis-à-vis the Port. The fact that it can exercise this dominance through the relevant ministry to which it is affiliated supports this interpretation. Additionally, ship chandlers and supply enterprises have displayed dependent stakeholder characteristics. However, since the stakeholder class salience rate for Borusan Port has been determined to be 0 points, it has been accepted as a non-stakeholder even though it showed dependent stakeholder characteristics.

Dangerous stakeholders in terms of operational and commercial activities -Considering the operational and commercial activities of Borusan Port, it has been determined that there are 9 structures whose stakeholder class (salience profile) is dangerous stakeholder. The number of possible stakeholder structures has been determined as 66 before the analysis. In this sense, even though 9 structures having dangerous stakeholders may seem like a high rate; Stakeholder class salience ratios and salience level groups of these 9 stakeholder structures are seen in Table 30, of these, only maritime insurance companies, General Directorate of Customs, and General Directorate of Customs Enforcement stakeholders are in the very high salience level group and their stakeholder salience ratios has been detected at the same level as 66.67 points as seen in Table 30. Moreover, although the stakeholder structures of banks and other financial Institutions are in the high salience level group; The stakeholder salience rate has been found to be at an average level of 52.07 points. infrastructure - superstructure project management organizations (such as ARUP company), local, regional and global environmental organizations, and The

General Directorate of Highways stakeholders are in the medium level salience group and; Their Stakeholder salience ratios have been determined to be low, with 31.34, 30.71 and 29.61 points, respectively. Finally, although local resident (urban) communities, and press organizations have showed dangerous stakeholder characteristics, their characteristics have been in a very lowlevel salience group and their stakeholder salience ratios have been determined to be 0. In this sense, the fact that local resident (urban) communities shows dangerous stakeholder characteristics at a very low level and the salience rate is 0 can be explained by Borusan Port's good relations with local residents and urban communities.

Table 31: Dangerous Stakeholder List of Borusan Port in Terms of Operational and Trade Activities.

<i>Dangerous Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Maritime Insurance Companies</i>	Very High	66,67
<i>General Directorate of Customs</i>	Very High	66,67
<i>General Directorate of Customs Enforcement</i>	Very High	66,67
<i>Banks and Other Financial Institutions</i>	High	52,07
<i>Infrastructure - Superstructure Project Management Organizations (such as ARUP company)</i>	Moderate	31,34
<i>Local, Regional and Global Environmental Organizations</i>	Moderate	30,71
<i>The General Directorate of Highways</i>	Moderate	29,61
<i>Local Resident (Urban) Communities</i>	Very Low	0
<i>Press Organizations</i>	Very Low	0

In fact, it is thought that the port's efforts in seashore and bottom cleaning and the on-the-job training and employment-oriented activities of the Gemlik Vocational Technical Anatolian High School have made positive contributions. This situation coincides with the findings obtained in the SOI evaluation. Although it is accepted that Press Organizations have dangerous stakeholder characteristics, it can be interpreted that the fact that this dangerous stakeholder structure is not evident in Borusan Port is due to the fact that the activities and all kinds of practices carried out by the port are well covered in the press and it is seen as a good institution by the

press and broadcasting organizations. In addition, as stated in the strategy objectives of Borusan Port, it can be stated that the port does not show a political identity and is neutral to all kinds of political formations.

Dominant stakeholders in terms of operational and commercial activities

-Considering the operational and commercial activities of Borusan Port, it has been determined that there are 14 structures whose stakeholder class (salience profile) is the dominant stakeholder.

Table 32: Dominant Stakeholder List of Borusan Port in Terms of Operational And Trade Activities

<i>Dominant Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Shareholders</i>	Very High	66,67
<i>Other Ports in the Region</i>	Very High	66,67
<i>Industrial Establishments in the Port Hinterland (Land area)</i>	Very High	66,67
<i>Ro-Ro Line Operators</i>	Very High	66,67
<i>Exporters</i>	Very High	66,67
<i>The Ministry of Transport and Infrastructure</i>	Very High	66,67
<i>The Ministry of Labor and Social Security</i>	Very High	66,67
<i>The Ministry of Energy And Natural Resources</i>	Very High	66,67
<i>The Directorate General of Coastal Safety</i>	Very High	66,67
<i>Employees</i>	High	52,28
<i>Port Authority</i>	High	48,92
<i>Turkish Coast Guard Command</i>	High	46,82
<i>Central Government</i>	High	44,72
<i>Local Governments</i>	High	44,72

Shareholders, other ports in the region, industrial establishments in the port hinterland (Land area), Ro-Roline operators, exporters, The Ministry of Transport and Infrastructure, The Ministry of Labor and Social Security, The Ministry of Energy And Natural Resources, and The Directorate General of Coastal Safety are in the very high salience level group, but stakeholder salience rates have been determined to be at an average level of 66.67 points. Therefore, it can be stated that Borusan Port must be prepared for the dominance situations that these stakeholder structures will present due to their nature while carrying out its operational and

commercial activities, and they have to seriously take these stakeholder structures into consideration in their processes. Although employees, Port Authority, Turkish Coast Guard Command, Central Government, and Local Governments are in the high salience level group stakeholders; stakeholder salience rates are at an average level with 52.28, 48.92, 46.82, 44.72, 44.72 points, respectively. has been detected. The fact that employees are among the dominant stakeholders indicates that Borusan Port is employee-oriented and employees has an impact on the operational and commercial activities of Borusan Port.

Dormant stakeholders in terms of operational and commercial activities -

Considering the operational and commercial activities of Borusan Port, it has been determined that the stakeholder class (salience profile) is a dormant stakeholder structure. This stakeholder structure has been determined as general cargo / bulk cargo ship operators, whose stakeholder class salience level group is high.

Table 33: Dormant Stakeholder List of Borusan Port in Terms of Operational and Trade Activities

<i>Dormant Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>General Cargo / Bulk Cargo Ship Operators</i>	High	25,41

The fact that general cargo/bulk cargo operators have been identified as dormant stakeholders is due to the fact that these stakeholders have no power against Borusan Port, they remain as dormant stakeholder due to their need for the port. In this sense, since Borusan Port handles more of iron and steel cargo, wind turbines and other project cargo, it should be known that general cargo and bulk cargo ships visit the port frequently. Naturally, general cargo / bulk cargo ship operators are stakeholders that have to remain dormant due to the fact that wind turbine cargo owners or representatives for the port and other project cargo owners and representatives are definitive and dominant stakeholders for Borusan Port. In this regard, it can be stated that, as Borusan Port's good relations with the general cargo owners, general cargo / bulk cargo ship operators will be continue to be a dormant stakeholder of Borusan Port harmlessly.

Non-stakeholders in terms of operational and commercial activities -

Considering the operational and commercial activities of Borusan Port, 12 stakeholder structures have been identified, whose stakeholder class (salience profile) emerged as non-stakeholder. Although 7 of these stakeholders have the characteristics of some stakeholder classes, they are considered non-stakeholders since their stakeholder class salience scores are 0. It has been determined that universities, institutes and research centers and chambers of commerce are perceived as stakeholders with demanding stakeholder characteristics. In addition, it has been determined that Scientific and Technological Research Council of Turkey showed definite stakeholder characteristics, while local resident (urban) communities, and press organizations showed dangerous characteristics.

Table 34: Non-Stakeholder List of Borusan Port in Terms of Operational and Trade Activities

<i>Non- Stakeholder List for Operational and Trade activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Universities</i>	Very Low	0
<i>Institutes and Research Centers</i>	Very Low	0
<i>Scientific and Technological Research Council of Türkiye</i>	Very Low	0
<i>Other Non-Governmental Organizations</i>	None	0
<i>Small and Medium Enterprises Development Organization of Türkiye (KOSGEB)</i>	None	0
<i>Local Resident (Urban) Communities</i>	Very Low	0
<i>Press Organizations</i>	Very Low	0
<i>Ship Chandlers and Supply Enterprises</i>	Very Low	0
<i>Chambers of Commerce</i>	Very Low	0
<i>Trade Unions</i>	None	0
<i>European Union Project Offices</i>	None	0
<i>Amateur/Commercial Fishing Vessels, Fishing Shelters</i>	None	0

However, these stakeholders are also considered non-stakeholders in terms of the operational and commercial activities of Borusan Port, since their salience rates have been determined as 0. Since all input variables (power, urgency, legitimacy) in other non-governmental organizations, Small and Medium Enterprises Development Organization of Türkiye (KOSGEB), trade unions, European Union project offices,

and amateur/commercial fishing vessels, fishing shelters are below 1.5, it is accepted that it is perceived as a non-stakeholder by stakeholder analysis participants.

3.6.4.2. Salience Level and Class of Stakeholders in Terms of the Sustainability and Innovation Activities of the Borusan Port

Considering the sustainability and innovation activities of Borusan Port, definitive, dependent, dangerous, dominant, demanding, discretionary stakeholders and non-stakeholders have been determined. Any dormant stakeholders have been identified in Borusan Port in terms of sustainability and innovation activities. This situation points to an important element in terms of the stakeholder management capabilities of the port, considering the sustainability and innovation activities of Borusan Port. The fact that the port does not have dormant stakeholders regarding the areas of sustainability and innovation activities is an indication that it has well determined the stakeholder classes in sustainability and innovation activities. Under this title, stakeholder findings regarding sustainability and innovation activities will be presented respectively.

Definitive stakeholders in terms of sustainability and innovation activities

-Considering the sustainability and innovation activities of Borusan Port, it has been determined that there are 19 structures whose stakeholder class (salience profile) is a definite stakeholder. What is noteworthy here is that the salience rate of management and board members has been 100 full points. In addition, Ro-Roline operators and wind turbine manufacturers are two other definitive stakeholder structures whose stakeholder class salience rate is determined as 100 full points. In the findings obtained in the Borusan Port SOI evaluation study, it has been determined that SOI activities are supported by the senior management and the board of directors and that the directives of the senior management and the board of directors are taken into account in sustainability and innovation activities.

Stakeholder analysis findings have given supportive results, in terms of the influence of top management and the board of directors on sustainability and innovation activities. It has been confirmed that senior management and the board of directors are effective in evaluating SOI. The banks and other financial institutions

salience ratio has been determined as a definitive stakeholder with 100 full points. In this sense, participants in the Borusan Port SOI evaluation study have stated that ROI is seen as an important performance indicator in identifying and selection of candidate SOI activities. The view that this finding regarding financial institutions and supports of financial institutions are meaningful has also been supported in the SOI analysis. The banks and other financial institutions has been identified as a definitive stakeholder in the stakeholder analysis, as financial resources are considered important for the realization of sustainability and innovation activities.

Table 35: Definitive Stakeholder List of Borusan Port in Terms of Sustainability and Innovation Activities

<i>Definitive Stakeholder List for Sustainability and Innovation activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Management</i>	Very High	100
<i>Board Members</i>	Very High	100
<i>Banks and Other Financial Institutions</i>	Very High	100
<i>Ro-Ro Line Operators</i>	Very High	100
<i>Wind Turbine Manufacturers</i>	Very High	100
<i>International Maritime Organization (IMO)</i>	High	77,48
<i>Importers</i>	High	68,35
<i>The Ministry of Environment, Urbanization And Climate Change</i>	High	67,09
<i>Maritime Insurance Companies</i>	Moderate	45,59
<i>The Ministry of Trade</i>	Moderate	44,41
<i>The Ministry of Industry And Technology</i>	Moderate	44,41
<i>The Ministry of Energy And Natural Resources</i>	Moderate	44,41
<i>General Directorate of Customs</i>	Moderate	40,87
<i>General Directorate of Customs enforcement</i>	Moderate	40,87
<i>Scientific and Technological Research Council of Türkiye</i>	Moderate	40,87
<i>Forwarders</i>	Low	26,77
<i>Inner or Outside Port Waste Acceptance Facilities</i>	Low	26,61
<i>The Ministry of Interior*</i>	Low	24,88
<i>Other Non-Governmental Organizations</i>	Low	24,09

International Maritime Organization (IMO), importers, The Ministry of Environment, Urbanization And Climate Change stakeholder class salience level groups have been determined to be high, and stakeholder profile salience rates have been determined as 77.48, 68.35 and 67.09, respectively. IMO is an organization that provides consultancy services regarding maritime trade to regulatory bodies such as the United Nations. In this sense, while it is expected to be seen as discretionary regarding the stakeholder literature, the fact that IMO has emerged as a definite stakeholder, according to Borusan Port top and middle level management employees, may be due to the port's monitoring and compliance with the relevant regulations in terms of carrying out sustainability and innovation activities. It is thought that the fact that The Ministry of Environment, Urbanization And Climate Change has a similar stakeholder class salience score may be due to the sensitivity of Borusan port regarding the field of the relevant ministry. The stakeholder class salience level groups of Maritime Insurance Companies, The Ministry of Trade, The Ministry of Industry and Technology, The Ministry of Energy And Natural Resources, General Directorate of Customs, General Directorate of Customs enforcement, and Scientific and Technological Research Council of Turkey have been determined to be moderate. However, the stakeholder profile salience rates of these relevant stakeholder structures are below 50 points. However, since Borusan Port's sustainability and innovation activities must be compatible with these stakeholder structures, it is thought to have been taken place in the findings as a moderate level definitive stakeholders as a stakeholder profile. For example, the port must be safe and secure in terms of innovation activities, insurance and risk activities considering the Maritime insurance companies. The stakeholder class salience level groups of forwarders, inner or outside port waste acceptance facilities, The Ministry of Interior, and other non-governmental organizations have been determined to be low.

*In particular, the fact that the Ministry of Internal Affairs has been identified as the definitive stakeholder for the port's operational processes and SOI processes supports the literature. It is an expected result that an important body of the central government will become a definitive stakeholder with very high salience ratio (Rogene et al., 2004: 148). However, when the situation that the Ministry of Internal Affairs, which is determined as the definitive stakeholder, is determined to have a

low level of salience in terms of sustainability and innovation activities. It is also an expected result that the port shows a low level of clarity on sustainability and innovation activities in accordance with the job description of the relevant Ministry. In this sense, it has been determined that the power of the Ministry of Internal Affairs over Borusan Port is realized through the operational and commercial activities of the port with a 100 score of stakeholder salience level. In summary, since the Ministry of Internal Affairs is very clearly involved in the operational and commercial activities of Borusan Port, the Ministry of Internal Affairs may also intervene in the port's SOI activities in accordance with the Ministry of Internal Affairs job description. However, it is not directly effective in SOI activities of Borusan Port.

Dangerous Stakeholders in Terms of Sustainability And Innovation Activities -Considering the port's sustainability and innovation activities, the stakeholder class salience level groups of other ports in the region and other 3rd and 4th party logistics service providers have been determined to be moderate level.

Table 36: Dangerous Stakeholder List of Borusan Port in Terms of Sustainability and Innovation Activities

<i>Dangerous Stakeholder List for Sustainability and Innovation activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Other Ports in the Region</i>	<i>Moderate</i>	29,29
<i>Other 3rd and 4th Party Logistics Service Providers</i>	<i>Moderate</i>	27,24

However, it can be stated that their impact on the Port is very low since the stakeholder profile salience rates are below 30 points. In addition, even though The General Directorate of Highways shows dangerous stakeholder characteristics, It has been detected as very low in terms of salience level group, and it has been accepted as a non-stakeholder in the sustainability and innovation activities since its salience ratio is 0 points.

Dominant stakeholders in terms of sustainability and innovation activities -Considering the Borusan Port's sustainability and innovation activities, the stakeholder class salience level group of container line operators has been determined to be very high. The stakeholder class salience groups of employees,

shareholders, wind turbine cargo owners or representatives, major port operators overseas, The Ministry of Transport and Infrastructure, industrial establishments in the port hinterland (land area), and other project cargo owners or representatives have been identified as high level. Although the stakeholder class salience level group of general cargo / bulk cargo ship operators, Central Government, Local Governments, Port Authority, classification and survey societies or representatives, overseas transshipment port operators, and The Ministry of Treasury and Finance have been determined as moderate level, salience ratio of them have been detected as below 30 points.

Table 37: Dominant Stakeholder List of Borusan Port in Terms of Sustainability and Innovation Activities

<i>Dominant Stakeholder List for Sustainability and Innovation activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Container Line Operators</i>	Very High	65,88
<i>Employees</i>	High	51,65
<i>Shareholders</i>	High	47,87
<i>Wind Turbine Cargo Owners or Representatives</i>	High	47,66
<i>Major Port Operators Overseas</i>	High	46,40
<i>The Ministry of Transport and Infrastructure</i>	High	45,35
<i>Industrial Establishments in the Port Hinterland (Land area)</i>	High	44,72
<i>Other Project Cargo Owners or Representatives</i>	High	42,62
<i>General Cargo / Bulk Cargo Ship Operators</i>	Moderate	29,45
<i>Central Government</i>	Moderate	29,45
<i>Local Governments</i>	Moderate	29,45
<i>Port Authority</i>	Moderate	29,29
<i>Classification and Survey Societies or Representatives</i>	Moderate	28,50
<i>Overseas Transshipment Port Operators</i>	Moderate	27,87
<i>The Ministry of Treasury And Finance</i>	Moderate	26,93
<i>Port Suppliers</i>	Low	17,32
<i>The Ministry of Labor and Social Security</i>	Low	17,22
<i>The Ministry of Health</i>	Low	17,22
<i>The Ministry of Foreign Affairs</i>	Low	16,80
<i>The Directorate General of Coastal Safety</i>	Low	16,80
<i>Ship Agents</i>	Low	16,38

Also, the stakeholder class salience level group of the other 6 stakeholder structures, including port suppliers, have been determined to be low in terms of sustainability and innovation activities.

Demanding stakeholders in terms of sustainability and innovation activities -The stakeholder profile salience levels of the stakeholder structures as seen on Table 37 have been determined as displaying demanding characteristics. Also, the salience ratio of them has been detected as being low. Additionally, institutes and research centers have been considered as being non-stakeholders in terms of sustainability and innovation activities since their salience ratio are 0.

Table 38: Demanding Stakeholder List of Borusan Port in Terms of Sustainability and Innovation Activities

<i>Demanding Stakeholder List for Sustainability and Innovation activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Local Resident (Urban) Communities</i>	Low	8,56
<i>Infrastructure - Superstructure Project Management Organizations (such as ARUP company)</i>	Low	8,35
<i>Institutes and Research Centers</i>	Very Low	0

Discretionary stakeholders in terms of sustainability and innovation Activities - Considering sustainability and innovation activities of Borusan Port, exporters, and Port Operators Association of Türkiye (Turklim) has been identified as discretionary stakeholders whose stakeholder profiles have a high salience ratio. Additionally, the salience ratio of these stakeholder structures has been determined to be below 30 points.

Table 39: Discretionary Stakeholder List of Borusan Port in Terms of Sustainability and Innovation Activities

<i>Discretionary Stakeholder List for Sustainability and Innovation activities</i>	<i>Stakeholder Class Salience Level Group</i>	<i>Stakeholder Profile Salience Ratio</i>
<i>Exporters</i>	High	25,72
<i>Port Operators Association of Türkiye (Turklim)</i>	High	22,26
<i>Institutes and Research Centers</i>	Very Low	0

However, as stated by Participant R-1 in the Borusan Port SOI evaluation study conducted after the stakeholder analysis, “Port Operators Association of Türkiye (Turklım) serves as a sharing platform for member ports regarding improvement and development areas”. Although the general salience rate among all stakeholders is relatively low for discretionary stakeholders, it has been observed that the views of Participant R-1 in SOI assessment have been also supported and confirmed in the stakeholder analysis, with the stakeholder class salience level group being high. Participant R-1, in the SOI assessment interview, have stated that export customers in some sectors are discretionary for the port. Participant R-1 also has stated that Turklım provides optional advantages for ports for information exchange and identification of development opportunities. In addition, the stakeholder analysis was conducted before the interview. The findings of the stakeholder analysis have been reveals the reliability of the study.

Non-stakeholders in terms of sustainability and innovation activities - General Directorate of State Hydraulic Works, ship/cargo brokers ship and container repair and maintenance enterprises, press organizations, Turkish Coast Guard Command, Small and Medium Enterprises Development Organization of Türkiye (KOSGEB), road transport companies, universities, trade unions, European Union project offices, Turkish Industry & Business Association, Chambers of Commerce, pilotage and towage enterprises, ship chandlers and supply enterprises, and amateur/commercial fishing vessels, fishing shelters have been detected as non-stakeholder in terms of sustainability and innovation activities of Borusan Port.

3.7. METHODOLOGY FOR THE EMISSION CALCULATION OCCURRED BY THE PORT’S HANDLING ACTIVITIES AND SHIP CALLING

According to the United Nations Conference on Trade and Development (Unctad-RMT, 2018), maritime trade constitutes a significant proportion, ranging from 80% to 90% of the overall transportation of international trade worldwide. According to the International Maritime Organization (IMO, 2021), there was a 9.6% increase in greenhouse gas (GHG) emissions from worldwide shipping, which includes both international and domestic shipping, as well as fishing operations.

These emissions rose from 977 million tons in 2012 to 1.076 million tons in 2018. The emissions emerging from the exhaust systems of ships and port operations are a noteworthy factor in the increasing of atmospheric contamination. Consequently, this phenomenon creates adverse consequences for human well-being, manifesting in premature mortality, as well as for the ecosystem, resulting in acidification (Hassellöv et al., 2013: 2731). Therefore, emission control and reduction efforts of coastal and port facilities are important for Türkiye as well as the as well as other countries of the world. In this sense, taking preventive measures to observe and reduce emission formation in the port areas of the Gemlik Gulf, which includes 5 ports including Borusan Port, and calculating the impact of these measures have become important in terms of sustainability. The Emission gap report of UNEP (2022) has emphasized the importance of reducing emissions, stating that businesses should reduce their carbon emissions by 45% by 2030. These reduction requirements are 55% according to fit for 55 program of EU commission by 2030 (EU, 2021). Also it is aimed to completely eliminate the amount of emissions as being net zero by 2050.(IMO, 2021). Additionally, the implementation of emission reduction strategies are SOI applications in themselves, as they involve preventive innovations. As Rogers (2002: 991) stated, preventive innovations include new ideas that require taking action at a certain time to avoid undesirable consequences in the future. In this respect, preventive innovations are the basis of sustainability-oriented innovations. Borusan Port has gradually started to implement emission reduction strategies since 2020 according to Borusan Holding Report (2022). In this sense, the emission reduction strategies made by Borusan Port stand out as a practice that concerns all of Borusan Holding's climate, people and innovation themes. Therefore, in this dissertation, which is based on the implementation of sustainability-oriented innovations in ports, it has been deemed necessary to determine the capabilities provided by SOI applications for sustainable port operation efficiency by applying emission reduction strategies in port operations.

3.7.1. The Emission Literature in the Context of Ports and Vessels

The second analysis carried out within the scope of this doctoral thesis has been based on the emission calculation of Borusan Port operations and ships calling the Borusan Port. CO₂ and other greenhouse gas emissions resulting from port operations and ships in ports cause serious consequences, primarily in terms of environmental sustainability and economic sustainability. As a result of ships calling at ports, many stakeholders in maritime and international trade interact (Notteboom and Winkelmanns, 2002: 3). These many stakeholders interact and cause greenhouse gas emissions as a result of operational activities, which also causes serious pollution for the settlements where the ports are located (Wang et al., 2023: 1). In this sense, it is clear that any application to reduce emissions in the execution of port operations, including port-city interaction, can be achieved with stakeholders who will handle sustainability from an innovative perspective (Carpenter and Lozano, 2020: 37-45; Kong and Liu, 2021: 4). For this reason, as the general research model is shown in Figure 33, in this research, port operations emission calculations have been made, which will reveal another environmentally important aspect of SOI applications in ports. In addition, the partial practices of Borusan Port in reducing emissions have been identified in the SOI assessment meeting held with the port authorities and in the port's 2022 activity report. The sensitivity level of the emission reduction that will be achieved if the identified emission reduction strategies are fully implemented has been revealed.

In general, decarbonization strategies are discussed in four basic parts. These are energy efficiency applications, industrial electrification, the using of low-carbon fuels, feedstocks, and energy sources; carbon capture, utilization, and storage. (Cresko et al., 2022: 10-21; Sundaramoorthy et al., 2023: 3). Along with these four basic strategies, the European Union Commission considers three more strategies: mobility, circular economy, smart network infrastructure and interconnections (European Commission, 2019: 6). These basic decarbonization strategies are shaped according to the dynamics of each sector (Cresko et al., 2022: 10-21). Port management plays an important role in the maritime industry's decarbonisation agenda. In addition, there are generally high greenhouse gas (GHG) emissions

resulting from the complex structure of the industries operating in port areas (cement, electricity, iron and steel, aluminum, and fertilizer sector) (EU, 2023). These industries create a great potential to significantly reduce emissions in the ports where they are located and to receive assistance from the ports in the transition to clean energy. In this sense, according to the European Union Green Deal, it is aimed to reduce emissions in EU port cities by 90% by 2050 (Eit InnoEnergy, 2022: 3-5). Therefore, it seems that Borusan Port's implementation of emission reduction strategies is an important issue. In addition, the electrical energy needs of the ships calling at the port during their hoteling have been determined. A greenhouse gas (GHG) strategy by the International Maritime Organization (IMO) aims to reduce the carbon intensity of the shipping sector by up to 40% by 2030 and 70% by 2050 compared to 2008 levels. Additionally, at the United Nations Climate Change Conference in 2021, a 100% emission reduction has been determined globally across sectors by 2050 (Aakko-Saksa et al., 2023: 1). Waterway transportation activities are an important element of air pollution in coastal cities caused by ship emissions (Chen et al., 2018b: 191).

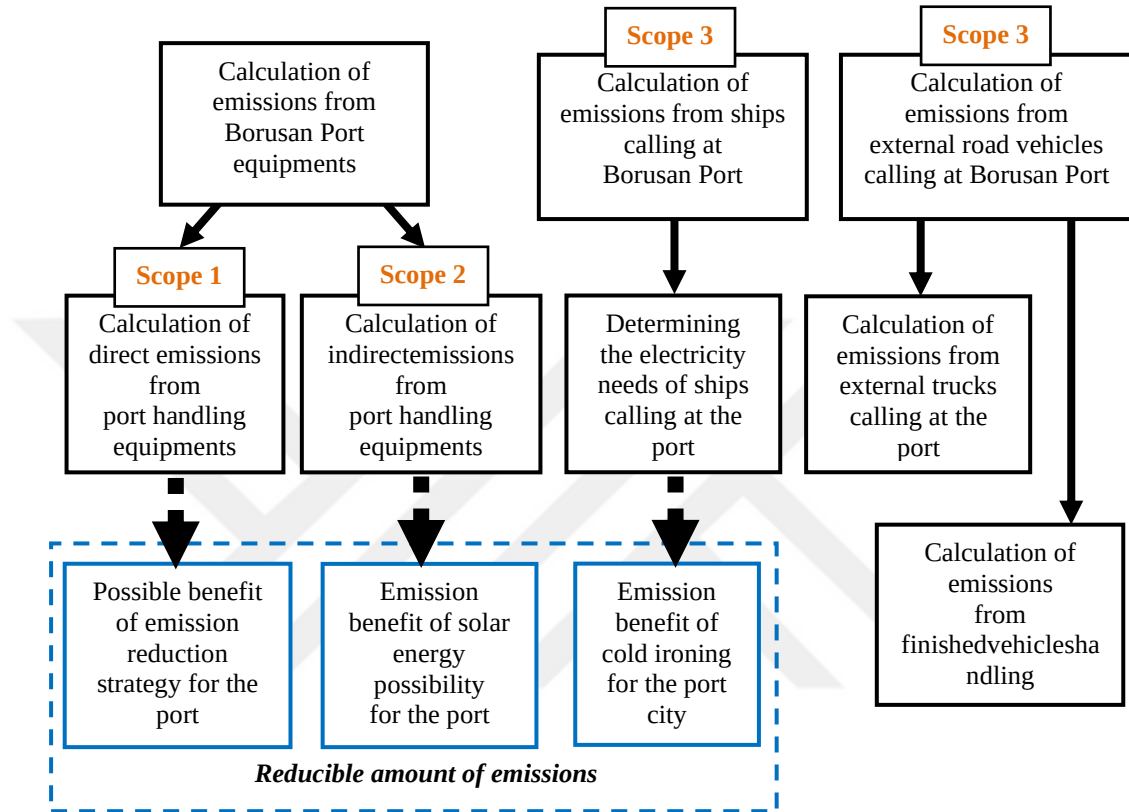
3.7.2. The Research Model for the Emission Calculation in the Context of Ports and Vessels

In calculating the emissions resulting from port operations and calling ships, data obtained from Borusan port's publicly available activity reports, interviews with port officials, and calling ship data received in accordance with the Port's privacy policy, and energy and fuel usage data of the port's equipment are used. The relationship between the emission calculations made and the purposes of their calculations are shown in Figure 38. It has been determined how much electrical energy capacity the ships will need if this electrical energy is provided by cold ironing technology through the port facility with grid connection or renewable energy support. Global shipping is responsible for approximately 24% of all CO₂ emissions, and maritime shipping accounts for 10% of total transport emissions. In this sense, it will be imperative for ports to help facilitate the transition of shipping vessels to clean energy. Ports facilitate this transition of ships to clean energy with

cold ironing technology (Eit InnoEnergy, 2022: 5). However, cold ironing technology is not yet mandatory for use all over the world. In this sense, the European Union has introduced a 0.1% sulfur limit for the fuel of ships berthing in all European ports for more than 2 hours as of January 2010. It has been announced that the same obligation applies to ships navigating in inland waters (EU Commission, 2005). In addition, with the decision taken by IMO, the upper limit of sulfur in the fuel used in ships has been reduced from 3.5% to 0.5% as of January 2020 outside of the emission control areas (ECA). This ratio has been reduced to 0.1% in emission control areas. This ratio has been reduced to 0.1% in emission control areas. Naturally, ships now have to pay attention to these ratios when using fuel and scrubber in ECA (MEPC 70, 28/2016). In response to this EU regulation, because of the high electricity price, shipowners have started using ultra-low sulfur marine gas oil (MGO) instead of using shore-based electricity. Some Shipowners have installed scrubber systems that reduce SO₂ and Particular Matter in the exhaust gas on their ships in order to continue using heavy fuel oil (HFO). In summary, ships must either use more environmentally friendly but expensive fuel in the port or be retrofitted to receive shore power. At the same time, ports' decision to invest in cold ironing technology depends on factors such as emission reduction policies and the prevalence of this technology in calling ships. Considering the meaning of the term cold ironing, the term cold ironing refers to the historical practice of the cooling coal-fired engines while the ship was docked in port (Zis, 2019: 83). Additionally, for confidentiality reasons, the energy consumption rates per equipment resulting from the port's equipment use have been used only for emission calculations. These ratios have been used in a way that cannot be determined from the calculation results. So, the amount of emissions resulting from Borusan Port and the ships calling at the port and the amount of emissions that will be prevented if emission reduction strategies are implemented have been determined. Thus, what needs to be done for net zero emissions at Borusan Port has been determined. In this dissertation, first of all, the emission reduction strategy implemented by Borusan port in its operational equipment was taken into account in terms of emission reduction. In this sense, a fuel catalyst system has been installed on some equipment in the port machinery park. In

this way, a 15% improvement in emission efficiency has been achieved (Borusan Holding Report, 2022: 73).

Figure 38: The Research Model for the Emission Calculation Based on Borusan Port and Ships Callings



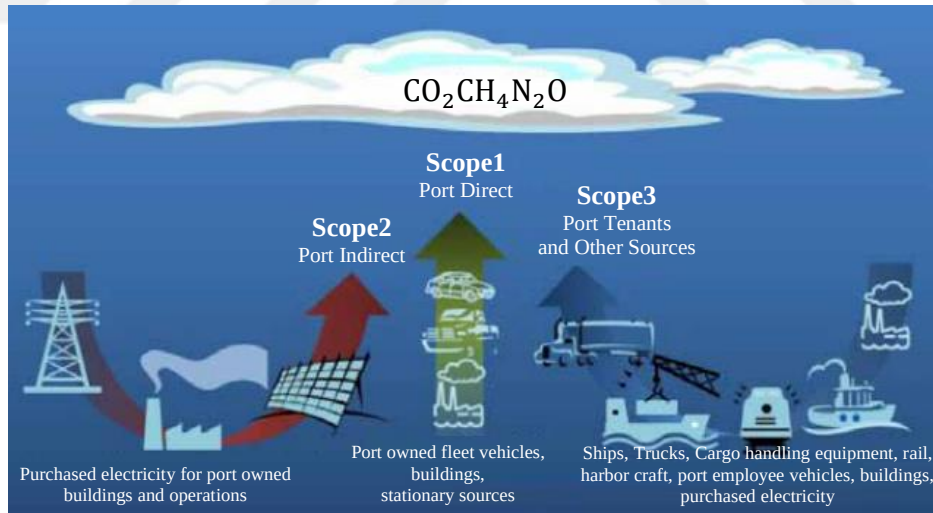
The emission improvement that would be achieved if a fuel catalyst system was installed in all internal combustion field equipment of the port has been calculated. Another issue regarding reducing the amount of emissions in ports is to meet the energy needs of the port and, if possible, the ships at the berth, through renewable energy (Bakar et al., 2022: 12). The total solar energy potential of the port has been determined due to the possible effects of the solar roof project, which will be partially operational on an area of 3000 m² by Borusan Port in 2023. Another emission element in port areas is the emission resulting from the finished vehicles handled and the 3-party trucks entering and exiting the port (Chelsea, 2015: 8870). In addition, emissions from trucks and terminal tractors carrying trailers and heavy machinery brought to and from the port at Ro-Ro terminals should also be taken into account (Gonzales, 2023: 10). At this point, only finished vehicle handling

operations at Borusan Port Ro-Ro terminal are taken into account since, only finished passenger cars, commercial vehicles and heavy construction equipment are handled at Borusan Port.

3.7.3. Design of the Emission Calculation Analysis

The carbon perspective necessitates an examination of the relationship between the administrative authority of a port and its operational terminals, since this link plays a crucial role in categorizing the sources of various activities. Greenhouse gas emissions sources are subject to distinct treatment in the context of inventories, as compared to other forms of air pollutants. Several greenhouse gas quantification methodologies suggest that emissions-producing activities should be classified into three groups, referred to as “scopes”, largely depending on the ownership or control of the sources (GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 5).

Figure 39: Port-Related GHG Emissions Sources by Scope



Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 5.

In calculating the emissions resulting from Borusan Port operations and ships calling at the port, Port emission toolkit guide no.1 and guide no.2, jointly developed by GEF, UNDP, IMO, GloMEEP Project, and IAPH, have been taken into account.

The emission measurement approach in this guide has been validated at the Port of Los Angeles and the Port of Long Beach. Lists of Acceptance values and emission factors taken into account for measurement are included in the appendix 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27. Before moving on to the sample and findings of the research, in this part of the emission calculation, it has been mentioned how some acceptance values in the literature are included in the equations to make the calculations. In addition, the emission factors used in measuring ship and port-related emissions in ports have been explained for different operational processes and equipment as used in this study.

Table 40: Global Warming Potential of GHG Gases Considering in This Study

<i>Green House Gases</i>	<i>Global Warming Potential</i>
CO₂	1
CH₄	25
N₂O	298

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018: 25.

Gases whose coefficients are given in Table 40 are taken into account in the emission calculation. As seen in the table, when CO₂ is taken into account, CH₄ is 25 times more harmful and N₂O is 298 times more harmful (UNEP, 2022). The reason why the greenhouse gas emissions of the gases in the table are taken into account in the research is that the port in which the research has been conducted took only these three gases into account in its own calculations.

3.7.3.1. Vessel Based Emission Calculation

Maritime transport is responsible for 10% of global transport energy demand. This situation has brought to the fore the vessels that share the leading role in maritime transportation with ports (Balcombe et al., 2019: 72). The constraints set by the European Union Commission and other international structures to achieve the net zero emission target by 2050 also require implementing decarbonization strategies to both measure and reduce emissions from ships (Aakko-Saksa et al., 2023: 1). At this

point, the first three options emerge. It can be summarized as using low sulfur fuel, using a scrubber system and using new fuel sources such as hydrogen, methanol and biofuel (MEPC 70, 28/2016). Another decarbonization strategy to prevent ship-related emissions is the establishment of a cold ironing system by ports that will meet the energy of ships in the port (Zis, 2019: 83). Calculation of the emissions from ships calling at the port is handled within scope 3. In other words, it can be expressed as emissions originating from the parties that are related to the port but not its own means (GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 5). In ports, ship-related emissions are calculated based on the emissions that occur while the ship is at anchor, the emissions during arrival and departure maneuverings, and the emissions that occur while the ship is at the dock (IMO, 2021: 62). Generally, emissions are estimated as ship power demand, or energy used expressed in kWh, multiplied by an emission factor; where the emission factor is expressed in grams per kilowatt-hour (g/kWh). This emission calculation is a general calculation used for the ship's transit, maneuvering, anchorage and hoteling operations (GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39).

Table 41: General Emission Equation Table

$$(1) \quad \text{Emission}_i = \text{Energy Requirement}_i \times \text{EF} \times \text{FCF} \times \text{CF}$$

- i : transit, anchoring, maneuvering or hoteling operation mode.
 - Emission_i : emission in operation mode i .
 - EF: Emission factor, expressed in terms of gr/kwh, related to engine type, standards, and fuel used.
 - FCF: Fuel correction factor.
 - CF: control factors for Emission reduction technologies.
-

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

Equation (1) above is essentially the calculation to be taken as basis for all emission calculations. In calculating ship emissions, calculations are made using this equation and the ship's main engine and auxiliary engine power and energy/fuel requirements constraints. The emission factor enables the determination of various air pollutants and greenhouse gases generated by the energy consumption per kW/h

of the main machine and auxiliary machines in different production generations. Emission factors are located in Appendix 18 and 19. The relevant emission factors are taken from the port emission toolkit guide no.1 (2018) based on the Third IMO Greenhouse Gas Study 2014 annex 6 (IMO, 2015). Fuel correction factor refers to the correction required for the sulfur rate of the fuel used. The emission factors in Appendix 18 and 19 are acceptance values given for fuel containing 2.7% sulfur. As it has become mandatory to use fuels with a sulfur content of at most 0.5% on ships as of January 1, 2020, with the decision numbered MEPC 280(70) of the International Maritime Organization (IMO) Marine Environment Protection Committee. These values are based on the fuel correction factor for the emission factors in Appendix 19 and 20, after a 0.5% sulfur correction was applied and the emission calculation has been made. The variables in equation (1) above have been calculated in equations (2), (3) and (4) below and included in the emission calculation equation (1). Thus, the emissions created by all ships calling at Borusan Port during entry and exit maneuvers and hoteling in the port have been calculated.

Table 42: General Energy Requirement Equation Table

(2) $\text{Energy Requirement}_i = \text{Load}_i \times \text{Activity}_i$

- $\text{Energy Requirement}_i$: energy demand by operation mode i, kWh.
 - Load_i : maximum continuous rated (MCR) power times load factor (LF) for propulsion engine power, kW; reported operational load of the auxiliary engine(s), by mode i, kW; or operational load of the auxiliary boiler, by mode i, kW.
 - Activity_i : activity for mode i, hours
-

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

Equation (2) above is used for the energy/fuel needs of the main engine and auxiliary machines in different operations. Maximum continuously rated power(MCRP) is the highest power level specified by the manufacturer for the main machine and auxiliary machines. Load factor (LF) is obtained by dividing the speed of the main machine at the time of operation by the maximum speed, as seen in

equation (3) below. Additionally, in ENTEC (2010) and GLEC (2018), load factors for slow, medium speed and high speed are given as fixed values. In this thesis study, these acceptance values for load factor have been taken into consideration. In Appendix 21, emission factors for ship types and ship sizes calling at Borusan port, main engine and auxiliary engines' port arrival and departure maneuvers, and hoteling in the port are given.

Table 43: Load Factor and Activity Equation Table

(3)	Load Factor _i =	$\frac{\text{Speed}_{actual}}{\text{Speed}_{maximum}}$
(4)	Activity _i =	$\frac{D_i}{\text{Speed}_i}$
• Activity_i : activity, hours. • D_i : distance travelled in operation mode i, nautical miles. • Speed_i : actual ship speed in mode i, knots. • Speed_{maximum} : maximum speed of ship in mode i, knots.		

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

3.7.3.2. Port Equipments' Operation Based Emission Calculation

Due to the increasing fuel and energy consumption (e.g. fossil fuels) resulting from port operations, CO₂ emissions caused by cargo handling equipment have become a serious problem (Yun et al., 2018: 288). Most of the current energy flows directly related to the port come from the electricity and fuel used in the port's equipment. Electricity is currently used mostly to power the port's buildings, lighting, and equipment; A smaller portion is allocated to shore-to-ship energy. However, as environmental regulations tighten, shore power supply to ships is expected to increase significantly. It is also possible to use ancillary data to conclude that there is a significant flow of fossil fuels that are sold to trucks passing through the port and used to refuel ships. Although not currently directly connected to the port, it should be monitored as current energy flows are likely to evolve with the adoption of

alternative fuels in both the road and maritime transport industry in the near future (Gonzales, 2023: i). In addition, calculating emission formation is also important in terms of directing sustainability-oriented innovation activities related to greening activities (Guzman-Urbina et al., 2022: 1). Based on this, Borusan Port equipment emissions were calculated since calculating port emissions can also help the decision-making mechanism in coming up with SOI solutions for the sector. To calculate the emissions resulting from the use of port equipment, the emission calculation equations resulting from ships can be used in a similar way for port equipment. However, emission calculations have been made based on equipment and terminal-based fuel and electrical energy usage data received from Borusan Port. In this dissertation, port equipment emissions have been calculated through fuel and energy data and emission factors per operation and equipment, without using equations containing load factor and fuel correction factor.

Table 44: Emission Equation Considered in the Analysis

(5) $\text{Emission}_i = \text{Energy or fuel requirement}_i \times \text{EF}_{\text{electric or diesel, fuel oil}}$
• Emission_i : emission amount for each equipment (tCO₂-e). • $\text{Energy or fuel requirement}_i$: the amount of energy or fuel used by each piece of equipment in different amounts in all operations (kw/h or lt/h). • $\text{EF}_{\text{diesel or other fuel}}$: emission factors for diesel-fueled port equipment are included in Appendix 22, and • $\text{EF}_{\text{electric}}$: emission factor created by electrical energy provided from the grid for electric port equipment is included in Appendix 23.

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

3.7.3.3. The Emission Calculation Based on Ro-Ro Terminal Operation

The main equipment used in Ro-Ro ports are terminal tractors, which enable the movement of trailers between the ship and the apron, and reach stackers, which enable the transfer of trailers to the railway connection (Gonzales, 2023: 10). However, there is no railway connection at Borusan Port Ro-Ro terminal. Only finished passenger vehicles and heavy vehicles such as locomotives, trucks,

construction equipment and military vehicles are handled. Some of the heavy vehicles move between the apron and Ro-Ro ships with their own means, while the other part is handled by terminal tractors. Finished passenger cars and light commercial vehicles move between the apron and the ship by their own means. Third party trucks are used to deliver finished vehicles to and from the port via highway.

Within the scope of the research, for the emission rates resulting from the vehicles handled at Borusan Port Ro-Ro terminal, the distance of the geographical parking locations of these vehicles in the port parking area to the Ro-Ro ramp and the passenger vehicles' exhaust emission norms are seen in Appendix 25. Assuming that all handled vehicles are passenger cars, emissions resulting from vehicles handled at Borusan Port Ro-Ro terminal have been calculated. In addition, the emissions of trucks coming to the port for finished vehicle handling have also been calculated within the scope of the study, taking into account the distance between the port entrance and RO-RO parking areas and heavy vehicle exhaust emission factors according to Appendix 22.

- Emissions occurring at the Ro-Ro terminal can be expressed as follows (Muravev et al. 2016: 288):
 - Emission amount from vehicle carrier ships calling at the terminal,
 - The amount of emissions resulting from the handling distance traveled by finished vehicles handled at the terminal between the Ro-Ro ramp and vehicle parking areas,
 - The amount of emissions resulting from the in-port distance of trucks that bring and take finished vehicles to the terminal by road.

Table 45:Emission Equation for Ro-Ro Terminal

(6)	$\text{Emission}_{\text{trucks in Ro-Ro terminal}} = \text{Distance}_{\text{trucks in Ro-Ro terminal}} \times \text{EF}_{\text{trucks}}$
• $\text{Emission}_{\text{trucks in Ro-Ro terminal}}$: emissions of trucks calling at the Ro-Ro terminal. • $\text{Distance}_{\text{trucks in Ro-Ro terminal}}$: distance traveled by trucks calling at the Ro-Ro terminal. • $\text{EF}_{\text{trucks}}$: truck emission factor with year in Appendix 24 (CO₂-e/km).	

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

The emission calculation in equation (6) above has been calculated separately for each vehicle parking area of the Ro-Ro terminal using equation (7) below (GEF-UNDP-IMO GloMEEP Project and IAPH, 2018: 55).

Table 46:Emission Equation for the Trucks calling to Ro-Ro Terminal

$$(7) \text{Emission}_{trucks \text{ for the each capacity of park area } i} = \text{Distance}_{trucks \text{ in Ro-Ro park area } i} \times \text{EF}_{trucks}$$

- $\text{Emission}_{trucks \text{ for the each capacity of park area } i}$: Emission amount for 5 different finished car parking areas, $i = \{1^{st}, 2^{nd}, 3^{rd}, 4^{th} \text{ and } 5^{th} \text{ park areas}\}$

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

As seen in Table 47 variable (a) has been determined by taking into account the capacities of each parking area as seen on google earth in relation with the data taken from Borusan Port. For example, the number of trucks carrying vehicles that can fill the capacity of parking area number 1 (column a in Table 47)has been calculated with the equation below.

Table 47:Ro-Ro Terminal Parking Area Information of Borusan Port

	(a)	*(b)	(c)
<i>Finished Car Park Area</i>	<i>Number of trucks required to fill parking spaces</i>	<i>Distance of parking areas to port gate (m)</i>	<i>Truck arriving and departing distance for each fill-unload capacity of Ro-Ro parking areas (km)</i>
1stPark Area	168	950	319,2
2ndPark Area	160	950	304
3rdPark Area	160	950	304
4thPark Area	250	700	350
5thPark Area	120	560	134,4

*According to distance measurement through Google Earth GIS.

According to Table 48, the routine use capacities and flexible capacities of the finished vehicle parking areas of the Ro-Ro terminal have been shown in

columns (e) and (f), respectively, taking into account the hatchback passenger vehicle sizes. The capacities in column (e) have been taken into account in the analyses.

Table 48: Finished Car Parking Capacity of Borusan Port

<i>(d)</i>	<i>*(e)</i>	<i>** (f)</i>
<i>Finished Car Park Area</i>	<i>Finished Car Routine Using Capacity</i>	<i>Finished Car Flexible Capacity</i>
<i>1st Park Area</i>	1.260	1350
<i>2nd Park Area</i>	1.200	1300
<i>3rd Park Area</i>	1.400	1500
<i>4th Park Area</i>	1.750	1850
<i>5th Park Area</i>	900	1000
<i>*It has been accepted that the finished vehicles handled receive storage services only in these five areas. But parking areas are used as flexible.</i>		
<i>**According to park areas capacities that used as flexible by Borusan Port.</i>		

Equation (8) above has been used to calculate the number of times the parking spaces will be filled, considering that each parking space at the Ro-Ro terminal is filled with finished vehicles handled in the relevant year. The calculation rates are given in Table 49.

Table 49:Equation for Ro-Ro Park Area Capacity Ratios

$$(8) \text{ Ratio of Vehicle handled to capacity}_{in\ 1st\ park\ area} = \frac{FVC_{in\ 1st\ park\ area}}{CT_{per\ transport}}$$

- Ratio of Vehicle handled to capacity_{in 1st park area} : It is the ratio required for a truck to fill the relevant Ro-Ro parking area and also it is value in the third row (f) of columns of Table 42,
- FVC_{in 1st park area} : It is finished vehicle capacity of 1st and other Ro-Ro park areas and it is the value in the first row of column of Table 41.
- CT_{per transport} : The capacity of a truck to carry hatchback cars at per transport has been accepted as 9 vehicles.

$$(9) \text{ Ratio}_{vehicle\ handling\ in\ year\ i} = VH_{in\ year\ i} \times VPC_{instant\ parking\ capacity\ in\ year\ i}$$

- Ratio_{vehicle handling in year i} : It is the ratio of yearly handled vehicles to instant parking area capacity.
 - VH_{in year i} : It is the volume of yearly finished car handling in Ro-Ro terminal of Borusan Port.
 - VPC_{instant parking capacity in year i} : It is the instant parking area capacity in Ro-Ro terminal of Borusan Port.
-

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 39.

In summary, the emission amount from ships calling at Borusan Port, the emission amount from trucks calling at the port's Ro-Ro and container terminals, and the emission amount from the port's operations and emission amount from the handled finished cars in Ro-Ro terminal are calculated based on acceptance values that listed in Appendix 16, 17, 18, 19, 20, 21, 22 and 23.

Table 50:Ro-Ro Terminal Finished Vehicle Handling Quantities and Parking Areas Capacity Ratios

	2022	2021	2020	2019
(d) Handled Finished Vehicles*	180.000	188.675	218.340	266.582
(e) Finished Vehicle Parking Capacity (number)*		6510		
(f) The ratio of finished vehicles handled in the relevant year to the finished vehicle parking areas capacity**				
1st Park Area				
2nd Park Area				
3rd Park Area	27,65	28,98	33,54	40,95
4th Park Area				
5th Park Area				
<i>*Borusan Port Public Reports; **Author</i>				

In addition, other values taken into account in the calculations are included in Table 40, 41, 42, 43 under this title. Additionally, 8 basic equations used for emission calculation are also included in this title. Other equations have been presented in related findings of emission calculation. Under the next title, emission findings have been presented after the periods, equipment and terminal information subject to emission calculation are explained.

3.7.4. Sampling for the Emission Calculation Analysis

In the emission calculation of ships docking at the port, the annual number of ships docking at Borusan port between 2019 and 2022 has been taken into account. In addition, the operations of three SSG (Ship to shore gantry) cranes, 8 E-RTG cranes, six Reach stackers, 14 units Light type terminal tractor, 11 units Heavy type terminal tractor, three mobile dock cranes, and nine overhead cranes used by Borusan Port in carrying out its operations have been taken into consideration as seen on Table 50.

Table 51: Terminals that used the Port Equipments

Port Equipment	Container Terminal	General Cargo Terminal
<i>SSG (Ship to Shore Gantry Crane)(3 units) (Electrical)</i>	✓	
<i>E-RTG(8 units) (Electrical)</i>	✓	
<i>Reach Stacker(6 units) (Diesel)</i>	✓	✓
<i>Light type terminal tractor LT(14 units) (Diesel)</i>	✓	✓
<i>Heavy type terminal tractor HT(11 units) (Diesel)</i>		✓
<i>Mobile Crane(3 units) (Electrical)</i>		✓
<i>Overhead Bridge Crane(9 units) (Electrical)</i>		✓

Source: Port Information Guide of Borusan Port

Among these equipment, SSG cranes and E-RTGs are used only in the container terminal of Borusan Port. E-RTG equipment at Borusan port was electrified between 2014-2016. In this way, carbon emissions decreased by 94% (Borusan Port Brochure, 2020: 4). This transformation implemented out by Borusan Port is a good example of the implementation of decarbonization strategies in ports (Acciaro et al., 2014a: 5; Balcombe et al., 2019: 85; Gonzales, 2023: 39-41). Mobile cranes, overhead cranes and Heavy type terminal tractors are used only in the general cargo terminal. Reach Stackers and light type terminal tractors are used in both the container terminal and general cargo terminal. The usage rates of the equipment in different terminals of Borusan Port have been taken into account in the calculation. However, these data have been used only in calculating the fuel and energy consumed and in calculating emissions. Data regarding the usage amounts of each equipment in the pier, bonded area and duty-free area in different terminals of Borusan port have not been shared due to confidentiality reasons. In addition, the port's finished vehicle and container handling data have also been used to calculate the emission rates from trucks entering and exiting the Port's container terminal and finished vehicles handled at the port. Also, the emission amounts resulting from trucks calling at the Ro-Ro and Container terminals have been calculated based on the number of finished vehicles and containers handled in the relevant years and the findings are presented under the relevant titles.

3.7.5. Findings of the Emission Calculation Analysis

Based on the model created for emission calculation, the findings regarding the emission values arising from the vessels arriving at Borusan Port and the amounts of electrical energy required by the ships during their stay in the port are presented, respectively. If it is necessary to install a cold ironing system at Borusan Port, the possible amount of electrical energy that the ships at the dock will need to receive through this system has been determined. In addition, the possible emissions created in the port area by trucks calling at the container terminal (Okşar, 2023: 1-2) of the port and the amount of emissions resulting from finished vehicles handled at the Ro-Ro terminal have been calculated (Gonzales, 2023: 31-35). Then, the amount of emissions resulting from the operations of Borusan port will be presented. In addition, the sensitivity level of the partial improvements made in the port's equipment and the emission reduction that the equipment will result in if the equipment is completely improved have been presented as a decarbonization scenario. Finally, findings regarding the possible solar energy capacity of Borusan port have been presented, since ports are suitable areas for the adaptation of solar renewable energy systems and decarbonization strategies (Acciaro et al., 2014a: 5; Balcombe et al., 2019: 85; Gonzales, 2023: 39-41).

3.7.5.1. Findings of the Emission Calculation Analysis Based on the Ships Callings to Borusan Port

Approximately 80% of the world's fleet is located close to land at all times, with 55% in port and 25% near the coast (ICCT, 2007: 24). Ships mostly use fuel-powered generators for their electrical energy needs when they are at anchor and at the docks out of cruising (NRDC, 2004: 8). In this sense, it is necessary to calculate the amount of emissions created by ships docking at the port and take relevant measures. The number of vessels calling at Borusan port and the arrival and departure maneuvers of these vessels and the time they spend in hoteling are calculated by taking into account the main engine and auxiliary engine sizes of the ships and their production generation as seen in Appendix 18, 19, 20, 21.

Table 52: Emission Amount and Electricity Needs of Ships Calling at Borusan Port

<i>Vessel Types' Situations</i>	<i>2022</i>	<i>2021</i>	<i>2020</i>	<i>2019</i>
Container Vessel				
<i>Ship calling</i>	412	481	518	555
<i>Arrival maneuvering emission*</i>	2.748,858	3.209,225	3.456,088	3.702,951
<i>Departure maneuvering emission*</i>	3.092,465	3.610,378	3.888,099	4.165,82
<i>Hoteling emission*</i>	1.959,078	2.287,176	2.463,112	2.639,049
<i>Hoteling Electricity needs**</i>	2.679.300	3.128.018	3.368.635	3.609.252
(kw)				
General Cargo/Bulk Vessel				
<i>Ship calling</i>	753	751	657	690
<i>Arrival maneuvering emission*</i>	258,9843	258,2965	225,9664	237,3163
<i>Departure maneuvering emission*</i>	528,4985	527,0948	461,1202	484,2815
<i>Hoteling emission*</i>	7.405,047	7.385,379	6.460,977	6.785,501
<i>Hoteling Electricity needs**</i>	10.127.391	10.100.492	8.836.249	9.280.079
(kw)				
Vehicle Carrier Vessel				
<i>Ship calling</i>	204	206	216	281
<i>Arrival maneuvering emission*</i>	317,1648	320,2742	335,8215	436,8789
<i>Departure maneuvering emission*</i>	370,0373	373,6651	391,8042	509,7083
<i>Hoteling emission*</i>	1.288,766	1.301,401	1.364,576	1.775,212
<i>Hoteling Electricity needs**</i>	1.762.560	1.779.840	1.866.240	2.427.840
(kw)				
TOTAL				
<i>Ship calling</i>	1.369	1.438	1.391	1.526
<i>Arrival maneuvering emission*</i>	3.325,007	3.787,796	4.017,876	4.377,146
<i>Departure maneuvering emission*</i>	3.991,001	4.511,138	4.741,023	5.159,81
<i>Hoteling emission*</i>	10.652,89	10.973,96	10.288,67	11.199,76
<i>TOTAL Vessel Emission*</i>	17.968,9	19.272,89	19.047,56	20.736,72
<i>TOTAL Vessel Electricity Needs**</i>	14.569.251	15.008.350	14.071.124	15.317.171
(kw)				
<i>*According to Scope 3 emission; **Note: Vessel Electricity requirement subject to scope 3 emission margin.</i>				

Accordingly, as seen in Table 52, the emission amounts of calling ships and the amount of electrical energy they need for hoteling have been determined. Also, it can be seen that the emissions resulting from ships docking at the port are very high. In addition, emissions resulting from the fuel consumed by ships for electricity during their stay in the port emerge as another serious environmental sustainability problem. The amount of emissions resulting from the electricity needs of ships in the Borusan Port calculated in this research coincides with the findings of Kılıç et al. (2020: 199)'s study that related to the ports of İskenderun Bay. In the study of Kılıç et al. (2020), it has been seen that the emissions per vessel coming to and leaving the berth, maneuvering and hoteling were 22,831 tons. Looking at Borusan Port, the relevant emission has been determined to be 13,125 tons for 2022. Here, the size of the ship's machinery and the duration of their stay in the port are effective (Kılıç et al., 2020: 197-199). Also, Ekmekçioğlu et al. (2019: 190) calculated the emissions from ships calling at İzmir Alsancak Port and Mersin MIP Port between 2017-2018. When compared with the relevant study, the emission amount from ships calling at Borusan Port between 2018-2019 has been determined as 13,588 tCO₂-e/vessel. According to Ekmekçioğlu et al. (2019: 190), ship-related emissions from İzmir Alsancak Port have been determined as 58,402 tCO₂-e/vessel. Vessel-related emissions in Mersin Port have been determined as 85,133 tCO₂-e/vessel. However, in the initial study, emission values were calculated only as CO₂. Emission calculations in this thesis study have been calculated based on CO₂-e. This difference between emission amounts can only be explained by the waiting time of the calling ships in the port and the main engine and auxiliary engine power of these vessels.

3.7.5.2. Findings of the Emission Calculation Analysis Based on external trucks calling at Borusan Port Container terminal.

The emission amounts resulting from trucks calling at Borusan Port container terminal have been calculated. The calculation has been evaluated based on three different regimes in container terminals. These consist of three parts: export regime, import regime and transit regime (Esmer, 2010: 52-54). However, since only terminal tractors belonging to the port are used in transit regime operations, in the

transit regime for container terminal activities of external trucks is excluded. The amount of emissions resulting from terminal tractors has already been calculated under the title of Port equipment emission calculation in title 3.7.5.5. In addition, as seen in Table 53, emissions from trucks calling at different operations and handling processes in each regime at the container terminal have been calculated since the distance the trucks travel within the port is different in each operation of regimes. These distances have been determined by taking the average of the distances of the locations determined on the Google Earth geographical information application to the port gate, taking into account the operation processes within the port. In addition, fuel consumption data per teu has been determined by taking into account this distance information for different operations in each regime. Emission factors in Appendix 22 have been used for calculations based on trucks calling at Borusan Port.

Table 53: Distance, Fuel and Emissions Data per Teu for Trucks Calling at The Container Terminal of Borusan Port in 2022

	External Truck (km/Teu) <i>(distance traveled within the port)</i>	External Truck Fuel Consumption <i>(lt / per Teu)</i>	External Truck Emission <i>(CO₂-e gr / per Teu)</i>
Container Terminal - Export			
CFS internal loading + Loading onto vessel	0,44	0,14344	441,45552
CFS internal filling + Storing + Loading onto vessel	0,44	0,14344	441,45552
Gate entrance + Storing + Loading onto vessel	2,425	0,79055	2433,0219
Gate entrance + Reefer storing + Loading onto vessel	2,418	0,788268	2425,998744
Gate entrance + Loading onto vessel	2	0,652	2006,616
Container Terminal - Import			
	External Truck (km/Teu) <i>(distance traveled within the port)</i>	External Truck Fuel Consumption <i>(lt / per Teu)</i>	External Truck Emission <i>(CO₂-e gr / per Teu)</i>
Unloading from vessel + CFS internal unloading + empty storing	0,44	0,14344	441,45552
Unloading from vessel + Storing + CFS internal unloading + empty storing	0,44	0,14344	441,45552
Unloading from vessel + Storing + Exit from gate	2,425	0,79055	2433,0219
Unloading from vessel + Reefer storing + Exit from gate	2,418	0,788268	2425,998744
Unloading from vessel + Exit from gate	2,455	0,80033	2463,12114
Container Terminal - Transit			
	External Truck (km/Teu) <i>(distance traveled within the port)</i>	External Truck Fuel Consumption <i>(lt / per Teu)</i>	External Truck Emission <i>(CO₂-e gr / per Teu)</i>
Unloading from vessel + Loading onto vessel	<i>External trucks were not taken into account in transit operations. Transit operations are supposed to be carried out through the port's terminal tractors.</i>		
Unloading from vessel + Storing + Loading onto vessel			
Unloading from vessel + Reefer storing + Loading onto vessel			

As can be seen in Table 54, although the trucks calling at the container terminal have covered very little distance within the port, they still cause serious emissions.

Table 54: Emission Based on External Trucks Calling at Borusan Port Container Terminal

<i>External Truck Emission (tCO₂-e/year)</i>	<i>2022</i>	<i>2021</i>	<i>2020</i>	<i>2019</i>
<i>(In Container Terminal -Export Operation)</i>	144,15	162,31	206,40	241,89
<i>(In Container Terminal -Import Operation)</i>	140,42	158,10	201,06	235,62
<i>Total External Truck Emission in Container Terminal (tCO₂-e/year)</i>	<i>284,57</i>	<i>320,41</i>	<i>407,46</i>	<i>477,51</i>

Looking at Table 54, the amount of emissions resulting from trucks calling at Borusan Port container terminal by road corresponds to approximately 10-15% of port equipment emissions. In this sense, the port's efforts to reduce emissions from its own equipment alone are not sufficient for sustainable improvement since all other stakeholders involved in the operations of the port must show the same care and responsibility as Borusan Port.

3.7.5.3. Findings of the Emission Calculation Analysis Based on Finished Vehicles Handled at Ro-Ro Terminal of Borusan Port

Vehicles are valuable products at Ro-Ro terminals where finished vehicles are handled. In order to minimize the risk of damage to these products, vehicles are not asked to move on the apron until they are loaded onto the ship or until they exit the port from the highway (Chen et al., 2021: 251).

Under this title, emissions resulting from finished vehicles handled at the port during Ro-Ro terminal operations have been calculated. As can be seen in Table 48, it has been determined how many times the finished vehicles handled annually at Borusan Port Ro-Ro terminal can fill the parking capacity. The distance traveled by the annual handling amount between the Ro-Ro parking area and the loading ramp and the emission amounts they create have been determined. In this sense, in the

calculation it has been assumed that all vehicles are passenger cars and half of them are diesel vehicles and the other half are gasoline vehicles. The calculation has been carried out based on this assumption.

Table 55: Distance Travelled and Emission Based on Finished Vehicles Handled in Borusan Port Ro-Ro Terminal

	2022	2021	2020	2019
<i>Vehicle Handled (unit)</i>	180.000	188.675	218.340	266.582
<i>Park Area Capacity (unit)</i>	6510	6510	6510	6510
<i>Rate of annual volume filling parking capacity</i>	27,6497696	28,9823349	33,5391705	40,949616
<i>Total distance of yearly handled volume (km)</i>	85.240,57	89.348,69	100.156,25	103.396,81
<i>Total tCO₂-e (ton)</i>	10,22	12,59	14,71	15,91
<i>Yearly Emission Factor/Per Finished Car</i>	0,0000568	0,0000667	0,0000674	0,0000597
<i>Changes in Yearly Emission Factor (%)</i>				
<i>Compared to Previous Year</i>	85,09158029	99,0177998	112,8875896	100
<i>Compared to The Year of 2019</i>	95,11435369	111,7788074	112,8875896	100

In this sense, the emission rate of finished vehicles handled at the Ro-Ro terminal has been increased by 12% in 2020 compared to the previous year. It has decreased by approximately 1% in 2021 compared to the previous year. In 2022, there has been a significant decrease of approximately 15% compared to the previous year. In addition, when looking at the amount of emissions in 2022, it is seen that it decreased by approximately 5% compared to 2019. Naturally, vehicle manufacturers' development of technologies that will reduce emissions will make a small environmental contribution to the region where the port is located.

3.7.5.4. Findings of the Emission Calculation Analysis Based on External Truck calling at Ro-Ro Terminal of Borusan Port

Similar to the container terminal, in Ro-Ro terminal operations, trucks calling at the port carry out the transportation operation for the finished vehicles handled at

the port to leave the port by road (for import) and to arrive at the port parking area by road (for export). Based on this, under this title, emission calculations of trucks calling at the Ro-Ro terminal have been made. Emissions from trucks calling at the Ro-Ro terminal have been calculated by taking into account the distances of the 5 vehicle parking areas in Table 48 to the port gate, the number of vehicle handlings in the relevant year and the emission factor acceptance values in Appendix 24.

Table 56: Distance Travelled and Emission Based on External Trucks Calling at Borusan Port Ro-Ro Terminal

	2022	2021	2020	2019
<i>Distance travelled by External Trucks in Ro-Ro Terminal Park Areas</i>				
<i>1st Park Area (km)</i>	8.825,806	9.251,161	10.705,7	13.071,12
<i>2nd Park Area (km)</i>	8.405,53	8.810,63	10.195,91	12.448,68
<i>3rd Park Area (km)</i>	8.405,53	8.810,63	10.195,91	12.448,68
<i>4th Park Area (km)</i>	9.677,419	10.143,82	11.738,71	14.332,37
<i>5th Park Area (km)</i>	3.716,129	3.895,226	4.507,665	5.503,628
<i>Total Distance of External Truck in Ro-Ro Terminal (km)</i>	39.030,41	40.911,46	47.343,89	57.804,48
<i>Total Emission based on External Truck in Ro-Ro Terminal (tCO₂-e)</i>	35,13518	36,8285	42,61897	52,03559

Inspired by the study of Chen et al. (2021: 254-258), the distances of the vehicles in the finished vehicle parking area to the dock were calculated based on the location of each vehicle and the dock distances were calculated via the Google Earth GIS application. In addition, according to the maritime cargo data between 2004 and 2022 received from the Ministry of Transport and Infrastructure, it is assumed that all vehicles handled at the port are automobiles, since almost all of the finished vehicles handled at Borusan port are automobiles. Since hatchback car data is high in the relevant data, it is assumed that the cars in the port are Renault Clio brand. Half of the vehicles handled have been considered diesel and half have been gasoline. In addition, the capacity of trucks carrying cars calling at the port has been taken into account as 9 vehicles as seen on the explanation of equation (8). As can be seen in

Table 48, even though the amount of emissions resulting from trucks calling at the Ro-Ro terminal may seem low on an annual basis, it is still a significant amount. Naturally, the emission reduction strategies that heavy vehicle manufacturers and operators will consider will contribute to the port's emission reduction efforts for the environment and the settlement where the port is located. Although the amount of emissions resulting from vehicles handled in Borusan Port Ro-Ro terminal operations and trucks calling at the port has a very small place in the total indirect and direct emissions, it is still an amount that should be taken into account. It has been mentioned that the calculation has been made by considering the distances and capacities of the five car parking areas in Table 48 to the dock and the port gate. Another assumption related to this is that in the calculation it is assumed that the annual handling amount fills all five car parking areas evenly.

3.7.5.5. Findings of the Emission Calculation Analysis Based on The Equipments at the Container and General Cargo Terminal of Borusan Port

In this title, the emissions resulting from Borusan Port's own equipment in container terminal and general cargo terminal operations have been calculated. Essentially, among the emission calculations in this research, the emission results that are most important for the research purposes are included in this title. Port emissions resulting from operations in 2019, 2020, 2021 and 2022 will be disclosed separately on the basis of equipment and terminal, respectively. Additionally, the calculated emission amounts include the results arising from fixed and mobile equipment used only in the container and general cargo terminal of the port.

Consumption and uses such as the port's generators, mini equipment, road vehicles for administrative purposes, natural gas used administratively and operationally, lighting, heating and cooling are not included in this calculation. As seen in Table 57, when looking at terminal-based emission formation in 2019, the emission amount of the general cargo terminal is much higher than the container terminal with a rate of 69.79%. The highest emissions in the container terminal come from light type terminal tractors. It is followed by SSGs, E-RTG's and reach

stackers. The highest amount of emissions in the general cargo terminal comes from heavy terminal tractors. It is followed by mobile cranes, reach stackers, overhead bridge cranes and light terminal tractors, respectively.

Table 57: GHG emission Result of Borusan Port Equipments in 2019 (tCO₂-e/ton/year)

<i>Port Equipment</i>	<i>Container Terminal 206.395 Teu</i>	<i>General Cargo Terminal 2.962.587,80 t</i>	<i>Total (Container, General Cargo)</i>
<i>SSG (Ship to Shore Gantry Crane) (tCO₂-e)</i>	398,03 100%	- -	398,03 12,5%
<i>E-RTG (tCO₂-e)</i>	229,23 100%	- -	229,23 7,2%
<i>Reach Stacker (tCO₂-e)</i>	110,72 30%	258,35 %70	369,08 11,6%
<i>Light type terminal tractor (tCO₂-e)</i>	478,41 75%	159,47 25%	637,88 20%
<i>Heavy type terminal tractor (tCO₂-e)</i>	- -	1046,49 100%	1046,49 32,9%
<i>Mobile Crane (tCO₂-e)</i>	- -	337,34 100%	337,34 10,6%
<i>Overhead Bridge Crane (tCO₂-e)</i>	- -	165,13 100%	165,13 5,2%
<i>Total</i>	1216,39 38,21%	1966,78 61,79%	3183,18 100%

 : Scope 2 emission ;  : Scope 1 emission

According to Table 58, when looking at the terminal-based emission formation in 2020, the emission amount of the general cargo terminal is again much higher than the container terminal with a rate of 63.68%. The highest emissions in the container terminal again come from light terminal tractors and decreased by approximately 10% compared to the previous year. SSG emissions decreased by 6.2% compared to the previous year. There is also a reduction in the annual emissions of other equipment. However, this decrease is due to the decrease in the handling volume. In the general cargo terminal, the highest emissions come from heavy type terminal tractors. It is followed by mobile cranes, reach stackers, overhead bridge cranes and light terminal tractors, respectively.

Table 58: GHG Emission Result of Borusan Port Equipments in 2020 (tCO₂-e/ton/year)

<i>Port Equipment</i>	<i>Container Terminal 176.117 Teu</i>	<i>General Cargo Terminal 2.856.861,75 t</i>	<i>Total (Container, General Cargo)</i>
<i>SSG (Ship to Shore Gantry Crane) (tCO₂-e)</i>	373,52 100%	- -	373,52 12,2%
<i>E-RTG (tCO₂-e)</i>	212,58 100%	- -	212,58 6,9%
<i>Reach Stacker (tCO₂-e)</i>	93,02 30%	217,05 %70	310,07 10,1%
<i>Light type terminal tractor (tCO₂-e)</i>	431,95 75%	143,98 25%	575,94 18,8%
<i>Heavy type terminal tractor (tCO₂-e)</i>	- -	1000,75 100%	1000,75 32,7%
<i>Mobile Crane (tCO₂-e)</i>	- -	396,72 100%	396,72 13%
<i>Overhead Bridge Crane (tCO₂-e)</i>	- -	189,86 100%	189,86 6,2%
<i>Total</i>	1111,07 36,32%	1948,36 63,68%	3059,44 100%

: Scope 2 emission ;
 : Scope 1 emission

According to Table 59, looking at the terminal-based emission formation in 2021, although the share of the general cargo terminal in total handling is still very high compared to the container terminal, the share of the general cargo terminal in the total emissions has also increased compared to the previous year. The share of heavy type terminal tractors in total emissions decreased by 5.5% compared to the previous year's distribution. Although this rate is a serious decrease, it shows that the task of this equipment is alleviated by assigning it to other types of equipment. In addition, in the light terminal tractors, the amount of emissions in the total distribution decreased by 2.7% in 2021, compared to the total distribution in the previous year. Instead, the proportion of the overhead bridge crane appears to have increased.

Table 59: GHG Emission Result of Borusan Port Equipments in 2021 (tCO₂-e/ton/year)

<i>Port Equipment</i>	<i>Container Terminal 138491 Teu</i>	<i>General Cargo Terminal 3.486.394,89 t</i>	<i>Total (Container, General Cargo)</i>
<i>SSG (Ship to Shore Gantry Crane) (tCO₂-e)</i>	323,62 100%	- -	323,62 10,2%
<i>E-RTG (tCO₂-e)</i>	163,96 100%	- -	163,96 5,2%
<i>Reach Stacker (tCO₂-e)</i>	76,15 30%	177,65 %70	253,8 8%
<i>Light type terminal tractor (tCO₂-e)</i>	383,25 75%	127,75 25%	511,01 16,1%
<i>Heavy type terminal tractor (tCO₂-e)</i>	- -	1209,5 100%	1209,5 38,2%
<i>Mobile Crane (tCO₂-e)</i>	- -	464,12 100%	464,12 14,7%
<i>Overhead Bridge Crane (tCO₂-e)</i>	- -	239,14 100%	239,14 7,6%
<i>Total</i>	946,98 29,92%	2218,16 70,08%	3165,15 100%

: Scope 2 emission ;
 : Scope 1 emission

According to Table 60, when looking at the terminal-based emission formation in 2022, there is no notable change in the emission amounts of equipment on a terminal basis. However, while the share of heavy terminal tractors in total emissions decreased by 0.5% compared to the previous year's distribution; the emission share of light terminal tractors increased by 0.4%. Additionally, while the share of mobile crane decreased by 1.3% compared to the previous year; reach stacker's share in 2022 increased by 1.3%.

Table 60: GHG Emission Result of Borusan Port Equipments in 2022 (tCO₂-e/ton/year)

<i>Port Equipment</i>	<i>Container Terminal 123.000 Teu</i>	<i>General Cargo Terminal 3.500.000 t</i>	<i>Total (Container, General Cargo)</i>
<i>SSG (Ship to Shore Gantry Crane) (tCO₂-e)</i>	304,93 100%	- -	304,93 10,1%
<i>E-RTG (tCO₂-e)</i>	152,36 100%	- -	152,36 5%
<i>Reach Stacker (tCO₂-e)</i>	84,07 30%	196,16 %70	280,23 9,3%
<i>Light type terminal tractor (tCO₂-e)</i>	372,93 75%	124,3 25%	497,23 16,5%
<i>Heavy type terminal tractor (tCO₂-e)</i>	- -	1137,75 100%	1137,75 37,7%
<i>Mobile Crane (tCO₂-e)</i>	- -	406,15 100%	406,15 13,4%
<i>Overhead Bridge Crane (tCO₂-e)</i>	- -	241,4 100%	241,4 8%
<i>Total</i>	914,29 30,27%	2105,76 69,73%	3020,05 100%
 : Scope 2 emission ; : Scope 1 emission			

When the port equipment emissions calculated in this thesis study are compared with the 2021 equipment emission calculation of Ambarlı Container Port study of Okşas (2023: 6-7), the SSG emission per Teu is calculated as 878.57 gr CO₂-e/teu in his study. Borusan Port SSG equipment emission is calculated as 1928,48 gr CO₂-e/teu in this dissertation. Although at first glance, the SSG emission amount of Borusan Port seems to be more than 2 times more, in fact, the emission rate of SSG in Borusan Port is approximately 30% on a yearly basis. The emission rate from SSG at Ambarlı Container Port is 7.38%. However, the emission rate resulting from fuel use in Ambarlı Port is much higher. Therefore, according to the analysis results of Okşas (2023: 7), the direct emission rate for Ambarlı Port is much higher. In addition, the emission amounts resulting from fuel use of Borusan Port container terminal equipment on a yearly basis were calculated as 48% and the emission amounts resulting from electricity use were calculated as 52%. However, at

Ambarlı Container Port, the emission from electricity is 22.84% and the emission from fuel is 77.16% (Okşas, 2023: 7). In summary, it can be said that Borusan Port implemented the electrification strategy, one of the decarbonization strategies, much better in its container terminal operations between 2019 and 2022 compared to the Ambarlı Container Port 2021 operations. At this point, the analysis that is the subject of comparison has been evaluated based on the study findings of Okşas (2023: 7).

Table 61: GHG Emission Result of Borusan Port Equipments 2019-2022 (tCO₂-e/ton/year)

Port Equipment	2022 (Container, General Cargo)	2021 (Container, General Cargo)	2020 (Container, General Cargo)	2019 (Container, General Cargo)
SSG (Ship to Shore Gantry Crane)	304,93 10,1%	323,62 10,2%	373,52 12,2%	398,03 12,5%
E-RTG	152,36 5%	163,96 5,2%	212,58 6,9%	229,23 7,2%
Reach Stacker	280,23 9,3%	253,8 8%	310,07 10,1%	369,08 11,6%
Light type terminal tractor	497,23 16,5%	511,01 16,1%	575,94 18,8%	637,88 20%
Heavy type terminal tractor	1137,75 37,7%	1209,5 38,2%	1000,75 32,7%	1046,49 32,9%
Mobile Crane	406,15 13,4%	464,12 14,7%	396,72 13%	337,34 10,6%
Overhead Bridge Crane	241,4 8%	239,14 7,6%	189,86 6,2%	165,13 5,2%
Total	3020,05 100%	3165,15 100%	3059,44 100%	3183,18 100%

 : Scope 2 emission ;  : Scope 1 emission

In Table 61, the emission amounts occurring in the general cargo and container terminal between 2019-2022 are given collectively. Accordingly, when looking at the equipment emission distributions in each year, it has been seen that the share of light type terminal tractor emissions increased by 0.4% only in 2022, when the annual distribution rates gradually decreased. Compared to 2019, in 2022, the share of emissions from heavy type terminal tractors increased by 4.8%, while the share of mobile crane emissions increased by 2.8%. The share of emissions from SSG cranes decreased by 2.4%, the share of RTGs by 2.2% and the share of reach

stackers by 2.3%. In the the SOI assessment meeting held with top and middle level managers of Borusan Port, Participant R-2 has stated that the amount of emissions resulting from Borusan Port container and general cargo terminal equipment will be much reduced in the coming years by assigning tasks to the equipment through the SafeCard system SOI project.

R-2: ...In the next stage of SafeCard, we will optimize the cargo and equipment with this load and navigation information. The system will tell us which machine should go and pick up which load. The load will fall on the screen of the relevant operator and he will go and pick it up. But now, all equipment has a screen, the load falls on the screen, and an operator reserves the load for herself and goes and picks up that load. But maybe a wrong decision might have been made although someone else was much closer to that load, or he might still be on return load duty. Of course, operators still provide efficiency by talking on the radio, but the decisions made by the system will be much more efficient. When we switch to this application, we will achieve a significant increase in equipment-load efficiency.

The participants also stated that despite the increasing amount of handling at Borusan Port in the last 4 years, emission reduction has been achieved. In addition, it has been stated in the Borusan Holding Report 2022 that emission reduction occurs together with increased handling. In this sense, during the SOI evaluation interview, the Participant R-3 stated that emission reduction was supported by some emission reduction technologies that named as Rentar*(*Rentar is a brand of fuel catalyst unit that used in heavy machinery for reduction fuel and emission) partially implemented in the machinery park.

R-3: On the climate theme side, our vision is to be carbon neutral by 2030. For this reason, we invested in the 3D coil ceiling crane you saw during the field trip. In this way, we achieved a carbon emission reduction of 22.5 tons per year and a 15% increase in operational efficiency. In addition, in terms of decarbonization, we achieved fuel savings of 3-5% and carbon reduction of 10-15% by installing reach stackers in our field equipment and rentar* devices in 11 of our terminal tractors. While doing this, instead of purchasing a product from the market and installing it, our technical works and machine maintenance team made some integrations and brought the system to our machinery park.

However, the important point here is that since handling amounts and emission amounts change over the years, it is important to determine whether there is a real decrease in emissions. In this sense, equation (10) below has been used to

clearly determine whether there is a decrease in the amount of emissions despite the increasing handling volume.

Table 62: Equation for Yearly Emission Factor of Container and General Cargo Terminal

$$(10) \quad \text{Yearly Emission Factor}_{in \text{ terminal } i} = \frac{\text{Yearly Emission}_{terminal \ i}}{\text{Handling Volume}_{terminal \ i}}$$

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 63-64.

Using in line (a) and (b) of Table 65 and equation (10) in Table 62, the annual emission factor per 1 ton of cargo of the general cargo terminal has been determined. The calculated factors seen in line (c) in Table 65 indicate that emission formation in the general cargo terminal decreased between 2019 and 2022.

Table 63: Equation for Yearly Emission Factor of the Terminals as to previous year

$$(11) \text{Yearly Emission Factor}_{in \text{ terminal } i} = \frac{(\text{Yearly Emission Factor}_{year \ t} \times 100)}{\text{Yearly Emission Factor}_{previous \ year \ of \ year \ t}}$$

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 63-64.

In line (e) of Table 65, the change values of emissions compared to the previous year have been calculated using equation (11) in Table 63. Accordingly, emission values increased by 2.72% in 2020 compared to 2019. In 2021, the amount of emissions decreased by 6.71% compared to 2020. In 2022, the amount of emissions decreased by 5.44% compared to 2021.

Table 64: Equation for Yearly Emission Factor of the Terminals as to 2019

$$(12) \text{Yearly Emission Factor}_{year \ t} = \frac{(\text{Yearly Emission Factor}_{year \ t} \times 100)}{(\text{Yearly Emission Factor}_{year \ 2019})}$$

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 63-64.

In line (f) of Table 65, the change values of emissions compared to 2019 have been calculated using equation (12) in Table 64. Accordingly, emission values increased by 2.72% in 2020 compared to 2019. In 2021, the amount of emissions decreased by 4.17% compared to 2019. In 2022, the amount of emissions decreased by 9.7% compared to 2019. In this sense, the statement that the amount of port emissions has decreased, stated in the Borusan Holding 2022 activity report, has been confirmed for the general cargo terminal. It has been observed that general cargo terminal equipment emission do not attract enough attention. In the literature review, it has been seen that the emission calculation of General cargo terminal equipments do not attract enough attention.

Table 65: General Cargo Terminal Emission Efficiency of Borusan Port

	2022	2021	2020	2019
General Cargo Terminal				
a) General Cargo Handling (ton)	3.500.000,00	3.486.394,89	2.856.861,75	2.962.587,80
b) Yearly Emission (tCO₂-e)	2105,76	2218,16	1948,36	1966,78
c) Yearly Emission Factor/Per 1 Ton Cargo	0,0006016	0,0006362	0,0006820	0,0006639
d) Yearly Cargo Factor/Per 1 Ton Emission	1662,1077	1571,7509	1466,2905	1506,3138
Changes in Yearly Emission Factor (%)				
e) Compared to Previous Year	94,563717	93,290262	102,72956	100
f) Compared to The Year of 2019	90,626722	95,836675	102,72956	100
Changes in Yearly Cargo Factor (%)				
g) Compared to Previous Year	105,7488	107,19232	97,342966	100
h) Compared to The Year of 2019	110,34273	104,34419	97,342966	100

The annual emission factor per one teu container of the container terminal has been determined by using equation (10) of Table 62 and the values in line (a) and (b) of Table 66. The factors seen in line (c) in Table 66 indicate that emission formation at the container terminal decreased between 2019 and 2022. In line (e) of Table 66, the change values of emissions compared to the previous year have been calculated using equation (11). Accordingly, emission values increased by 7.04% in 2020

compared to previous year. In 2021, the amount of emissions increased by 8.38% compared to 2020. In 2022, the amount of emissions decreased by 9.40% compared to 2021. In line (f) of Table 66, the change values of emissions in different years compared to 2019 have been calculated using equation (12). Accordingly, emission values increased by 7.04% in 2020 compared to 2019. In 2021, the amount of emissions increased by 16.02% compared to 2019. The amount of emissions in 2022 has been determined to be 26.12% more than in 2019. Also, it increased 8,7% significantly in 2022 compared to the previous year. In this sense, although container terminal emissions have increased, the amount of emissions has decreased significantly when container terminal and general cargo terminal emissions are considered together.

Table 66: Container Terminal Emission Efficiency of Borusan Port

	2022	2021	2020	2019
Container Terminal				
a) Container Handling (teu)	123.000	138.491	176.117	206.395
b) Yearly Emission (tCO₂-e)	914,29	946,98	1111,07	1216,39
c) Yearly Emission Factor/Per 1 Teu Container	0,0074332	0,0068378	0,0063087	0,0058935
d) Yearly Cargo Factor/Per 1 Ton Emission	134,530	146,2449049	158,5111649	169,6783104
Changes in Yearly Emission Factor (%)				
e) Compared to Previous Year	108,7074790	108,3874786	107,0450214	100
f) Compared to The Year of 2019	126,1253923	116,0233996	107,0450214	100
Changes in Yearly Cargo Factor (%)				
g) Compared to Previous Year	91,9266715	92,26157977	93,41863703	100
h) Compared to The Year of 2019	79,285325	86,18951032	93,41863703	100

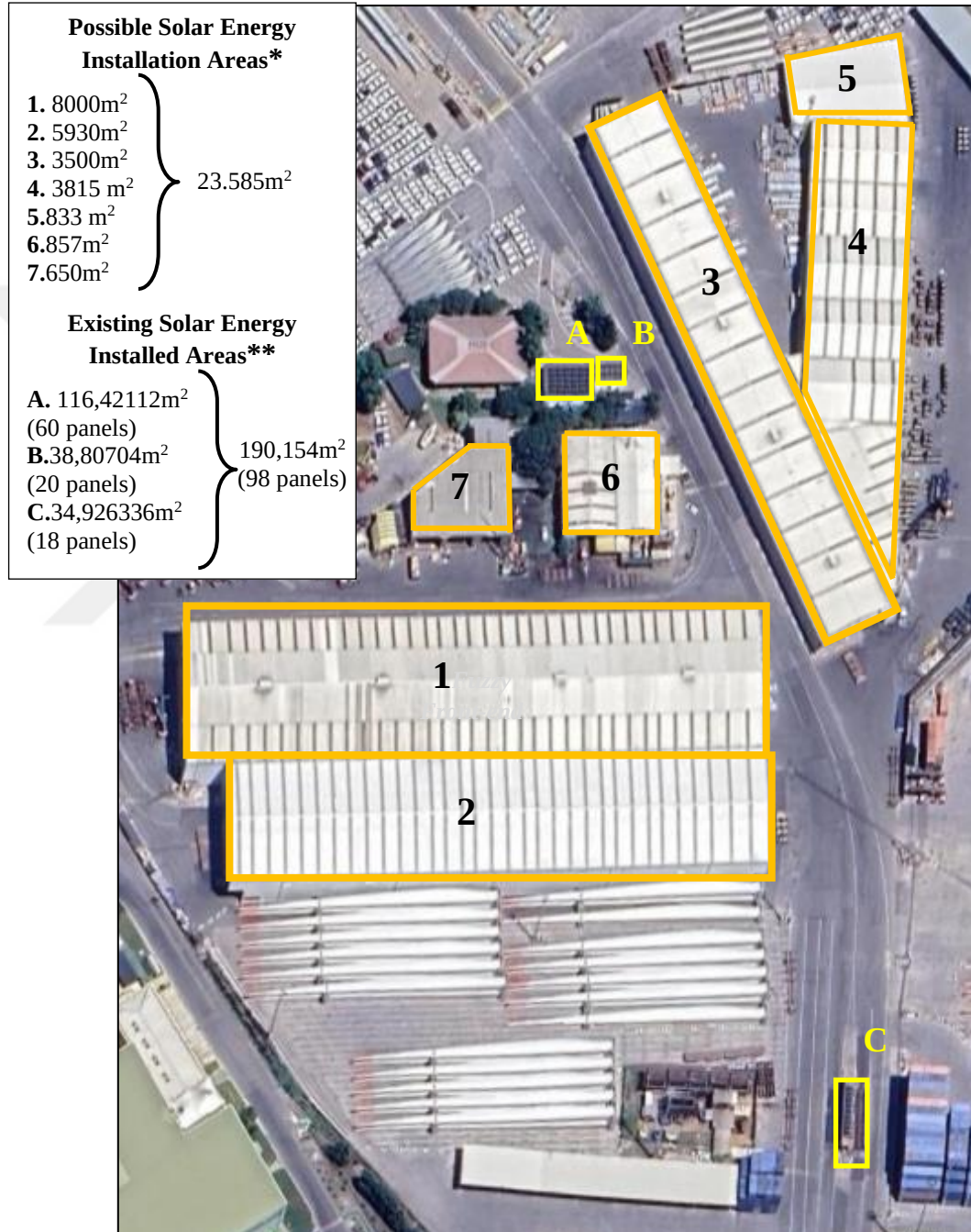
This situation confirmed the statement in the Borusan Holding 2022 activity report that the amount of port emissions has decreased. Additionally, reefer container storage electricity consumption for 2022 has been determined as 556,8 kw/h and 458.94 tons tCO₂-e/year.

3.7.5.6. Findings of the Possible Solar Energy Capacity Calculation of Borusan Port

Renewable energy plays an important role in ports. Ports are often located in areas particularly suitable for energy production. Electrical energy in ports can be obtained from wind, waves, tidal differences and, in some cases, geothermal energy and solar energy, depending on the characteristics of the region where the port is located. In particular, there are often sufficient areas and connection points for the installation of solar panels and the storage of the resulting energy. Additionally, large flat surfaces such as storage areas and warehouses can be used for the installation of solar panels, as they often have connection points. Although the infrastructure required for the installation of solar panels is not always suitable for large-scale businesses, ports are generally suitable for the installation and use of this system (Acciaro et al., 2014a: 5). Borusan Port also has the flat and wide storage areas and roof surfaces required for the installation of solar panels. In this sense, the possible electrical energy that can be obtained and the possible amount of emissions that can be prevented if a solar energy system is installed for all suitable roof areas of Borusan Port have been determined. Emissions from handling equipment at Borusan port terminals, cargo ships calling at the port, trucks calling at the container terminal and Ro-Ro terminal, and finished vehicles handled have been calculated. At this point, the amount of electrical energy that will be provided by the solar energy system that can be installed in suitable places in the port area in order to reduce the emissions, and the amount of emissions that can be prevented by the technologies to be applied in the equipment have been determined. In the Borusan Port layout visual in Figure 40, possible locations (warehouse roofs and technical workshop workshops) where solar energy systems can be installed in the port are seen. The areas of the relevant locations calculated through the Google Earth geographic information system application are also included in Figure 40. As seen in Figure 40, the possible area where a solar energy system can be installed in the port is calculated as 23,585 m². In addition, solar energy started to be used with 98 solar panels, each of 330Wp and containing 72 Polycrystalline cells, and one SMA Sunny Tripower STP25000TL-30 and STP5.0AV-40 model inverter, which were put into

operation at the beginning of 2020 as a pilot application at the port, in a total area of 190,154 m².

Figure 40: Possible Solar Energy Installation Areas on the Borusan Port Facilities and Existing Solar Energy Installed Areas



*: Borusan Port Facility Screenshot from Google Earth GIS; **:www.sma.com.tr

In this sense, the established system has a nominal installed power of 32.34 kWp and an annual production capacity of 46.9 MWh as of 2020. In this sense, the relevant system prevents the annual formation of 21.1 tons of tCO₂-e in Borusan Port (<https://www.sma.com.tr/referans/borusan-lojistik-ges.html>). In addition, the dimensions and efficiency of the CW Energy 405Wp 80PM-F M12 HC-MB model solar panel have been taken into consideration for the possible solar energy system that could be installed in the port. There is no particular reason for choosing this solar panel. It is a widely used model in the market. Additionally, ease of access to technical information has been effective in using this panel in calculations. The area information taken into account in the calculation is 23,585 m², as seen in Figure 40 19,620.47 m², 83.19% of this area, has been taken into account as the installation area. Under this title of the research, the amount of electrical energy that can be produced if the system is installed in possible areas where solar energy systems can be installed and the amount of tCO₂-e emissions that can be prevented with this environmentally friendly production have been determined. For the possible solar energy system design, calculations have been made by taking into account the solar energy potential atlas (GEPA) and the sunshine hours of Gemlik district of Bursa province and the electrical energy production capability values Appendix 26 and 27 for photovoltaic solar panels.

Table 67: Solar Panel Capacities of Possible Installation Areas

<i>Possible Solar Panel Areas (as see in Figure 40)</i>	<i>Dimensions of Areas (m×m)</i>	<i>Row Numbers of Panels (unit×unit)</i>	<i>Solar Panel Capacities (unit)</i>
1st Installation Area	175m×40m	95unit×35unit	= 3.325 units
2nd Installation Area	160m×32m	90unit×29unit	= 2.610 units
3rd Installation Area	170m×20m	95unit×18unit	= 1.710 units
4th Installation Area	90m×30m	50unit×27unit	= 1.350 units
5th Installation Area	30m×35m	17unit×30unit	= 510 units
6th Installation Area	30m×30m	17unit×27unit	= 459 units
7th Installation Area	25m×30m	14unit×27unit	= 189 units
TOTAL			= 10.153 units

In addition, a linear calculation has been made considering the capabilities of the pilot solar energy system installed in the port and the possible installation area. Although there is a significant difference between the solar capacity calculated with the help of data received from GEPA and the capacity that the existing installed system would provide if it were of similar size, it can be evaluated in terms of providing a macro projection. Solar panel electricity production capacity has been calculated according to the GEPA-Solar energy potential atlas in Appendix 26 and 27, using equation (13) in Table 68. However, possible solar capacity calculation in this dissertation has been made based on the capabilities of the existing pilot capacity using equation (14) in Table 68.

Table 68: Equations for Solar Electric Energy Production Calculation

$$\begin{aligned}
 (13) \text{Solar electric prod}_{\text{same capability with pilot system}} &= \text{Solar electric prod}_{\text{per m}^2/\text{yr/gemlik}} \times \\
 &\quad \text{Possible solar energy field}_{\text{per m}^2/\text{yr/gemlik}} \\
 &= 246,842 \text{ kW/m}^2/\text{year} \times 19620,47 \text{ m}^2 \\
 &= \mathbf{4.843.156 \text{ kWh/year}}
 \end{aligned}$$

$$\begin{aligned}
 (14) \text{Solar electric prod}_{\text{GEPA}} &= \text{Solar electric prod}_{\text{per m}^2/\text{yr/gemlik}} \times \\
 &\quad \text{Possible solar energy field}_{\text{per m}^2/\text{yr/gemlik}} \\
 &= 200 \text{ kW/m}^2/\text{year} \times 19620,47 \text{ m}^2 \\
 &= \mathbf{3.924.094 \text{ kWh/year}}
 \end{aligned}$$

Source: Coskun et al. 2011: 1319; GEPA, 2023.

Under the last title of the port emission calculation, an evaluation have been made as to what the emission situation of the port would be if a possible solar energy system would be installed in Borusan Port, based on the 2022 emission data. In addition, the emission reduction that will be achieved if the emission reduction technology (Borusan Holding Report, 2022: 73) that the port partially applies to 3 reach stackers and 8 heavy terminal tractors is applied to all diesel equipment (all reachstackers, light and heavy terminal tractors) have been calculated.

3.7.5.7. Findings of The Impact of Emission Reduction Strategies And Emission Benefit of The Possible Solar Energy Capacity of Borusan Port

Decarbonization strategies in ports are discussed under four main subjects: energy efficiency (Ambrosetti, 2022: 1), industrial electrification (Abu Bakar et al., 2023), low-carbon fuels feedstocks, and energy sources (Al-Enezi et al., 2021; Pivetta et al., 2024), carbon capture, utilization, and storage (Acciaro et al., 2023: 5).

In terms of decarbonization strategies, ports are also likely to become major players in carbon capture and storage (Acciaro et al., 2023: 5). Collecting the CO₂ emissions of carbon-intensive facilities such as various factories and iron and steel factories and storing them in suitable underground areas via ports, also opens up a business area for ports and other industries in terms of circular economy (Notteboom et al., 2022: 172-179). Fuel catalyst systems that filter greenhouse gases are used in road vehicles and terrestrial construction equipment for providing energy efficiency (Ambrosetti, 2022: 1), just like the scrubber system installed on ships (MEPC 70, 28/2016). Another important implementation of decarbonization strategy in maritime sector is cold ironing (shore electrification) for the vessels in hoteling. Cold ironing is the most important decarbonization strategy in preventing vessel-related emissions in ports (Kılıç et al., 2020: 193). Because 80% of the world's fleet is located close to land at all times, with 55% in port and 25% near the coast (ICCT, 2007: 24). Also, ships mostly use fuel-powered generators for their electrical energy needs when they are at anchor and at the docks out of cruising (NRDC, 2004: 8). So, cold ironing implementation is the most important decarbonization strategy in ports. Terminal tractors, container reach stackers and mobile cranes, among the equipment used in ports, constitute approximately 80% of port equipment emissions. Based on this, Borusan Port has carried out the electrification transformation of its mobile cranes and RTG field cranes. The remaining equipment emissions, approximately 60-75%, come from terminal tractors and reach stackers (Okşas 2023: 6). It has been seen both in the SOI meeting and in the Borusan holding 2022 report that Borusan Port achieved a 15% emission reduction in the equipment related to the fuel catalyst system applied to 3 reach stackers and 8 heavy type terminal tractors. Under this title, it has been calculated how much emissions are prevented by the emission

reduction strategy. Additionally, we have been informed that the port will install a fuel catalyst system on all terminal tractors and reach stackers. In this sense, the amount of emissions that can be prevented based on 2022 emission values has been determined if the relevant equipments are converted.

Table 69:Equations for Emission reductions for Reachstackers

(15) Emission of Each Reachstacker_{reduction not implemented} = 100x is for the 3 of reachstackers.

and

Emission of Each Reachstacker_{reduction implemented} = 85x is for the other 3 of reachstackers.

then

Emission of Reachstackers_{partially reduction implemented} = $(100x \times 3) \times (85x \times 3)$
 $280,23 \text{ ton CO}_2\text{-e} = 555x$
 $x = 0,5049189189$

(16) Emission of Each Reachstackers_{reduction implemented} = (85x)
 $85x = 85 \times 0,5049189189$
=42,918 ton CO₂-e/
year of 2022

(17) Emission of Each Reachstackers_{reduction not implemented} = (100x)
 $100x = 100 \times 0,5049189189$
=50,491 ton CO₂-e/
year of 2022

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 63-64.

According to the partial emission reduction application applied to reach stackers through equations (15), (16) and (17) in Table 69, 7.57 tons of tCO₂-e reduction has been achieved per reach stacker that installed rentar fuel catalyst system for 2022. In this case, if emission reduction technology was used to applied to all reach stackers, 45,442 tons of tCO₂-e emission reduction would be achieved for 2022 operations. This is almost equal to the amount of emissions caused by a reach

stacker alone. In this sense, when this system is integrated into all equipment by the end of 2023, a significant amount of emissions will be prevented.

Table 70:Equations for Emission reductions for Heavy Terminal Tractors

(18) Emission of Each Heavy Tractor_{reduction not implemented}= 100y is for the 3 of heavy terminal tractors.

and

Emission of Each Heavy Tractor_{reduction implemented}= 85y is for the other 8 of heavy terminal tractors.

then

Emission of Heavy Tractor_{partially reduction implemented}= (100y × 3) × (85y × 8)

1137,74 ton CO₂-e = 980y

y = 1,1609659082

(19) Emission of Each Heavy Tractor_{reduction implemented}= (85y)

85y = 85 × 1,1609659082

=98,682 ton CO₂-e/

year of 2022

(20) Emission of Each Heavy Tractor_{reduction not implemented}= (100y)

100y = 100 × 1,1609659082

=116,096 ton CO₂-e/

year of 2022

Source: GEF-UNDP-IMO GloMEEP Project and IAPH, 2018a: 63-64.

According to the partial emission reduction application applied to heavy terminal tractors through equations (18), (19) and (20) in Table 70, 17,414 tons of tCO₂-ereduction has been achieved per heavy terminal tractors for 2022. In this case, if emission reduction technology was used to applied to all heavy terminal tractors, then 191,559 tons of tCO₂-e emission reduction would be achieved for 2022 operations. This emission amount is almost equal to the emission amount of two heavy terminal tractors. In this sense, when this system is integrated into the equipment of all heavy terminal tractors by the end of 2023, the emissions of two heavy terminal tractors will be prevented.

Table 71: Comparison of the Projected and Existing Situations in 2022

	Projected Situation in 2022		Existing Situation in 2022	
General Cargo Terminal				
(a) General Cargo Handling (ton)		3.500.000,00		
(b) Yearly Emission (tCO ₂ -e)		2018,96		2105,76
(c) Yearly Emission Factor/Per 1 Ton Cargo		0,0005768		0,0006016
(d) Yearly Cargo Factor/Per 1 Ton Emission		1733,5657		1662,1077
Changes in Yearly Emission Factor (%)				
(e) Compared to Previous Year		90,663313		94,563717
(f) Compared to The Year of 2019		86,880554		90,626722
Changes in Yearly Cargo Factor (%)				
(g) Compared to Previous Year		110,2951		105,7488
(h) Compared to The Year of 2019		115,0866		110,34273
Container Terminal				
(i) Container Handling (teu)		123.000		123.000
(j) Yearly Emission (tCO ₂ -e)		851,5269		914,29
(k) Yearly Emission Factor/Per 1 Teu Container		0,0069229		0,0074332
(l) Yearly Cargo Factor/Per 1 Ton Emission		144,445		134,530
Changes in Yearly Emission Factor (%)				
(m) Compared to Previous Year		101,2445523		108,7074790
(n) Compared to The Year of 2019		117,4667006		126,1253923
Changes in Yearly Cargo Factor (%)				
(o) Compared to Previous Year		98,7692529		91,9266715
(p) Compared to The Year of 2019		85,1287354		79,285325
The Impact of Solar Energy Capacity Projection				
(r) Solar Energy Capacity at Borusan Port		3.921.949,38 kw/year		38.030,8 kw/year
(s) Emission Reduction of Handling Equipment of Borusan Port after solar energy using (tCO ₂ -e)	(before)	3.001,64	(before)	3.020,05
	(after)	1.915,55	(after)	3.001,64
		Reduction 36,18%		Reduction 0,6%
(t) Emissions arising from the Electricity Needs of Ships Calling at Borusan Port After Solar Energy Based on Cold Ironing to Them (tCO ₂ -e)	(before)	10.652,89	(before)	10.652,89
	(after)	9.454,31	(after)	-
		Reduction 11,25%		Reduction 0%
(u) All Emissions of Ships Calling at Borusan Port's All Terminals (tCO ₂ -e)	(before)	17.968,9	(before)	17.968,9
	(after)	16.770,32	(after)	-
		Reduction 6,67%		Reduction 0%
(v) Emission Based on External Truck calling at Borusan Port's Container and Ro-Ro Terminals (tCO ₂ -e)		319,70		
(y) Emission Based on Finished Vehicles Handled at Borusan Port's Ro-Ro Terminals (tCO ₂ -e)		10,22		
Total Emission Comparison of Projected and Existing Situations (tCO ₂ -e)	(before)	31.953,35	(before)	31.971,76
	(after)	28.470,1	(after)	31.953,35
		Reduction 10,9%		Reduction 0,057%

If emission reduction technologies were used to applied for light terminal tractors using equations (18), (19) and (20) in Table 70, the reduced emission value for each light terminal tractor would be determined as 30,189 tons of tCO₂-e. The amount of emissions that can be prevented per equipment is 5,327 tons of tCO₂-e. The total amount of prevented emissions for all light type terminal tractors will be 74,585 tons of tCO₂-e, and the emissions of two light terminal tractors will be prevented. As a result, taking into account the handling volumes of Borusan Port in 2022, the Table 71 is useful to summarize as a projection the situation of the amount of emissions resulting from the port's own operations and the operations of its related parties in the port area. According to Table 71, if the fuel catalyst system is integrated in all Borusan Port reach stackers, heavy and light terminal tractors, emission amounts will decrease by 4.1% for general cargo terminal operations, as seen in row (b) of Table 71. As seen in line (j), it will decrease by 6.86% for container terminal operations. In addition, it has been determined that in the general cargo terminal, the emission efficiency per unit operation will become approximately 4% more efficient than the current situation for line (e) and 4% more efficient than line (f). Even if the emission efficiency of the container terminal is not like that of the general cargo terminal, according to lines (m) and (n), reducing the amount of loss in emission efficiency will be a significant gain. However, as mentioned before, the high emission efficiency in the general cargo terminal provides a much greater emission gain than the partial loss in the container terminal.

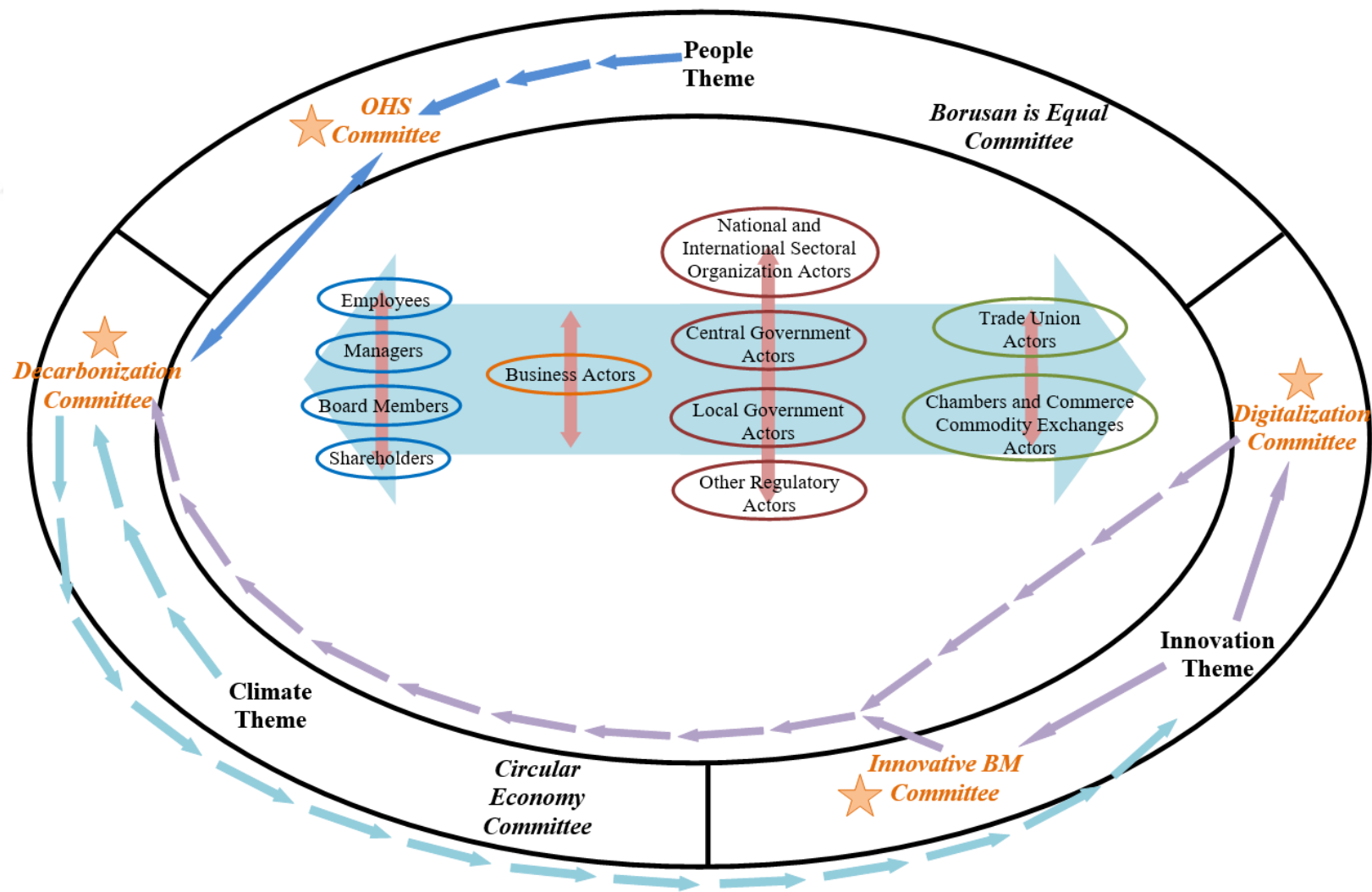
Both the current data for 2022 and the projection data show that Borusan port has achieved serious emission efficiency since 2020, and this efficiency continues to increase despite the significantly increased handling in the general cargo terminal. Within the scope of the research, after the stakeholder analysis and emission calculation of Borusan Port and the determination of possible solar energy capabilities, under the next heading, the SOI model for the sustainability-oriented innovation activities of Borusan Port will be determined and the selected SOI projects of the port will be evaluated.

Considering the emission scopes, it has been determined that the Port's scope 1 (direct emission from the port's own equipment) emissions can be reduced by 7.8% (149.55 tCO₂-e) according to the 2022 projection created with decarbonization

strategies. It has been determined that the port's scope 2 emissions (indirect emissions resulting from the port's own equipment) can be completely reduced. It has been determined that the scope 3 emission of the port (emission created by the parties associated with Borusan Port in the port area) can be reduced by 6.55% (1198.58 tCO₂-e). Due to the activities of the port in the region where it is located, the emission rate that can be reduced for the world in terms of all scopes has been determined as 11.5% (2452.97 tCO₂-e).

In this thesis study, the purpose of calculating the emissions resulting from Borusan Port operations and ships docking at the port is to determine the amount of emissions related to the European Union Emission Trading System in terms of the internal and external stakeholders the port has been associated with. In Figure 41, emission formation and the necessity of calculating emissions have been associated with Borusan Port SOI themes. How this relationship is shaped through decarbonization, innovation, digitalization and OHS committee has been framed through the SOI evaluation interview held with Borusan Port managers and the EU ETS relationship. In Figure 41, business actors represent the stakeholders with whom the port is associated and identified in the stakeholder analysis. Business stakeholders and all other stakeholders are taken into account in terms of SOI innovation and decarbonization strategies.

Figure 41: The Relationship and Necessity of Port and Ship Operations Based Emission Calculation with Borusan Port Themes



3.8. METHODOLOGY FOR THE SEMI-STRUCTURED INTERVIEW FOR THE SUSTAINABILITY-ORIENTED INNOVATIONS IN PORTS

In the last analysis applied in this study, an exploratory qualitative analysis has been conducted using the semi-structured interview method in order to examine the sustainability-oriented innovation activities of Borusan Port and to create the innovation model of the port. The analysis has been designed using grounded theory to identify and evaluate the findings. Historically, embedded theory emerged in the 1960s as a result of a sociological research program on dying in hospitals by Glaser and Strauss (Walker and Myrick, 2006: 548). Essentially, embedded theory has combined the depth and richness of qualitative interpretative traditions with the logic, rigor, and systematic analysis inherent in quantitative survey research (Charmaz, 2000: 516).

Table 72: Line-by-Line Coding Example of an Interview Statement

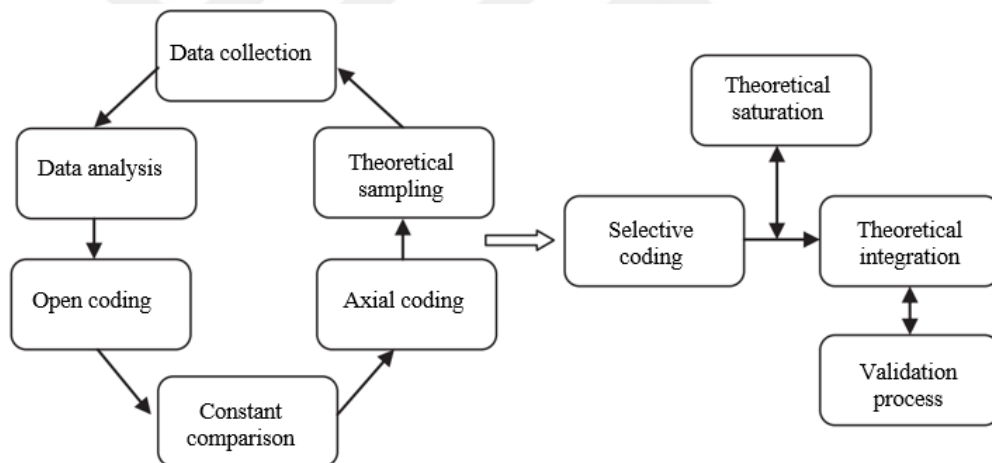
<i>Line-by-Line Coding</i>	<i>Interview Statement</i>
<i>“And so I decided this [pain, fatigue, and stress accruing during her workday] isn’t a way to live. I don’t have to work . . . So it was with great regret, and not something I planned, I turned in my resignation. It was the best thing I ever did.”</i> (Charmaz, 1995: 671)	Deciding to relinquish
	Accounting for cost
	Weighting the balance
	Relinquishing identity
	Making identity trade-offs

Source: Charmaz, 2000: 516.

When embedded theory, which has the potential to be reproduced with every research conducted within the qualitative research methodology and is a rich resource, is applied without being internalized sufficiently by the researcher, it causes the field to become shallow and is also exposed to unfair criticism. However, while it is possible to come across grounded theory studies, which is a qualitative approach that will contribute to both the academy and practitioners with the increase in correct use, in our country after 2013, it started to be used after the 1970s in the USA in researches in which qualitative research methodology is used in the field of

management and organization (Şener, 2019: 26). Two basic approaches stand out in grounded theory research in the literature. The first of these is the approach introduced as a qualitative research method by Glaser and Strauss (1967), and the second is the approach that connects data analysis to a detailed procedure and technical approach by reviewing the general understanding of Strauss (1987) and later Strauss and Corbin (1998). Thus, two movements emerged: “Glaserian” and “Straussian” (Şener, 2019: 30). The Straussian approach follows 3 basic coding processes. These are: open coding, axial coding and selective coding. Open coding is the process in which the researcher creates the first categories of information that are general and easily accessible in the literature about the phenomenon and is carried out to organize the data (Strauss and Corbin, 1998:101).

Figure 42: Steps of Grounded Theory Based on Strauss



Source: Roman et al. 2017: 994.

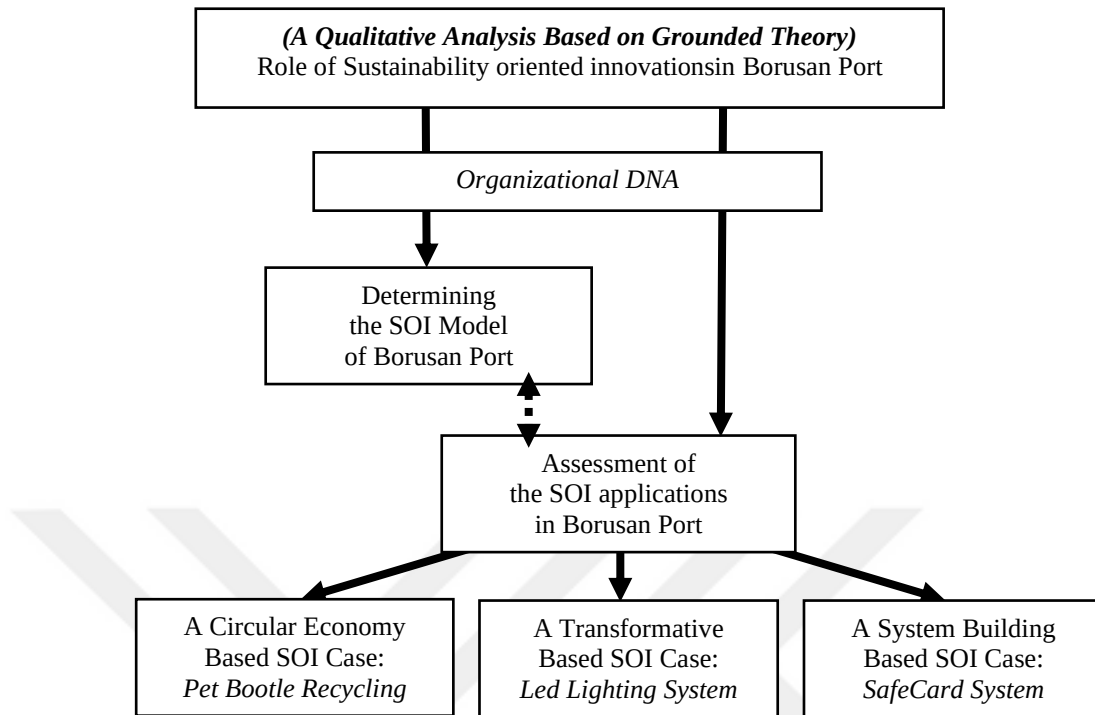
Axial coding aims to establish connections between categories that will help the researcher establish a central phenomenon to collect data together in new forms. To discover new relationships between the data, the researcher distributes them on different axes and thus the categories in open coding are reshaped (Strauss and Corbin, 1998: 123). Selective coding is defined as the researcher defining the story line by creating a story that integrates the categories previously determined by axial coding. In selective coding, the researcher constantly tries to saturate the categories using the comparison approach (Strauss and Corbin, 1998: 143). Both the

“Glaserian” and “Straussian” approaches argue that theories should emerge from the data. However, the analysis approaches are different (Şener, 2019: 31). Grounded theory has been used in the qualitative analysis part of this dissertation. Open coding, axial coding and selective coding of the Straussian approach have been used to analyze the data. In addition, sub-categories related to the literature on stakeholder management, sustainability and innovation management and sustainability-oriented innovation approach have been determined through the organizational DNA metaphor in strategic management studies, and the data have been divided into standard parts. In this respect, the first coding has been done with open coding (Strauss and Corbin, 1998:101). Then, basic cause and effect relationships have been revealed by establishing connections between the created categories and the events related to the categories (Strauss and Corbin, 1998:123). Finally, the Borusan Port SOI model and the port's three different SOI applications have been narrated comparatively, and selective coding has been applied.

3.8.1. Research Model of the Assessment of SOI Processes in Borusan Port

The main purpose of qualitative research is to try to understand concepts from the perspective of the people researching them. In this sense, as Sıgır (2021: 67) stated, an interest in the researcher develops. This interest emerged from the researcher's desire to explore social actors as a result of their efforts to make sense of the living-inanimate interactions, experiences, events and practices in their environment. Under this title of the dissertation, the purpose, literature gap and associated research questions, which is one of the three analyzes in the research and located on page a, and the model of the qualitative research carried out to explore the SOI processes in Borusan port are expressed. As a result of interviews with top and middle level managers of Borusan Port, the port's sustainability-oriented innovation model has been created using grounded theory.

Figure 43: Research Model of the SOI Process Assessment in Borusan Port



Additionally, as seen in Figure 43, three different SOI applications of the port (Pet Bottle Recycling, Led Lighting System, and SafeCard System) have been evaluated. In this part of this doctoral thesis, which is a case analysis on Borusan Port, a semi-structured interview has been held with a group of 6 participants from the top and middle management of Borusan Port, held simultaneously and lasting 2 working days. A face-to-face and simultaneous meeting was held with 6 senior Borusan Port employees, including the Borusan Port manager, on 4 and 5 July of 2023.

3.8.2. Data Collection Process

The semi-structured interview has been held simultaneously with 6 senior employees and 4 separate questionnaires have been used as seen in Appendix 13, 14, 15, 16. For the data collection process, the interview with the attached questionnaires has been held for 7 hours between 9:00 and 17:30 on Tuesday, July 4, 2023, and for 3 hours between 9:00 and 12:00 on Wednesday, July 5, for a total of 10 hours has been carried out. In addition, tangible practices regarding the sustainability-oriented

innovation activities of Borusan Port have been observed in the 45-minutes field trip on Tuesday, July 5, 2023. This 10-hours interview was audio-recorded with the permission of the 6 employees involved in the study. By transcribing the interview recording, interview answers consisting of 64 pages and 19731 words have been created. In addition, in the first stage of the research, the inferences obtained from the findings of the stakeholder analysis using the fuzzy inference system method, which is a quantitative method, and the handled cargo distributions to the sectors in the terminals of the port have been taken into account in the preparation of the questions that have been the subject of the interview. For this reason, the fact that the grounded theory-based qualitative study questions used in this part of the research have been created with Borusan port's qualitative data, quantitative data and exploratory quantitative stakeholder analysis is a result of paying attention to scope reliability.

3.8.3. Data Analysis Technique

The transcription text obtained as a result of the interview has been systematized with the content analysis method, taking into account the structural and process characteristics, cultural characteristics, strategic and management characteristics and organizational resource capabilities of the port, through the “organizational DNA” metaphor visually included in Figure 44, and evaluated through using grounded theory capabilities.

The study titled “Discovering the Nexus between Market Orientation and Open Innovation: A Grounded Theory Approach” by Denктаş-Şakar et al. (2014: 21) was based on establishing the organizational DNA metaphor in Figure 44. The organizational DNA structure in the study of Denктаş-Şakar et al. (2014: 21) has been created through Maersk, a maritime company. Since their study was prepared related to a maritime company, the organizational DNA structure in the relevant study has been taken into consideration in this dissertation. For improvements and innovations in the internal environment, changes in the external environment must be taken into account. At this point, in order to establish open innovation capabilities within the organization and to carry out these capabilities effectively, intra-organizational variables (Structural & Process Characteristics, Cultural

Characteristics, Strategic & Managerial Characteristics, Organizational Resources Capabilities) must be adapted for the success of open innovation capabilities Denктаş-Şakar et al. (2014: 21).

However, in this thesis study, some additions were made to the relevant structure, specifically for Borusan Port. Organizational DNA variables were established based on the structure in the study of Denктаş-Şakar et al. (2014: 21). Only some few minor changes have been made to the attributes. For example, employee commitment is expressed as preventing employee resistance in this thesis. However, employee resistance to change has been used together “openness to change” in this dissertation, and expressed as “preventing employees' resistance to change”. The formation of the SOI model of Borusan port has been modeled by the themes with the metaphor of “organizational DNA” and systematizing the analysis through the embedded theory expressed in title 3.8. In addition, 3 different SOI applications carried out by the port have been evaluated with regard to the innovation levels in 2 different SOI models proposed by Jay and Gerard (2015: 185) and Adams et al. (2016: 57), the formation of innovations, the benefits they revealed, resistance factors and a number of other constraints. The roles of the parties in the relevant SOI applications are expressed and classified in relation to the roles emphasized in the literature section, taking into account the innovation ecosystem. In addition, the current status of relevant SOI applications and the value they will offer for the future have also been evaluated.

3.8.4. Findings of the Semi-Structured Interview

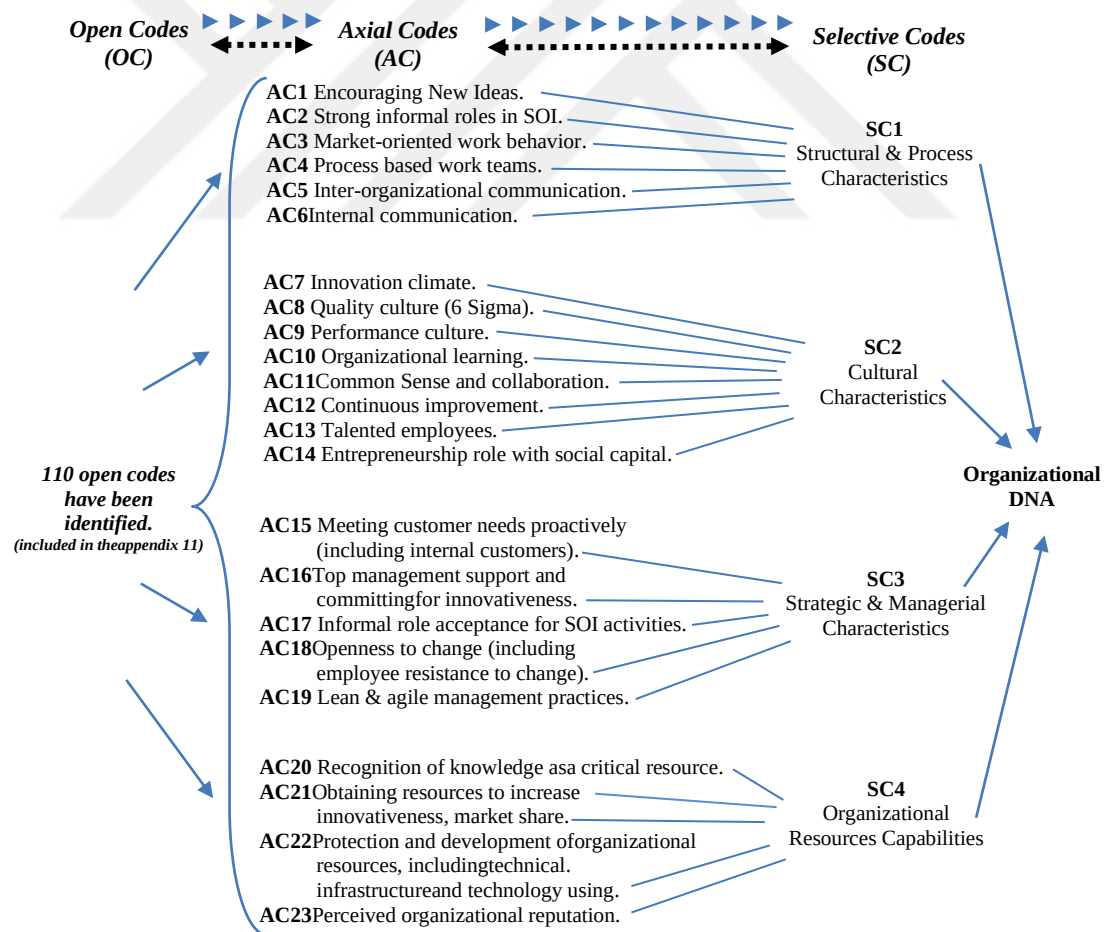
Based on the problem and literature gap emphasized in Title 3.2, in this study using mixed method, the need arose to first examine the innovation process of Borusan Port. For this purpose, based on the interview and taking into account the annual reports published by Borusan Port and Borusan Holding sustainability guide, the innovation model shown in Figure 45 has been created. This model is not a traditional innovation model; On the contrary, it has been determined as a result of interviews and literature matching that it is a sustainability-oriented innovation model. In addition, it has been revealed that Borusan port innovation model is a SOI

(Jay and Gerard, 2015: 185; Adams et al., 2016: 57) based open innovation (Chesbrough, 2003a: 44; Chesbrough, 2012: 23) model.

3.8.4.1. Data Coding for the Semi-Structured Interview in Borusan Port

Before moving on to the findings of the qualitative analysis study in which SOIs have been evaluated using grounded theory, it would be appropriate to mention the coding process that forms the basis of the semi-structured interview findings and creates the hierarchy of the structure of grounded theory. The structure has been created on the interview transcription text by performing open coding, axial coding and selective coding, respectively.

Figure 44: Hierarchical Structure of Interview Coding



This structure has been used as the basis for creating the Borusan Port SOI model and evaluating SOI applications in the port. The coding process, whose hierarchical structure is visualized in Figure 43, has been created by associating the 110 open codes as seen on Appendix 17 with 23 axial codes and then associating these 23 axial codes with the 4 selective codes created as seen on Figure 44. After the coding process was completed, the literature association of the established structure has been made to evaluate through the relevant literature. A qualitative data analysis program has not been used for coding, and the interview transcription has been created by tagging the sequential decision tree visual created in the Excel program. The coding process has been created with the researcher and the dissertation advisor, a professor in the field of management and organization. In addition, to reconfirm and verify the coding hierarchy and associations made, they have been verified by obtaining an expert opinion from a scholar who has publications based on qualitative research methods in academic journals with proven international reputation and prestige, and who also holds an associate professorship in the field of management and organization. Another important point is that the grounded theory structure used in the study has been created with the structure included in the literature as modified grounded theory. The structure of the coding process is included in the SOI evaluation model in Figure 45 through Appendix 17 and Figure 44.

3.8.4.3. Borusan Port Sustainability-Oriented Innovation Model

The innovative port capabilities Borusan Port have been mentioned with examples. These capabilities in the literature are explained for a clearer understanding of the port's innovation activities. From here on, the SOI model structure implemented by Borusan Port is explained, starting from the turning point in the 2008 World economic crisis. Some researchers argue that situations characterized by low economic growth, recession, or stagnation can potentially facilitate the identification of innovation possibilities and foster the innovation (Peris-Ortiz et al., 2014: 1). During the 2008 financial crisis, organizations that took globalization and institutionalization into consideration together with innovation management were able to use the power of innovation correctly during the crisis

period (Brem et al., 2020: 360). In this regard, during the 2008 world economic crisis, Borusan Holding adopted an innovation-based structure to reduce vulnerabilities arising from global balances. This structure is not based on informal roles and separate from the main job; As part of its core business, it has attempted to attract, implement and disseminate innovations. The participant R-1 expressed the direction Borusan holding took after the 2008 world economic crisis and its attitudes towards the crisis as follows.

***R-1:** Especially after the 2008-2009 crisis, we, as a holding company, put innovation on our agenda... ...During the 2008-2009 crisis, Lehmann Brothers said: We will not be able to achieve the future with the work we did before, what will we do to exist in the future? We are very fragile. While the sentence resonated all over the world, Borusan group also said, Well, we are fragile, what will we do then? 'We need to be developing new business models or creating new business areas. we thought. First, we thought, let's make the innovation work central. In other words, innovations should be introduced within the Holding. As a sub-dimension of this, let there be representatives at the company level. We thought let's collect project ideas from representatives and follow up on this work from the top. We thought that our companies should create suggestion systems, review them again and then trigger them.*

In order to attract sustainability-oriented innovations into the system, a thematic filter mechanism with performance indicators has been established under the roof of Borusan Holding, as seen in Figure 45. The aim here is to ensure that the innovation activities to be carried out coincide with the scope. In doing so, Borusan Holding has aimed to ensure that the top management's decision function is strong and to draw expertise to the center in order to effectively balance the society and stakeholders and for what needs to be done regarding sustainability (Waas et al., 2014: 5524-5525). The working system of the innovation filter at the holding level is carried out through the Holding sustainability working group, which is also established at the holding level. Similar to this working group, it is also structured at the group company level and serves as a platform for group companies to connect with each other and the external environment and to reach the connections necessary for the organization's DNA. The consolidated platform structure established by the Holding top management and the working groups established at the company level is similar to the advantages provided by the facilitating platforms that Yoon (2020: 3) stated in his study on Maritime stakeholders. Consolidated platforms can be established in many areas. These consolidated platforms help organizations make

fast, accurate and clear decisions in carrying out activities that will support their main goals with technological opportunities. It is also an important tool and stakeholder interaction channel for the continuous review and improvement of skills and capabilities in line with strategic and tactical plans (Yoon, 2020: 3). In this sense, Borusan Port has created a good example of the consolidated platform structure expressed by Yoon (2020: 3) with its committee structure formed by the holding and company working groups in six different areas.

Sustainability working groups will facilitate their roles as top management stakeholders in the collaborative and activity-oriented actions of the Holding and group companies same as seen in Denktas-Sakar and Karatas-Cetin, (2012: 313). In addition, sustainability working groups will provide a networking opportunity to make the right decisions in innovative activities (Mohanbir et al., 2006; Van Tonder et al., 2020) and will facilitate the matching of the decisions coming from the platform with the strategies (Bowonder et al., 2010; Van Tonder et al., 2020). Working groups and committee structures within Borusan Holding and group companies coincide with the “type-6 adaptive platform” structure, as seen on Table 14, which is the highest level of the business model innovation framework of Chesbrough (2007: 13-14). Adams et al., (2012: 20-21) emphasized that when a measurable innovation access platform is established, the foundations of an innovation ecosystem that can deal with all dimensions of sustainability equally and fairly will be created. In this sense, Borusan holding sustainability working group and company sustainability working groups reveal an important mission.

In the decisions taken by the sustainability working group of the holding, as can be seen in Figure 45, the subjects related to the themes are determined as a result of the interim decisions coming from the sustainability working group of the company. Regarding these themes, the SOI practices and improvements needed by the group companies are determined by the committees in the company sustainability working groups. Committee topics regarding Borusan Holding's sustainability themes have been updated in 2019. These:

- **Climate theme - decarbonization committee:** Borusan Port has achieved a reduction in carbon emissions with its electric overhead crane investment.

Additionally, a 15% reduction in carbon emissions has been achieved with the regenerative system conversion of 11 equipment in the machinery park.

- **Climate theme - circular economy committee:** Producing port work clothes from Pet Bottle waste. 2000kg/year hazardous waste has been eliminated by using harmless absorbent powder instead of leakage absorbing pads used in bulk cargo operation.

- **People theme - Borusan equals committee:** The rate of female employees has been being increased. Female field workers are employed. Priority has been given to coaching students of vocational high schools and employment for their graduates. On the International Women's Day, the products prepared by women's cooperatives have been presented to women employees. Awareness activity has been carried out by giving away the “equal tales” book set for the children of the employees. A cooperation has been made with Bursa Provincial Directorate of Family and Social Policies to provide training to village headmen, who have not yet started, within the scope of KADES.

- **People theme - occupational health and safety committee:** Borusan SafeCard personnel and machine interaction and tracking system, which has won three international awards, has been established. In order to reduce the risks in the working environment, virtual reality supported trainings are implemented in the port simulation center.

- **Innovation theme - innovative business models committee:** Equipment was designed and manufactured for the double-decked wind turbine tower loading, which has been the first in Turkey and the third in the world.

- **Innovation theme - digitalization committee:** Carrying out projects that will reduce paper consumption (B-signature, E-signature, digital machine checklist, all field and OHS inspection lists). 200 thousand pages of paper have been saved annually.

Again, as seen in Figure 45, it is a structure that is responsible for providing physical benefit in the bureaucratic procedures of the Borusan Holding Ankara office in order to achieve the practices, requirements and innovations that will direct the Borusan Holding sustainability working group and the company sustainability working groups. In this sense, information can be obtained very quickly, for

example, about a development concerning Borusan Port. This situation facilitates cooperation and communication with central government bodies on issues that will benefit the business and the public (Warren et al., 2018: 1787). In addition, with the Borusan corporate venture capital firm, which has been established in the United States in January 2023, this structure will conduct overseas activities that will support the innovation ecosystem and establish beneficial collaborations, screening start-ups and provides commercializable technologies to Borusan holding and the group companies that include Borusan port is located will enable companies to gain (Dedehayir et al., 2018: 24).

The company sustainability working group illustration as seen in Figure 45 has been designed separately for each company within the holding. In the committee structuring of the sustainability working groups, other group company employees who will provide support for the SOI practices desired to be implemented in each of the six committees and who have knowledge of the subject serve as “committee sponsors”. These committee sponsors may vary on a project-by-project basis. Each funnel in Figure 45 represents 13 companies of Borusan Holding. The large funnel represents Borusan Port. Organizational DNA variables, that have been based on the the organizational DNA model of The Denктаş-Şakar et al. (2014: 21), have been written on the Borusan Port funnel. Organizational DNA model includes four variables. The attributes under these variables reveal the structure created for the success of Borusan Port’s SOI structure. The fact that the committee sponsors from the group companies take part in the sustainability working group committees in Borusan port will support the organizational learning of the port and help the SOIs, which will be useful for organizational transformation, to rise to the system design level (Adams et al., 2016: 187). In addition, committee sponsorship is one of the informal roles that are effective in the proper implementation and dissemination of innovations by Borusan Port, and acts as a mediator for internal stakeholder interaction (Markham et al., 2010: 402). Open innovation-based SOI applications realized through stakeholder interaction in Borusan Group Companies may have 4 outputs. These can happen one by one, or they can happen all at the same time. In other words, an innovation output can be directed to both the relevant company and other group companies. These appear as SOI’s created for the existing market, SOI’s

created for group company markets, SOI's created for new markets and SOI's created for other company markets. The markets where these outputs will be effective are shaped by the ability of the innovation levels of the outputs to provide system building (Adams et al., 2016: 57) or system transformation (Jay and Gerard, 2015: 185). For example, Borusan Port's "3D Coil" product is both a product innovation, since it has a physical equipment infrastructure and superstructure; It is also a process innovation, since it has provided benefits in OHS capabilities and operational efficiency with the operation process change in the coil sheet handling operation. In addition, the fact that this SOI application has been designed by the IT team of Borusan port and the machinery maintenance and repair operation team ensures that innovative entrepreneurship is matched with talented personnel (Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197) and the establishment of strong informal roles (Markham et al., 2010: 402; Hall et al., 2013: 87; Verbano et al., 2015: 1053; Lee and Law, 2016: 167). If we draw attention again from this example, with contribution of the Borusan Port IT team that having a software-driven by developer structure that dominates the port ecosystem, the IT team plays the role of champion in innovation for new concepts that will enable gains in the future (Howell and Higgins, 1990: 41-49). In this sense, Participant R-1 expressed the fact that the full-time software team of Borusan Port has mastered the dynamics of port management as follows.

R-1: *...When there is a software team that has a good command of the processes and the dynamics of the industry, things get easier. otherwise, if there was a team that only knew software and did not know the port, many things would have been overlooked. They would expect us to want something and tell them about it. In its current state, our IT structure is extremely robust and operates in a robotic manner... ..As Borusan Port, we have experienced and continue to experience the advantages of having an in-house IT team that knows the sector in all the projects we develop...*

As a result of the IT team being "software driven by developer" and taking on the role of champion in innovations, all other software related to the Ro-Ro and general cargo terminal, except for the container terminal software of Borusan port, is completely developed by this IT team using in-house capabilities, thanks to which talented employees are responsible for innovation (Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197). Participant R-3 stated that Borusan port IT team can be

supportive and guiding in corrections and improvements in the processes of other units of the port, thanks to its knowledge of port operation processes.

R-3:“...Since the IT team knows the internal operation structure very well, there are times when the IT team corrects us while meeting in the meetings. For example: When we say “we are labeling this, they tell us not them; There are times when he corrects us by saying, You need to put a label on this...”

In this sense, Borusan port IT team's command of the port ecosystem enables them to create process-based business teams that guide SOI applications and create new generics (Hansen et al., 2009a: 687). At the same time, activities and initiatives that will contribute to the operational performance development of Borusan Port (Nafei, 2015: 130) are revealed by supporting the structuring of the informal role in the functional business units and these process-based business teams (Rashid and Chalab, 2007: 10-18). The ETA Logistics application developed within Borusan Logistics has emerged as a result of attaching importance to this “software driven by developer” structure. Participant R-1 stated that, in addition to the main work, they adapt side jobs that may be relevant to the needs of the day through business model entrepreneurship.

R-1: *...For example, when the Eta logistics application was emerging, we said that we were already in the transportation and logistics business regarding Eta; But we were not on the digital side of the business. We started this initiative to adapt it to the digital side, and therefore we started ETA by saying that even though this is not our main business, it is a business that complements and can create value together with our main business...*

The double-deck wind turbine tower transportation, which has been developed and started to be implemented at Borusan Port this year, is also a product innovation (the design and production of the double-deck loading equipment by the Borusan Port Machinery technical team together with the wind tower manufacturer who requested the service); and as a process innovation, this is a SOI application developed through the innovative business models committee within the scope of the Innovation theme of the sustainability working group of Borusan Port. Here again, the entrepreneurial role with social capital and talented employees (Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197), the market-oriented work behaviors of

process-based work teams (Hansen et al., 2009a: 687; Vanelslander et al., 2019: 616), continuous improvement (Dooms et al., 2004: 16; Pérez-Rave et al., 2023: 126), collaboration and being a learning organization (Braga, A. Braga, V, 2013: 44; Warren et al. 2018: 188) are the unique elements of the SOI applications carried out through the organizational DNA identity as seen on Table 73, 74 and Figure 45 created in a harmonious innovation climate (Amabile et al., 1996; Adams et al., 2016: 190).

Returning to Figure 45, SOI development and implementation processes in Borusan port are settled on open innovation (Chesbrough, 2003a: IX-XXIV; Lazzarotti and Manzini, 2009: 622-623; Adams et al., 2016: 181-192) and lean and agile and it is expressed with a funnel in accordance with the requirements of management practices (Power et al., 2010: 1; Bushuyeva et al., 2019: 77-78). In this funnel, projects that are not suitable, unsuccessful or whose time has not yet come are taken out of the funnel. Participant R-2 stated that Borusan Port's view of innovation is within the context and without a single truth, but as a whole of processes that will provide flexibility and that can be given up when necessary and require being ready.

***R-2:** ...In our view of innovation, we think of it as in-context. That is, there is no single truth. We are shaped depending on the event and situation. Because if we start with a single line, a line that works at the current point may not work at another point. We need to be flexible on this issue too. So let's be flexible when trying new things. If these new things lead us to the right place in the subject we are practicing, we have an attitude that we should continue or pivot, give up or change. Naturally, there is always a gap between where we want to be and our realities. Then we say that what we see as a solution or as a change and innovation does not suit us and we give up on it. Or we say we are not ready yet. Let's wait a moment and realize the concept a little more. We say, let's try the related innovation a little bit outside of us, let's observe it and then discuss this issue again after we are ready...*

Participant R-1 stated that, institutionally, they have adopted a structure where innovation is learned as a result of experiments, planning is made for the future, and if necessary, it can be canceled and pivoted and put on the agenda and followed.

R-1:“...Let's try something as an institution and according to what we learned from him, we say, let's plan or cancel our next account or pivot and keep it on our agenda for later...”

However, at this point, the important point is that untimely projects are put on hold and continue to be followed. These projects and ideas are re-evaluated and included in the process, when necessary, through the relevant committees of the company's sustainability working group. Unsuccessful projects are already removed from the system. However, for example, if a project that is not suitable for Borusan Port is suitable for another group company, it is covered by the sustainability working group of the relevant group company. In this sense, as Lazzarotti and Manzini (2009: 622-623) put it, Borusan Port is open to change and reacts in accordance with the requirements of the day and the future, thus establishing efficient collaborative networks and making it easier to integrate with the right stakeholders. Borusan Port, when necessary, pursues change in SOI projects by abandoning or pivoting them. In this regard, Borusan Port aims to achieve the right pivoting in SOI projects through change or abandonment. Additionally, Borusan Port implements this changes that will help implement SOI projects required for unit changes, market changes and business changes same as Chesbrough (2003a: IX) revealed in his study. By accepting the change, Borusan Port seizes the opportunity to uncover and bring disruptive SOI projects to market same as Vanelander et al. (2019: 616), revealed in their study. It has been observed that it has achieved this with the support and commitment of the top management (Bowonder et al., 2010: 20; Gyau and Stringer, 2011: 135; Dedehayir et al., 2018: 22; Erlandsson and Gaylong, 2019: 39). Additionally, Bordia et al. (2004: 525) and Reichers et al. (1997: 48-52) stated that insufficient availability of information may result in the propagation of rumors that exaggerate the adverse implications of the change, hence fostering resistance towards the change. In this sense, Borusan port is also as supported by Bordia et al. (2004: 525) and Reichers et al. (1997: 48-52) stated, it prevented the formation of misconceptions and employee resistance and fulfilled an important element for the success of SOI projects. Also, in addition to providing quality information, leadership behaviors concerned that involve initiating, encouraging, and facilitating change play a crucial role in influencing employees' willingness to accept

change (Oreg, 2006: 97; Yukl, 2012: 73-74), facilitating change the emergence of change processes (Yukl, 2012: 72), impact followers' implementation of innovative practices (Michaelis et al., 2010: 421), and creating a positive climate that promotes the adoption of change and encourages innovative behavior (Kavanagh and Ashkanasy, 2006: 98). In this sense, participant R-3 stated that when new applications were put into use, benefit-oriented explanations were made through training meetings instead of force, and that the applications were put into operation at partial intervals after the training provided.

***R-3:** ...We do not announce that we have implemented such and such a practice. Because when that happens, employees become afraid, uneasy and immediately react. Instead, we announce that it is a routine meeting. Everyone participates. First of all, we explain the benefits of the application before using it, we explain what it will do. Then we provide training. For example, in the promotion of the e-signature project, we wanted everyone to have their mobile phones with them. While I was explaining how to use the application at the meeting, the younger and technology-oriented employees immediately understood what needed to be done, and then they developed a learning process from the specific to the general by helping the employees next to them. However, we implement the applications in parts after the training...*

The participant R-2 has stated that the security unit showed resistance to monitoring SafeCard system due to the increasing workload. In this sense, Participant R-2 stated that the monitoring of only the two most vital issues in the relevant system is given to the security unit's responsibility. Thus, he stated that internal customer satisfaction was achieved with responsibilities that would not make it difficult to do business in accordance with the nature of the industry and the business. This has led to the elimination of employee resistance to SOI products and applications. As Ansoff (1965: 34) and Voelpel et al. (2004: 40) stated, taking into account the needs of employees, who are referred to as internal customers at Borusan Port, in the innovation process has emerged as a requirement of the positive innovation climate.

***R-2:** ...For example, the Security department created resistance regarding the use of the SafeCard, such as how can we keep track of this? why was this given to us? but here we only reflect the two most important warnings on the security screen. These are the warnings coming from the inactivity sensor and the warning coming from the fall sensor. Because when the dissatisfaction of employees arising from new tasks and new applications is not compatible with the nature of the job and the sector and makes it difficult to do business, we have to take internal customer satisfaction into consideration...*

Shi et al. (2020: 879) have revealed that overcommunication reduces uncertainty in project processes if over communication is provided through right communication channels. Also, Cabello-Medina et al. (2011: 390) stated that vertical and horizontal communication as well as being fast, easy and abundantly accessible have positive contributions in reducing uncertainties and supporting innovations. In this sense, the participant R-1 stated that they also include over communication in Borusan port to prevent communication accidents.

***R-1:** This communication is even called overcommunication in the literature. In other words, the essence of this job is to communicate more than necessary, not as much as necessary, so that there are no pauses or disruptions that may occur due to communication accidents. That's why there are times when we miss the tip of the scale in communication...*

Giving importance to internal customer experiences in the process of developing, implementing, integrating into the system and, if necessary, removing or regulating SOI projects that are subject to change and innovation for the reasons mentioned above for example, Vanelslander et al. (2019: 616), Ansoff, (1965: 34) and Voelpel et al. (2004: 40) It has been seen that it has been also implemented in Borusan Port and supported the literature.

3.8.4.3.1. Brief Summary of Borusan Port SOI Model

Finally, if we metaphorically summarize the interactive structure of the Borusan port SOI-based innovation model, SOI themes and performance indicators are determined by the holding sustainability working group within Borusan holding. In determining SOI themes and performance indicators, SOI themes and performance indicators are determined through organizational learning created at the company level by evaluating the feedback provided by the company sustainability working groups of 13 Borusan Group Companies operating under the holding sustainability working group and the holding expectations. Company sustainability working groups collaborate with external stakeholders both in the process of determining these themes and performance indicators and in the implementation of SOIs. In addition, 13 group companies have the opportunity to access the legal notices of Borusan Ankara office and the open innovation interactive start-up access to be provided by

Borusan America joint venture capital through the Borusan Holding sustainability working group. In Figure 45, green circles passing through the Borusan holding performance filter represent possible SOI ideas and capabilities related to the Climate theme, yellow circles to the People theme, and blue circles to the Innovation theme. SOI ideas that pass through this filter according to the priorities and requirements of the relevant group company are evaluated in the relevant committees in the company sustainability working groups together with committee sponsors from other group companies and interacted in the open innovation funnel in accordance with the organizational DNA identity. After the necessary tests and trials (the duration of these trials may be a few months, a few years or 5-6 years) and determining ROI suitability, it is added to the system if it provides positive results in accordance with the requirements of the day, the sector, the work done and the relevant themes for the company. However, those that are not suitable or not yet suitable are removed from the system, but are re-evaluated when it is possible to use them for the relevant group company or other group companies at a later time. However, although the main themes of all group companies are different, for example, the main theme of Borusan port is Climate theme and the main theme of Borçelik company is People theme. When evaluating SOI projects related to human contact, importance is given to the development and implementation of SOI projects related to People contact, even if the current ROI is not suitable, by taking future ROIs into consideration or by pushing ROI to the background. This situation in Borusan Port is supported in the literature by the fact that it is important to consider the return on investment in strategic innovation projects (Mukherjee and Bera, 1995; Tritle et al., 2000; Poh et al., 2001; Muller et al., 2005: 37-45; Verbano and Nosella, 2010; Braga, A and Braga, V., 2013; Bayarçelik et al., 2014; Mitchell et al., 2014; Kaliappen and Hilman, 2017). In addition, the realization of innovation projects with a strong social aspect is effective in eliminating communication barriers and prejudices in society and organizations Courtney and Powell (2020: 5-19). In this sense, it will be beneficial for Borusan Port to push ROI into the background in innovation projects related to human contact, such as OHS applications, in terms of employees' adaptation to change and communication. SOI projects, with the necessary eligibility, trials and acceptance, are put into use by the relevant group company. In fact,

sometimes some SOI applications are introduced to other group company activities outside of the group company in which they have been developed. SOI applications created with open innovation can be created as interactive concrete outputs for the market of the relevant group company, for the market of other group companies, for new business markets, and for the markets of other companies, as seen in Figure 45. In this sense, some SOI applications can be commercialized and presented to different companies operating in the related sector or in other sectors with the creation of supply-demand mechanisms. All these mentioned elements, constraints, capabilities, activities, products and processes, which overlap with the relevant literature, reveal that the innovations implemented in Borusan port are realized through the sustainability-oriented innovation model. After presenting the findings regarding the structure of the sustainability-oriented innovation model of Borusan Port in Figure 45, the evidence regarding the foundations of the sustainability-oriented innovation model at Borusan Port, which triggered the formation of the structure of this model, have been conveyed through the “organizational DNA” structure (same as in Govindarajan and Trimble, 2005: 49; Holladay, 2005: 1; Coombs, 2006: 91; Rashid and Chalab, 2007: 10; Denktas-Sakar et al., 2014: 22; Nafei, 2015: 117; Azudin and Mansor, 2018: 225; Elsanhawy and Badway, 2023: 115) especially in relation to the strategic management literature. In this regard, the concept of “Organizational DNA” has emerged as a metaphor in the field of organization and management to depict the nature and characteristics of an organization (Soroush et al., 2013: 1417).

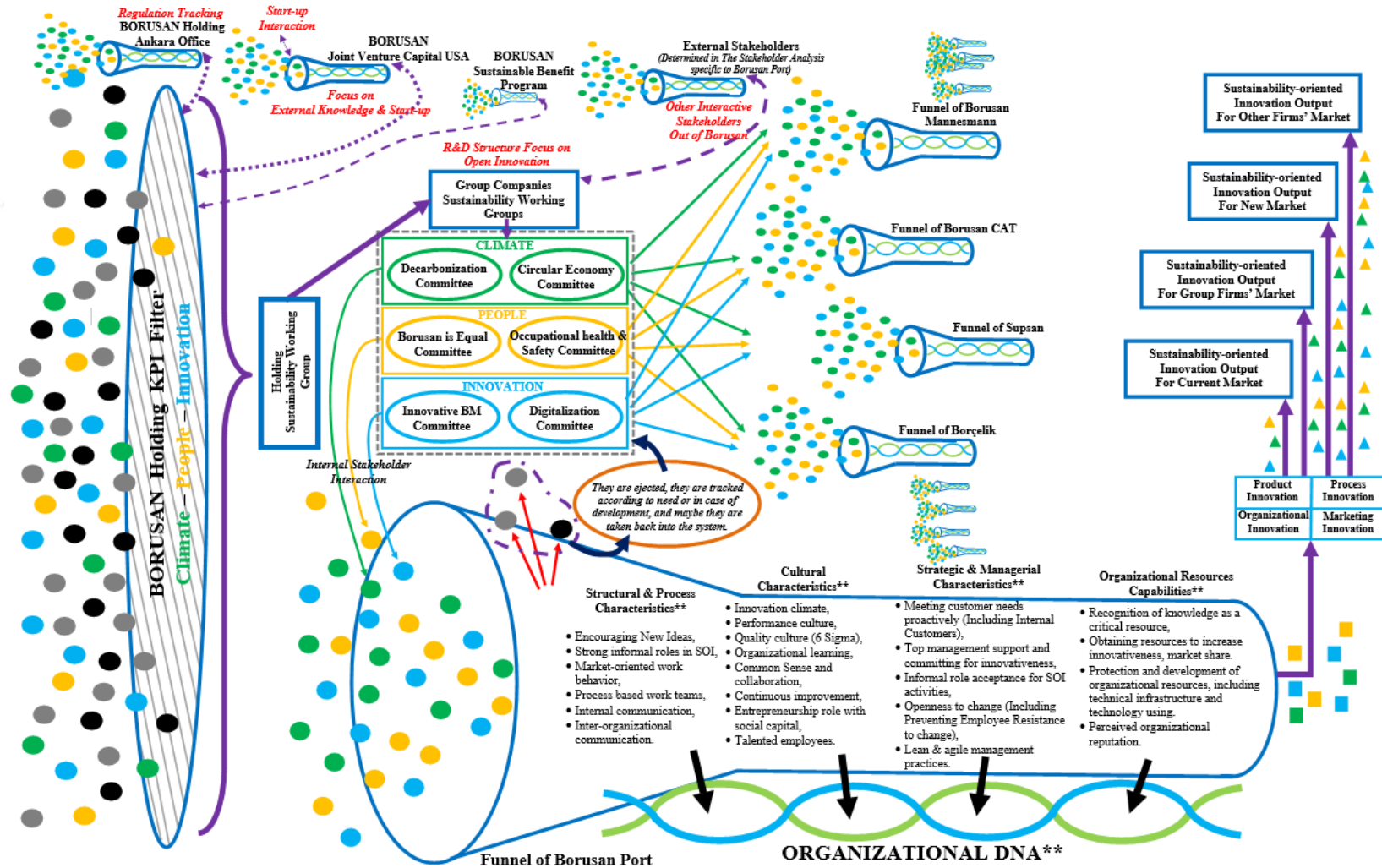
3.8.4.3.2. Structural & Process Characteristics

Regarding the impact of organizational factors on organizational innovation, Denktas-Sakar et al. (2014: 26) stated that there is a widespread belief that decentralized, informal and organic organizational structures exist in cases where Maersk facilitates innovation by encouraging new ideas. In this sense, the structural and process characteristics of the organizations have been expressed many times by Borusan Port's senior employees, who are the participants of this study. These structural and process features are gathered under 6 elements as the encouraging of

new ideas, strong informal roles in SOI, market-oriented work behaviors, process-based work teams, internal communication, and inter-organizational communication.



Figure 45: Innovation Funnel of Borusan Port in Terms of Sustainability-Oriented Innovation in The Structure of Borusan Holding



**Organizational DNA in the study of Denktas-Sakar et al. (2014: 26) has been based for the SOI Model of Borusan Port.

Encouraging new ideas - In the regular meetings held by Borusan Port, new ideas are supported within the business with a structure that will facilitate the emergence of new ideas that will facilitate operation and managerial capabilities and provide advantages within the agenda. Participant R-3 and R-1 expressed the importance given to ideas, suggestion systems and idea triggering in regular meetings at Borusan Port.

R-3: ...In meetings held every two weeks at Borusan Port, ideas regarding developments are taken into consideration while discussing the agenda...

R-1: We also look scientifically at uncommercial ideas, because ideas that we think can lead us astray are valuable to us even if they haven't been commercially proven... ...Let our companies reconsider their suggestion systems and trigger ideas through those works...

However, the important point here is that innovative business ideas should be filtered by management and accurate predictions about the ideas should be screened by the management (Govindarajan and Trimble, 2005: 54; Bressan and Pedrini, 2020: 508-510). Encouraging new ideas is an important element in the success of sustainability-oriented innovation activities at Borusan Port.

Strong informal roles in SOI - In sustainability-oriented innovations, the emergence of informal job descriptions provides support to the roles related to structural and process characteristics (Markham et al., 2010: 402; Hall et al., 2013: 87; Verbano et al., 2015: 1053; Lee and Law, 2016: 167). Participant R-1, R-2 and R-3 stated that sustainability and innovation activities and initiatives related to these activities were designed as a part of the current work regarding the creation of strong informal roles in SOI processes at Borusan Port. In addition, the relevant participants stated that in addition to the main responsibilities at Borusan port and other group companies, informal roles established through company and holding sustainability leaders, committee structures and committee sponsors have been institutionalized.

R-1: ...We see innovation and sustainable activities as a part of business development and aim for all our departments to see this as a part of their business...

R-2: ...Drivability and innovation activities are not something that can be done from the outside, that is, by establishing a separate department, it is not possible to make the necessary changes and renovations in terms of drivability and innovation. Since a structuring outside of us business will not know as much as we know. Therefore, drivability and innovation activities at Borusan Port are progressing as a part of routine work.

***R-3:** ...Because everyone carries out this activity regarding sustainability and innovation along with their primary responsibilities within their own company...*

***R-2:** ...Participant R-3 company acts as sustainability leader at Borusan port. There is also the holding sustainability leader, there are committee sponsors at the corporate level, and there are committee leaders at the holding level...*

In addition, the existence of informal job descriptions for activities that will ensure organizational transformation contributes to the formation of embedded knowledge. In this sense, Informal roles acts as a catalyst for process and product innovations (Adams et al., 2012: 17-20-21; 2016: 185). This situation matches the view advocated by Kelley (1991) that the creation of solid informal roles is effective in leaders assuming a successful regulatory role.

Market-oriented work behavior -Vanelslander et al. (2019: 616) revealed that ports will bring about development by triggering sectoral transformation after providing “unit change, market change, and business change”, respectively. From this point of view, the “3D Coil” product applied by Borusan Port and its introduction to operations show that the port has made a unit conversion in coil sheet handling and will make a market change for coil sheet customers with this unit conversion. Moreover, this market change is essentially a sustainability-oriented innovation. This “3D Coil” innovation can be made available in the relevant customers’ own field facilities by triggering development. This situation has changed the capacity-oriented operation climate as a result of the demand from coil sheet customers. Thus, the process of 3D coil handling equipment and product innovation of 3D Coil system has carried out with a market-oriented approach enabled the establishment of systemic relationships and organizational transformation. Participant R-1 stated that they keep product and system designs that will contribute to market adaptation at Borusan port, and practices that will benefit market penetration, even if they are not included in the agenda. On the other hand, Participant R-2 stated that they were successful in sustainability and innovation activities besides routine works by leaving the comfort zone regarding their understanding of doing business, and stated that while doing this, they steered innovations according to the expectations of the port and the sector they are in, conjuncture and employee characteristics.

***R-1:** ...By designing the 3D coil product, we contributed to our market adaptation to the needs of coil sheet customers in the operations of Borusan*

port... ...Even if we do not immediately implement practices that will benefit market penetration, we keep them in our focus and bring them to the agenda when necessary... ...By making improvements, we can adapt it to different businesses where it may be used for similar purposes.

R-2: *...Taking the risk of leaving your comfort zone is effective in being successful in sustainability and innovation activities. While doing this, we are trying to direct innovation activities according to the expectations of the port and the sector we are in, conjuncture and employee characteristics.*

It is noteworthy that this situation is in line with the structure put forward by the soi model of Adams et al. (2016: 185) and that the relevant model has also been realized in the port ecosystem.

Process based work teams -SOI has been considered to be quite risky due to common market risks and directional risks of sustainability-oriented innovations. However, such innovations attract the attention of the business world and society. Therefore, generic methods are needed to reduce the directional risk of sustainability-oriented innovations. In this sense, process-based work teams offer generics that will guide the SOI (Hansen et al. 2009a: 687). Participant R-3 stated that project working groups with the support of top management were established in improvement and innovation activities, and trends in this regard were followed, and stated that committee-structured formations and duties and responsibilities were created as a result of the areas the projects were related to. Participant R-1 mentioned the ease of performing process-based activities with the presence of an IT team that is familiar with port processes and the operational and managerial dynamics of the sector. He also stated that functions such as control, research and implementation related to project processes are distributed to all project teams as much as they are relevant, and that the entire team dominates the project processes from start to finish.

R-3: *...We set the agenda at bi-weekly meetings supported by senior management. Our improvement and innovation activities are progressing in the form of project working groups. We form teams within the scope of relevant projects... ...Additionally, the main point in our processes is to follow trends...*

R-1: *...Our IT activities are carried out by a software team of 10 people experienced in port management. This team is well versed in port processes and has strong software skills. Since there is a team of software developers who know the process, they help us when they say, "For example, there is such an optimization opportunity here... ...Since we have an in-house software team that masters the dynamics of the port industry, it is comfortable for us to operate process-based... ...We distribute the control, research and implementation functions as processes to the extent relevant to each team. However, our main concern is that everyone has control over the process...*

***R-3:** ...We divide projects into processes by acting with a committee structure...
...I prepare the project file by checking it in committees, then I contact the team
in the relevant project. So the project processes run through me. In addition, R-
1 makes the necessary evaluations.*

In this sense, Rashid and Chalab (2007: 10-18) stated that the appointment of project leaders (process owners) or functional business unit managers (informal role owners) who will lead the keeping alive of business processes and are responsible for the successful execution and They follow-up of project processes will support process-oriented work. stated. In addition, process authorization is directly related to the performance improvement of the business (Nafei, 2015: 130).

Inter-organizational communication -Bos-Brouwers, (2010: 430) has stated that the little bureaucracy and informal communication between organizations leads to efficiency, effectiveness and sensitivity to changes in sustainable innovation project teams in the (commercial) environment. A study conducted by Basov and Wuehr (2012: 279) revealed that individuals who achieve success in innovation had informal networks characterized by a high degree of centralization among important innovation actors. In addition, it has been determined that the centralization power of the project partners negatively affects the success of economic innovation projects. Furthermore, these actors are interconnected by a robust flow of communication. Effective internal and inter-organizational communication is crucial for the successful execution of research and development (R&D) endeavors pertaining to sustainability and innovation. Participant R-3 stated that the business development unit initiated the project processes and then the project execution authority was transferred to the other authorized department or departments, and that the employees shared when they saw improvement and innovation opportunities not only in their own business field but also in other departments.

***R-3:** ...We first started with the planning as a business development unit. Later,
the administrative affairs department took over the execution of this work. If
communication and coordination will be established within the company or on
the Holding basis in our projects, then we come into play. The process
progresses this way in each of our projects...*

***R-5:** ...As the investment and technical affairs unit, we are already in constant
communication. Not in the logic of a superior mind; We are also in constant
communication with our personnel who perform the tests in the field... ...If you
approach the events with horizontal integration rather than with a superior
mind, the possibility of experiencing indecision in projects is eliminated...*

R-3: ...For example, I saw a new technology related to lighting systems at a fair I attended. I took the brochures for that system to bring to the R-5... ...So, now everyone constantly informs each other if there is something related to both their own field and their side fields, so that they can follow it.

In this sense, Jaworski and Kohli (1993: 67) have empirically demonstrated that internal communication will facilitate market-oriented work and make positive contributions to business performance. Additionally, Adams et al. (2016: 191) emphasized that sustainability-related innovations will be embedded in the business through internal communication and interorganizational communication.

Internal communication -The sustainability working group and committee structures at Borusan Port have ensured that internal communication is proactively supported by inter-organizational communication in accordance with the literature, and that the appropriate structure has been established for the correct implementation of technology-driven and market-driven innovations (Rogers, 1962: 162; Verganti, 2003: 37). In this sense, The participant R-3 stated that committee meetings were held at the holding level and group companies level on business development and innovation activities. In addition, She stated that by appointing committee sponsors, both inter-company and intra-company communication are ensured, while the knowledge of an expert who is knowledgeable on the subject is also benefited. She, in this point, stated that employees inform each other about the elements that will benefit other units in the organizations they participate in, and she emphasized that committee sponsors have a role in disseminating information in all group companies.

R-3: ...Committees from group companies within the scope of Sustainability and Innovation meet every three months within the Holding to exchange ideas on business development and innovation activities... ...Company committees also hold meetings at the company level... ...Each committee has a sponsor appointed by the Holding. For example, I can be a sponsor for Borusan Energy or a person from Borusan Mannesmann can be a sponsor in our port company's a committee... ...Our entire team attends fairs and conferences. We interact here, and when we returned, we noticed an application, a product, an innovation that may not be directly in our field, but for example, we noticed for an area where R-5 can create a solution. When that time comes, we share it right away or sometimes we reach out to each other right away to see if there is such a thing, let's have an interaction... ...Holding sustainability meetings are held twice a year, where sponsors in the committees explain the work done throughout the group, and there are group sustainability meetings held within the companies themselves...

In this sense, committee structures in Borusan Port and other group companies and sponsors from group companies in the committees support entrepreneurship and organizational learning, helping to raise sustainability-oriented innovations to the level of system design in organizational transformation as stated by Adams et al. (2016: 187). Markham et al. (2010: 402), stated that sponsors are one of the informal roles that are effective in the proper implementation and dissemination of innovations. In this sense, the sponsor structure at Borusan Holding is also an important element in the discovery, implementation and dissemination of necessary innovations.

3.8.4.3.3. Cultural Characteristics

The importance of cultural characteristics of a market-oriented organization in achieving open innovation is discussed in the existing literature (e.g. Docherty, 2006: 13). In addition, from the results of the literature review and the analysis of the interview transcription, innovation climate (Amabile et al., 1996; Braga and Braga, 2013: 338-346; Adams et al., 2016: 190), performance culture (Marques and Monteiro-Barata, 2006: 124; Bos-Brouwers, 2010: 430; Elsanhawy and Badway, 2023: 117), quality culture (Adams et al., 2012: 12; Adams et al., 2016: 185), organizational learning and collaboration (Braga, A., Braga, V., 2013: 44; Warren et al., 2018: 1787-1791), continuous improvement (Dooms et al., 2004: 16; Pérez-Rave et al., 2023: 126), entrepreneurial role with social capital and talented employee (Briganti and Samson, 2019: 261; Lertxundi et al., 2019: 197) those are the main elements overlap with the relevant literature. These 7 elements are mainly associated with the company culture as a cultural pioneer.

Innovation climate -Amabile et al. (1996) have defined the organizational innovation climate as the degree to which individuals perceive support for creativity and innovation in their organizational environment, including factors that encourage creativity, autonomy, freedom, availability of resources, and the presence of pressure, as well as barriers that hinder the creativity process. Participant R-1 stated that, in addition to the main business, there are side jobs of strategic importance and that they support ideas regarding these side areas. He stated that instead of

establishing a department where innovation and sustainability activities would be evaluated in evaluating and implementing these ideas, they established a structure in which these activities were incorporated into the corporate culture. Again, Participant R-1 stated that there are startup companies that they follow within some technoparks in Turkey and that they established an American-based joint venture capital company to follow the startups in America and bring original ideas to Borusan group companies in Turkey. Participant R-2 emphasized that Borusan holding culture provides the necessary freedom and a playing field and opportunity to make improvements and innovations when necessary.

R-1: *...We need to clarify innovation. We have a core business, and besides these core businesses, there are jobs that are disconnected from these areas. We cannot continue on these disconnected matters. But we have strategic areas next to our core business, so let us support business ideas in these areas... ...We have come to a point where, instead of establishing an innovation department, we have incorporated this into the corporate culture of thinking to identify ideas that will lead to innovation... ...We follow certain startups within various technoparks in Turkey... ...We established a venture capital company as Holding in America and its name was determined as Borusan joint venture capital. This company also follows Turkey, but it will mainly be based in the USA and will follow it. In this way, we will take a quick look at startups and invest in some of them... ...It is actually a company that seeks to identify original ideas, which of them can be adapted to Turkey. As you know, there are startups with very original ideas. There is also the matter of localizing the original idea that you believe will be worked on and adapting it to the country. Therefore, as a company that will open some horizons for us at these points, we have restructured this company throughout the Borusan group...*

R-2: *...Borusan culture provides the necessary playground and opportunity for us to play with the relevant elements and make improvements or innovations in case of need, it allows us...*

Adams et al. (2016: 190) have stated that sustainability and innovation activities should be a set of processes consciously organized within the enterprise. They have also noted that sustainability should no longer be an add-on; Instead, they have emphasized that a growing SOI culture will emerge when it becomes established as a cultural and strategic norm.

Quality culture (Sixsigma) -To effectively establish a sustainable-oriented approach, firms must possess the capacity to seamlessly incorporate the sustainability aspects of their existing innovative skills into established quality systems, such as six sigma and ISO9000 (Adams et al., 2012: 12). Participant R-1 stated that suggestion systems are used at the senior management level and that the process is carried out to

bring the project topics that are wanted to be focused on to Borusan Port and other group companies through the committee sponsors, and that the committees review the topics included in the suggestion system with their expert knowledge and include them in the process if appropriate. He also emphasized that the resulting projects are evaluated by matching them with Borusan Holding's six sigma culture. He stated that within the suggestion system, blue-collar personnel mostly come up with operational and instant improvement ideas, but these ideas are also taken into account without being marginalized, and this attention sometimes leads Borusan port in terms of processes and products. He emphasized that innovations regarding processes and products are carried out through experiments and incrementally, and that Kaizen culture interaction prevails.

***R-1:** ...We use recommendation and proposal systems in our port and, of course, within the holding company. As senior management, the issues we want to focus on are reviewed through sponsors or our own committee members and taken into the process if necessary. The resulting projects are evaluated by Borusan in line with the 6 sigma culture... ...From the Blue Collar side, only operational solutions that will save the day and ideas that will perhaps only work for that moment come. However, we do not marginalize any ideas and we evaluate them with due consideration. Although that idea does not give a direct solution, it can guide the way to a solution. Because when you look at the world from a global level and a broad perspective while doing innovation work, without marginalizing any idea, the ideas, processes and products that emerge lead you to serious innovation... ...We never make an innovation 100% operational immediately... ...We want to progress incrementally and by experimenting in order to be more innovative. In summary, we want to do this with a little more kaizen culture.*

Adams et al. (2016: 185) emphasized that practices that will ensure organizational transformation are important for the formation of a sustainability-oriented innovation culture embedded within the organization, and that all elements that focus on culture are included in this.

Performance culture -Spreading a performance culture throughout the organization and determining a performance equation is necessary to remain competitive through innovation and creativity (Elsanhawy and Badway, 2023: 117). Marques and Monteiro-Barata (2006: 124) empirically determined that by creating a performance culture, businesses will encourage the use of tools that will encourage creativity in decision-making processes and the allocation of resources to create more profitable and beneficial innovations. In this context, the participant R-1 stated that

they give importance to performance criteria since they work with their business partners for a long time. They give importance to merit rather than loyalty. Participant R-1 also mentioned that the project partners provide feedback by making performance measurements and added that they parted ways with the project partners who did not resolve the deficiencies. Regarding the evaluation of SOI projects, he also emphasized that they take into account the existing ROI in projects with an emphasis on economic aspects, but that ROI remains in the background in issues that concern people.

***R-1:** ...The most important issue for us is the performance criterion. Actually, our friends wanted to express it. Our logic is this: We attach importance to merit rather than loyalty. Because we work with our business partners for a very long time... ...We both measure the performance of our project partners and provide feedback on performance. We say that if you do not correct these deficiencies, we will have to look elsewhere... ...Economically, we look at ROI in projects. In matters concerning people, ROI comes to the fore...*

In this sense, the fact that ROI is taken into account as the basic performance indicator at Borusan Port and that ROI comes to the fore in matters concerning people shows that a performance equation has been established. Also, the fact that businesses have a dynamic, entrepreneurial and long-term attitude in their projects supports their leadership and entrepreneurial abilities (Bos-Brouwers, 2010: 430).

Organizational learning, common sense and collaboration -When businesses cooperate with external agents in sustainability-oriented innovations, they both find new opportunities for organizational learning and establish the cooperation networks necessary for system creation (Warren et al., 2018: 1787-1791). For example, Braga, A and Braga, V, (2013: 44) found that collaboration with stakeholders has a partially positive impact on decision-making processes regarding innovation. Participant R-3 touched upon the functions of Borusan Holding Ankara office to follow the legislative changes regarding practices in the changing business environment. She also stated that Borusan Port General Manager is the vice president of Turkish Port Operators Association. Referring to the projects they developed with central and local government bodies, Participant R-3 also mentioned that they carried out good practice activities in the eyes of the society by developing elements that would create benefits together with public authorities. Participant R-1 stated that the working groups on OHS in the teams working within the Turkish Port Operators

Association are very effective and this is achieved by members' solution-oriented sharing without hiding data. Again, Participant R-1 stated that they aim to become an angel investor in promising ideas through a joint venture capital company established at the holding level in America, and stated that innovation is not just a linear, forward-looking process within a fixed funnel. In this sense, Participant R-1 stated that innovation and suggestion systems take place as an iterative process and he added that they want to move forward with a common mind in a collaborative structure since they want to do it. Participant R-2 also stated that, especially in operational projects, they involve the staff from the beginning to the end of the project and that they constantly exchange feedback and information with the relevant field operators regarding the problems encountered after the project is put into operation.

R-3: *...In order to get a reaction by better following the ever-changing structure of practices and legislation, our Borusan Holding Ankara office provides information on issues and regulations, laws, etc. concerning group companies and they are following. For example, when companies are asked for ideas and suggestions regarding a regulation in the sector, this is an office that is in close contact with Borusan Port and other group companies in preparing this suggestion. For example, Türklım works in a similar way. Our Port General Manager is working as vice president at Türklım... We are cooperating with Bursa Provincial Directorate of Family and Social Policies. Within the scope of KADES, we will provide training to rural headmen on violence against women...*

R-1: *...For example, within the teams working within Türklım, the working groups on OHS are very active. Because there, everyone puts any data on the table without hiding it and says 'let's solve this common problem'... We established an angel investor firm in the USA, called Borusan Joint Venture Capital. We said let's do such a job in America. Because the first original ideas happen in Silicon Valley. For this reason, we established a venture capital company in the USA, and its name was determined as Borusan Joint Venture Capital. This company both looks to Turkey, but will mainly be based in the USA... The innovation and suggestion system does not always move forward in such a one-to-one funnel. In this sense, we say, 'the recommendation system is a good thing and it has its place.'... We want to proceed collaboratively and with common sense on the path we want to follow, but sometimes if the team does not have enough information, it is possible to take a more decision-making attitude... Sometimes there are situations where we make more joint decisions. We say, 'Let's come to a place where we believe in critical reason, where we make decisions collaboratively and with common sense, so that the work can be done.'*

R-2: *...In operational projects such as 3D coil, we absolutely involve the personnel from the beginning to the end of the project. What we mean by the end is that the project starts to be used routinely, but of course it never ends,*

and we constantly exchange information and feedback with the operators regarding the problems encountered during use.

Communicating with employees through informal and horizontal leadership styles regarding the execution of projects and involving them in decision-making processes regarding the projects will both facilitate the operation, create a positive company culture and reduce the formation of resistance by increasing the satisfaction levels of the employees participating in the processes (Bos-Brouwers, 2009: 426).

Continuous improvement -Continuous improvement is a comprehensive and multifaceted concept that represents a philosophy, management style, process and method that announces periodic and systematic efforts to reduce waste and provide high quality products/services (Pérez-Rave et al.,2023: 126), and stakeholders are intertwined with the continuous improvement process (Dooms et al., 2004: 16). Participant R-1 stated that Borusan port employees responsible for SOI development will definitely react and find a solution when needed and when a problem occurs. Participant R-2 stated that they are working on designing equipment that will improve the handling of the loads of wind turbine customers, who are highly important stakeholders in the field operation. In this sense, another conclusion has been reached, which is consistency between stakeholder analysis findings and SOI evaluation results. According to Table 29, wind turbine manufacturers have been determined as definite stakeholders with a stakeholder profile salience ratio of 100 points in operational and commercial activities. In addition, the relevant stakeholder has been determined to be the dominant stakeholder with a stakeholder profile salience ratio of 47,66 points in sustainability and innovation activities. In this sense, SOI assessment results and stakeholder analysis findings support each other. More detailed results regarding the confirmation of this situation in the stakeholder analysis can be obtained in the quantitative findings seen in Tables 29 and 37. Also Participant R-2 stated that they support process innovations with improvements in field movements even when they reach the point where they cannot do anything about the improvements. Participant R-3 stated that Borusan port aims to develop sustainable business models compatible with the revenue model and operation model of the port in order to set sales and targets in carrying out its activities (e.g.E-Mobile crane conversion, E-RTG conversion, RTG automated positioning system, 3D

coilsystem, Multiple handling hook for big bag operation, SafeCard system, solar energy conversion for warehouses).

***R-1:** ...When situations like these examples arise, I know that our team will definitely come up with an innovative solution. We don't know today, because we don't have a problem today; But tomorrow, when we have a problem, we will definitely react and find a solution...*

***R-2:** ...At the moment, we have a project on our agenda that we are working on with R-4 and an external company regarding handling. We are in aresearch to design an efficient balancing device and make WES operations more efficient...
...If we get to the point where we can't do anything about improvement, we make improvements to field movements (such as positioning changes to support process innovations)... ...For example, we changed the location of our machine park for the sake of efficiency.*

***R-3:** ...We aim to reveal sustainable business models in terms of sales and target setting... We aim to move forward by reflecting this on our revenue model and our operational model.*

Making continuous improvements will benefit the sustainability activities of the enterprise, and therefore its competitiveness and profitability, and will provide the enterprise with the development that will facilitate the management of pressure and reputation concerns arising from stakeholders and complying with legal requirements (Bos-Brouwers, 2009: 419).

Talented employees -Briganti and Samson (2019: 261) have determined that there is a strong correlation between the talent possessed by employees and the attainment of favorable outcomes in corporate operations. Working attitudes of the employees, giving importance to their competencies rather than their knowledge, and employing personnel from different sectors and different competencies are important for gaining innovation capabilities to the enterprise (Lertxundi et al., 2019: 197). Participant R-5 stated that they follow energy sources and technologies that can be compatible with the dynamics of the port and that they are positive about technologies that will be compatible with the infrastructure and superstructure for the sake of efficiency. Participant R-1 stated that skilled personnel is an important element in meeting customer needs and developing solutions that will increase operational efficiency and maintain profitability. As stated by Participant R-3, the double-stored tower loading attachments specially designed for the loading operations of WES customers are an important product and process innovation carried out by Borusan Port's talented staff who come up with innovative solutions.

***R-5:** ...For example, in the recent past, a 2 square meter solar panel produced 330w power; Currently the same size panel produces 550w power. Naturally, there is rapid development in every field and that is why we constantly observe and follow up. For example, I follow electric vehicles very closely. I think electric vehicles will be a transitional thing. Once they solve the hydrogen storage problem, there will be a rapid transition to hydrogen. In addition, infrastructure for electric vehicles is a big problem all over the world, and once the 5-year battery life is completed, a battery cost is almost half of the vehicle price...*

***R-1:** ...In such cases, you need to be creative, or not you have difficulty in meeting customer expectations, increasing operational efficiency and achieving the desired profitability... ...Immediately, R-2's team designed and built a flexible apparatus that can lift 8-12-16-20 big bags instead of an apparatus that previously lifted 4 big bags at the same time. Thus, we used 4-piece equipment at the stern of the ship and 20-piece equipment in the middle...*

***R-3:** ...There are many extra fixing apparatuses for these double-layer loading operations. These apparatuses were designed in-house for the WES company we serve. These apparatuses are assembled before the ship arrives, and when the ship arrives, the towers are loaded onto the ship using these apparatus...*

Braga, A and Braga, V (2013: 338-346) have stated that one of the obstacles to the realization of innovative practices is the lack of skilled employees. Especially in urgent developing needs, talented employees support the innovation climate in the institution by making a difference for businesses in finding, preparing and adapting innovative approaches.

Entrepreneurship role with social capital -The function of an entrepreneur, commonly undertaken by people and start-ups, is a crucial element within an emerging ecosystem that gradually expands to foster economic development for regions, industries, or nations. The entrepreneur intends to develop a deliberate network including of internal entities like as staff and experts, as well as external collaborators including suppliers, customers, and complements. While there is some overlap between the tasks carried out by the ecosystem leader and the entrepreneur, it is important to note that the entrepreneur is not obligated to take on the latter job (Dedehayir et al., 2018: 23). Participant R-1 stated that the top and middle management employees of Borusan port are entrepreneurs in the execution of port activities and the continuation of the business environment, and He emphasized that Borusan holding senior management, shareholders and capitalist structure provide them through the opportunity by supporting corporate entrepreneurship in all kinds of innovations that will provide economic benefit. Participant R-3 stated that they propose practices and ideas for the expertise and interests of each employee in the

company's sustainability working group in line with the sustainability goals of Borusan port, and everyone in the sustainability working group is trying to do something to improve current practices and She also emphasized that everyone in the sustainability working group is trying to do something to solve the current problems.

***R-1:** ...Each of us at this table is an entrepreneur, and we know that if we prove that we can provide economic benefit to our shareholders, the capitalists will provide me with the necessary funds if I want to do a project on a subject that is economically effective... ...Essentially, we call this corporate entrepreneurship. This is actually one of the basic elements of sustainability and innovation.*

***R-3:** ...We all have clear areas of interest that are compatible with our sustainability strategy. In this sense, we recommend the practices we can do for sustainability and innovation... ...There is always something on everyone's mind in your port, you have already guided yourself accordingly. For example, I will do something about waste management because there is an important issue in this field...*

The second function encompasses extra duties such as managing value and platform, as well as governance. The entrepreneur assumes the role of a mediator between research entities, such as universities, and individuals or organizations seeking to commercialize technologies (Dedehayir et al., 2018: 24).

3.8.4.3.4. Strategic and Managerial Characteristics

Considering the strong link between market and strategic and managerial characteristics, meeting customer needs proactively (Verganti, 2003: 37; Bowander et al., 2010: 21; Dedehayir et al., 2018: 23), top management support and committing for innovativeness (Bowonder et al., 2010: 20; Gyau and Stringer, 2011: 135; Dedehayir et al., 2018: 22; Erlandsson and Gaylong, 2019: 39), informal role acceptance for SOI activities (Awazu, 2004: 2; Markham et al., 2010: 402; Hemphälä and Magnusson, 2012: 6; Hall et al., 2013: 87; Lee and Law, 2016: 167; Goodman et al., 2017: 742; Dedehayir et al., 2018: 22; Lertxundi et al., 2019: 197), openness to change (Chesbrough, 2003a: IX-XXIV; Lazzarotti and Manzini, 2009: 622-623; Adams et al., 2016: 181-192), lean and agile management practices (Power et al., 2010: 1; Bushuyeva et al., 2019: 77-78) are determined as 5 main elements for open innovation journey of the Borusan Port.

Meeting customer needs proactively (included internal customers) -

Verganti (2003: 37) stated that innovation activities will emerge for customers to whom power and urgency are attributed by technology push and market pull towards customer needs. Participant R-3 emphasized that services are provided for the demands of focus sectors and strategically important customers based on their needs. These stakeholders, which rank first with their stakeholder profile clarity rates, are wind turbine manufacturers, other project cargo owners or representatives, exporters, importers, industrial establishments in the port hinterland, Ro-Roline operators, major port operators overseas. More detailed findings about these stakeholders, which has been also determined in the stakeholder analysis to be strategically important, can be found in Tables 28, 31, 34, and 36. Participant R-2 also stated that they are constantly working to bring innovations to Borusan Port that will make them preferred by Wind turbine sector customers. Participant R-1 specifically stated that since the WES sector is a niche sector, they consider important, they accepted to bear the costs for the port needs based on this sector. In addition, Participant R-1 stated that they meet the expectations in the sector for other sector loads. For example, by developing the 3D Coil system, the port has created an opportunity area for its iron and steel industry customers' operations. Participant R-3 and R-4 stated that they made a product and process innovation that helps operational processes both in terms of customer expectations and efficiency with the double-deck tower attachments they designed specifically for a WES customer.

***R-3:** ...Most of the loads of our WES customers come from Izmir. As Borusan Port and Logistics Group, we provide holistic service to them both on the land leg from Izmir to here and on the sea leg from here on, with our advanced machinery... ...We offer integrated service to our WES customers... ...We completed the first double-deck tower loading operation in Europe. Actually, this is an innovation project for us because it provides benefits in terms of efficiency. Because we save half the space on the ship, since it is double loaded in the loading area. In this sense, there is a significant reduction and benefit by ship emissions... ...The double-decker loading work done in our port is done only in South Korea and Indonesia, and we are the third to do this operation in the World. But, We are the first to do this in Turkey...*

***R-2:** ...We try to be a choice for our customers by offering integrated services to our customers to whom we transport products for alternative energy sources...*

***R-1:** ...The WES sector is a sector that we are interested in and care about as a niche. For example, look, we have a double layer loading application. This is an area where we incurred the costs of this application and created a team and workforce for this. Because we see that there is a commercial future in that*

sector. Therefore, we attach importance to meeting the expectations of that sector operationally...

R-4: *...We started an innovation project to save space by loading WES loads double-layered onto private ships...*

Working with the customer and using their insights to provide new insights will foster innovation and create a co-creative business environment (Bowander et al., 2010: 21). Dedehayir et al. (2018: 23) have stated that making changes and innovations that will meet customer needs is an important element in the direct value creation process of businesses. Participant R-2 stated that if the SOI products and applications are not compatible with the requirements of the sector and the nature of the job, the dissatisfaction of the employees resulting from new duties and responsibilities will create internal customer dissatisfaction with SOI products and applications. For this purpose, he stated that they thought simpler and took internal customer efficiency into account when starting to use and implement innovations.

R-2: *...For example, the Security department created resistance regarding the use of the safe card, such as 'how can we keep track of this?', 'why was this given to us?', but here we only reflect the two most important warnings on the security screen... ...Because when the dissatisfaction of employees arising from new duties and new practices is not compatible with the nature of the business and the sector and makes it difficult to do business, we have to take internal customer satisfaction into consideration...*

In this sense, the needs of the employees, who are expressed as internal customers at Borusan port, are taken into consideration in the innovation process, as Ansoff (1965: 34) and Voelpel et al. (2004: 40) stated. Thus, the dynamic capabilities of Borusan Port have been maintained as Murphy and Wilson (2022: 211).

Top management support and committing for innovativeness -Bowonder et al. (2010: 20), Dedehayir et al. (2018: 22), Erlandsson and Gaylong, (2019: 39) have stated that the encouragement and commitment of the senior management mechanism will support entrepreneurship in the formation of the innovation ecosystem. Participant R-3 stated that each department acts as a strategic business unit in its own field and sub-areas regarding the execution of operations at Borusan port, and that the senior management provides them with a support function. Participant R-3 also emphasized that Borusan Holding plays an encouraging role in the business practices of its employees and said that employees can follow product

and process innovations and ideas for both their own work areas and the work areas of other departments in environments where they can access to information, new products and applications. He stated that they shared the benefits with other business units of the company before the senior management in order to bring them into Borusan's ecosystem. Naturally, he stated that the suggestions coming from the senior management in line with the strategic goals were evaluated in the relevant committee structures of the Borusan port sustainability working group, and they created final suggestions and started working in the areas specified by the senior management and the committee. The participant stated that the R-1 suggestion system operates strategically in line with the goals coming from the top management and that the suggestions are evaluated in the relevant committees in the sustainability working groups and innovations are seen as a part of the strategy and the business.

***R-3:** ...As you can see about making innovations, it is mostly R-2, R-4 and their team. As the top management at Borusan port, only processes are supported... ...Implementation recommendations regarding sustainability and innovation activities also come from senior management... ...In our port, everyone is constantly thinking about doing something. It is also important here that the company is encouraging. Of course, Borusan provides you with that structure... ...We go to conferences, we go to fairs. When we see a change or an innovation element that will benefit our own workspace or someone else's workspace, we share it.*

***R-1:** ...The recommendation and proposition system is a good thing and it has its place for us. we say; but we think that the strategy side and making innovations a part of the strategy are very very different and important.*

Moreover, Gyau and Stringer (2011) argue that if normative isomorphism does not dare to go beyond the execution of activities based on normatively established perceptions, it is not a support for development and innovation. In this sense, according to the statements of Participant R-1 and R-3 one paragraph above, it can be stated that Borusan senior management supports and undertakes innovation activities.

Informal role acceptance for SOI activities -The engagement of actors within the organization in innovation through informal roles for sustainability activities is also considered an important source of opportunity for sustainable development (Markham et al., 2010: 402; Hall et al., 2013: 87; Lee and Law, 2016: 167; Goodman et al., 2017: 742; Dedehayir et al., 2018: 22). Lertxundi et al. (2019: 197) have determined that providing autonomy of action to employees is valuable for

the efficiency of innovation activities, and the need for employees to perceive and fully assume this autonomy is equally important. Participant R-1 stated that with the autonomy given to managers and employees in committee structures in sustainability working groups, they can also work on the informal roles expected from their innovator roles, in addition to their formal roles, for sustainability and innovation activities next to the main job. In addition, Participant R-1, stating that the autonomy skill is a feature they want the whole team to have, emphasized that innovation is accepted by all units as a part of business development. Participant R-3 emphasized that the gains from SOI activities, which have become a part of the main business with the committee sponsorship structure, were realized by employees taking informal roles in bringing Borusan Port and other group companies.

***R-1:** ...They want a zone of autonomy. Let's give them that autonomy, but at the same time, there is a gap that this autonomy creates for managers. At this point, let's fill them in on more creative thinking... ...At that time, I will work on the issues that the organization expects from me and my role in developing vision in different areas, but other teams can do the things that they do not expect from me... ...Autonomy area using skill is a feature we want our entire team to have... ...We see innovation and sustainable activities as a part of business development and aim for all our departments to see this as a part of their business...*

***R-3:** ...For example, the committee sponsors sometimes help us (to The Borusan Port). Sometimes we help them (to the group firm that they work). The sponsors of the committee also act as intermediaries in bringing the gains they have made from us to their own group companies or another company of the group that is seen as missing...*

This situation in Borusan port supports the view in the literature, as Hemphälä and Magnusson (2012: 6) stated, that by sharing information through informal mechanisms such as social relations between employees, a work environment that will support formal tasks and be more dynamic and encouraging to employees will be created. Furthermore, Awazu (2004: 2) has argued that informal roles, regardless of their structure, may be more prone to innovative exchanges than formal roles.

Openness to change (including preventing employee resistance to change)

-In defining openness, Chesbrough (2003a: XXIV) argues that “open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology”. Lazzarotti and Manzini (2009: 622-623) stated that being open to change will facilitate both establishing efficient collaborative networks and

integrating with the right stakeholders. Also, acceptance of change is necessary in implementing and bringing innovations to the market and establishing the right structure for disruptive innovations to emerge (Chesbrough, 2003a: IX). Participant R-2 stated that, as Borusan Port, after determining the areas and issues in need of change, they made changes in SOI projects by pivoting when necessary in order to achieve efficiency in terms of providing solutions and complying with the strategies of the SOI products and applications they put forward. Besides, he also emphasized that they give up if there is a gap between the issues products and processes they see as change and innovation and the dynamics of the port and the sector. Participant R-5 stated that there may be issues that require continuous development and change for lighting systems, which have a structure that includes technological products and processes, and that they constantly follow the developments in the technological superstructure for this purpose and change products, processes, even suppliers when necessary.

***R-2:** We focused on where we needed to change. We are working step by step to ensure that the solutions and strategies we put forward are efficient... ...We choose the path to change by pivoting our projects at efficient points... ...There is always a gap between where we want to be and our reality. Then we say that what we see as a solution or change and innovation does not suit us and we give up...*

***R-5:** ...We make changes and renovations in our lighting systems from time to time. There is no such thing as a situation where we will always use a superstructure we have determined. Maybe in the near future we can start testing lighting systems that are claimed to be more efficient than LED... ...Since we are constantly monitoring, we can change the product, and if necessary, we also change the supplier company.*

According to Adams et al. (2016), Sustainability-Oriented Innovation (SOI) can be defined as “intentional changes to an organization’s philosophy and values, as well as to its products, processes or practices, to serve the specific purpose of creating and realizing social and environmental value in addition to economic returns” (Adams et al., 2016: 181), also they examined “Systems Building” as the most effective strategy for fostering sustainable business practices. The Systems Building approach necessitates a radical shift in the manner in which companies approach sustainability and examines the role of organizations in society, which involves “doing good by doing new things with others” (Adams et al., 2016: 192). In this sense, Borusan port's changes in its projects at necessary points or even giving

up will help it to be open to change for sustainability-oriented innovations and to establish system building.

Preventing employees' resistance to change at Borusan Port is also an element that supports openness to change (Rogers, 1962: 286). In order to prevent employees' resistance to change at Borusan Port, in the SafeCard system SOI project, following have been made as precautions: arrangements such as creating technological predisposition; providing the ease of use and possession (Oreg, 2006: 97; Yukl, 2012: 73-74) ; lack of training (Kreitner, 1992) eliminating prejudices (Kreitner, 1992; Reichers et al., 1997: 48-52; Dent and Galloway-Goldberg, 1999: 28; Bordia et al., 2004: 525); making it an officially mandatory part of the job (Dent and Galloway-Goldberg, 1999: 25; being accepted of it is necessary for security (Lazzarotti and Manzini, 2009: 622-623); and to include it partially in the process in order to get used to it (Dubrin and Ireland, 1993).The situation of preventing employees from resisting change has been explained through the SafeCard system SOI project.

A number of measures have been developed to combat employee resistance to the SafeCard system SOI project.In order to correct the misperception about privacy that employees are monitored and followed everywhere, a commitment has been made to the employees in accordance with the PDPA (Personal Data Protection Authority), and the employees signed the acceptance of this commitment, knowing the purpose of monitoring and tracking.The operational and managerial requirements posed by the project are matched with the routine obligations and requirements of employees.Since the security department resisted to take the monitoring SafeCard alarms, thinking that it would increase the workload on the current requirements of the business, the security department has been given responsibility for monitoring SafeCard system alarms for only two alarm types.Thus, employee resistance to change in the security department has been eliminated.In addition, once the other features of the SafeCard system SOI project become operational, the port integration of the system will continue through the Security department sub-business unit and the resistance of the staff at this point will be prevented again.Due to the staff's avoidance regarding the Carrying and Possession of the SafeCard Physical Device, a change has been made in the working legislation regarding the SafeCard System.A

special place and fixing buckle has been made for carrying the SafeCard device in the job attires of port. Adaptations have been made for complaints and erroneous warnings that occur due to unnecessary warnings and vibrations created by the SafeCard device disturbing employees. After the project became operational, the image and trust created among employees by eliminating near-miss work accidents and the employees' spontaneous sympathy with the system have been effective in eliminating the employee resistance to change. By conducting regular user-friendly promotional meetings and training activities for the stages of the SafeCard system SOI project, employees who know the benefits of the plug-ins integrated into the system and are trained in their use have moved away from the misconceptions of resistance and this have made it easier to integrate with the system.

Lean and agile management practices -Power et al. (2010: 1) found that agile and lean principles and practices create the right environment for open Innovation to thrive. They also stated that people have become agile instead of agile methodologies and this situation requires radical changes in thinking systems and leadership. Participant R-2 stated that they adopted lean and agile management principles when putting forward SOI solutions since they need to be flexible and fast in terms of the dynamics of the sector. The participant stated that while implementing R-4 projects, they always conduct product and process trials with possible project partners who are different from the current project partner, thus creating a reaction area for possible setbacks. Participant R-5 stated that, due to their adoption of lean and agile management principles, they also made project partnerships with old experiences that had previously failed but achieved success in the current situation. Likewise, in the example given by the Participant R-6 from the LED lighting transformation project, he stated that even if the operation of the project is smooth, cooperation should be made with new solution partners in order to be ready for possible changes in the future.

***R-2:** ...When we focused on culture, we came to the conclusion that we needed to be agile. For example, this is why we decided to carry out our activities as agile.... ...In other words, we switched to an agile management structure not because it looked cool, but because we needed to be really flexible and fast...*

***R-4:** ...After moving to another company, we continue to follow the changes in this technology and as I said, we have started tests with 2 companies for backup*

purposes... ...We need to have the opportunity to act if the current company withdraws from the market or does unsuccessful business...

R-5: ...When we first started the LED lighting project, the company that failed and could not get a job from us improved itself and now we have switched to that company that was previously unsuccessful. because they have reached a very good point in lighting systems...

R-6: ...After switching to the second company in LED lighting transformation, we continue to follow the changes in this technology and, as I said, we have now started testing with 2 companies for backup purposes. Because one day, when our current supplier says he cannot supply it, we need to be ready for these conditions....

Flexibility can be benefited even in projects that require very serious process planning with agile and lean principles (Bushuyeva et al., 2019: 77-78). In this regard, lean means continuous improvement and increases quality and productivity by eliminating cost and waste from all operations (Power et al., 2010: 1; Bushuyeva et al., 2019: 79).

3.8.4.3.5. Organizational Resources Capabilities

Dickson (1992) stated that companies with more resources, larger market shares, or faster movements can have a high impact on market dynamics and lead to the emergence of innovation in the market. Considering the strong link between innovation capabilities and having more organizational resources, Recognition of knowledge as a critical resource (Spender and Grant, 1996:5; Denktas-Sakar et al., 2014: 28), obtaining resources to increase innovativeness and market share, protection and development of organizational resources (DiMaggio and Powell, 1983: 158), perceived organizational reputation (Yoon et al., 1993: 215; Petrick et al., 1999: 63; Carmeli and Tishler, 2005: 13; Wartick, 1992: 34) are determined as 4 main elements for open innovation journey of the SOI model in Borusan Port.

Recognition of knowledge as a critical resource -According to the resource-based approach, the company's resources are important for the survival of the company and the development of strategies that will provide competitive advantage. In this sense, information emerges as a critical resource for innovative businesses (Spender and Grant, 1996: 5; Denktas-Sakar and Karatas-Cetin, 2012: 301). In addition, the use of existing information resources for the continuity of innovations allows the creation of new information resources that will improve

organizational capabilities (Denktas-Sakar et al., 2014: 28). Participant R-2 emphasized that they did not think that failure and loss occurred for project initiatives that resulted negatively, but instead they gained updates and gains in information, which is a critical resource for creating better alternatives for solutions. Participant R-5 stated that, as senior management and sustainability working group employees, they interacted with the fairs, promotions, conferences. in which they participated in accordance with their respective committee roles, regarding ideas, products and applications that would benefit Borusan Port, for their own roles in the committee structures and the roles of other departments.

R-2: ...Of course, not all of these have positive results. When it ends negatively, we do not say we lost; We say we learned. While finding a solution, negative outcomes help us move on from how something cannot be done to other solutions on how it can be done...

R-5: ...The fairs, promotions and conferences we attend have a great impact on us. Not for the sake of being gone; We join to catch something new and when different departments see applications that will benefit each other, they notify immediately upon return...

Obtaining resources to increase innovativeness and market share -The Resource-Based View (RBV) framework posits that the heterogeneity of resources among enterprises results in variations in competitive advantage and performance disparity (Prahalad and Hamel, 1990: 79). Organizational resources are technical infrastructure, use of technology, assets of the business, information and human resources expertise, which add value to the activities and existence of the business and develop together with the business (Denktas-Sakar et al., 2014: 28). Participant R-2 stated that since the SOI projects put forward at Borusan port are not solely hardware-oriented and are embedded in the port's processes and way of doing business, they contribute to SOI applications that will both identify deficiencies and provide new gains for innovation and sustainability activities and market share.

R-2: ...Since SafeCard is not a hardware-only project, it's not something I can show as here, it's a system and an application that has been processed into the DNA of our port, so to speak. For this, all staff (Blue and white collar) have a smaller box than a cell phone. With this box and Wi-Fi and IoT connectivity, the system is integrated. In fact, it makes a great contribution to the renovations to be made in our innovation processes.

Resources are an important element for port sustainability in terms of their use, protection and development in business needs for today and tomorrow (Denktas-Sakar and Karatas-Cetin, 2012: 304).

Protection and development of organizational resources -Normative mechanisms motivate individuals to act in accordance with values, norms and standards through professionalized structures such as Borusan sustainability working group committees and professional networks such as in-service training and regular meetings. In addition, Borusan port sustainability working group committees learn and imitate precedents that will make the port more successful and reliable through committee structures. Committee structures help Borusan Port protect its resources. For example, it helps to preserve resources by providing consultancy, equipment, software. required for the Borusan Port through committees. In this sense, Borusan Port, through its Committee structures, has become effective guides in the protection and development of resources by using a combination of normative and mimetic isomorphism (DiMaggio and Powell, 1983: 158). Participant R-2 stated that by ensuring the product and process structures related to the developed SOI applications are functional in the Borusan port and in the areas related to the port industry, the developed SOI projects will be protected and benefited. In this sense, he stated that the SafeCard system used in Borusan Port is ingrained in the DNA of the port.

R-2: ...If you do not integrate the applications and products you make into the system and inside, they remain out of interaction and you do not see any benefit from it... ...Since SafeCard is not a hardware-only project, it's not something I can show as here, it's a system and an application that has been processed into the DNA of our port, so to speak...

Perceived organizational reputation -A positive corporate reputation is, by definition, a strategic resource as it reflects the firm's competitive position relative to its competitors and other market parties (Carmeli and Tishler, 2005: 13). Yoon et al. (1993: 215) found that a buyer's response to a service is consistent with the seller's attitude towards reputation. Extending this view, Petrick et al. (1999: 63) have discussed reputation as a capital element beyond being a strategic resource and expressed it as reputation capital, and they claimed that it is the first part of social capital that strengthens its credibility, reliability, responsibility, trustworthiness and accountability. The participant stated that the R-3 Borusan Port, thanks to its

corporate reputation, is seen by potential project partners, suppliers and companies that want to be solution partners, as a solution partner with which they want to move forward. Also he stated that this reputation would provide a price advantage to Borusan port from time to time. In addition, the participant stated that the change, correction of deficiencies and improvement requests from the R-3 Borusan Port are considered by the solution partners as a development opportunity. In this sense, Participant R-3 emphasized that Borusan port's demands in the SOI project, in which it supports the circular economy by recycling pet bottles, were accepted by the port workwear manufacturer. Participant R-1 emphasized that the reputation of Borusan port can be a reference for other ports in SOI project applications, and with the tested trust created by this reputation, project partners will be able to gain application opportunity and market share in similar or different sectors by benefitting from reputation of Borusan Port. In addition, Participant R-1 stated that Borusan Port will have the opportunity to test new products and applications for the first time. She stated that Borusan Port also provides an economic benefit as a positive response to this reputation and corporate stance.

R-3: ...Some companies want to work with us, thinking that Borusan will improve us. In other words, they think that if we set out with Borusan, our product will reach a certain point. We even have projects where we provide a price advantage with this reputation... ...If Borusan wants something, there is a response for it. In other words, it is said that 'Borusan requested this because of a point that is missing or needs to be improved'. So, saying 'There is a reason for this' is really taken into consideration... ...There is a recycling company to which we deliver plastic bottles... ...Another stakeholder of ours is the company from which we have our work clothes made and purchased. In the agreement we made with the company from which we purchased our work clothes, we stated that the polyester yarns to be used in production should be purchased from this recycling company...

R-1: ...Essentially, that reputation is a good thing. For example, we can be a reference to other ports. Our solution partners also think that "If we work with Borusan port, the reference we will receive will make us stand out in many areas." This is a good thing. We brought this perception from the past to the present. We want to take it into the future. Because, as R-3 said, this reputation has an economic advantage. We are the first to be informed about new products. We have an advantage such as the right to test first. All of these actually occur as a positive response to the corporate stance... ...Therefore, the height created by that reputation, that is, if we make it parametric, the height of the reputation also has an economic equivalent.

Wartick (1992: 34) identified corporate reputation as “the aggregation of a single stakeholder’s perceptions of how well organizational responses are meeting the demands and expectations of many organizational stakeholders”.

3.8.4.4. Borusan Port SOI Case Assessments

Borusan Port SOI model has been systematized through the organizational DNA metaphor based on the organizational DNA structure of Denktas-Sakar et al. (2014: 26) by using embedded theory. In addition, the SOI model whose structure has been revealed and some SOI applications made by Borusan Port will be evaluated as a case analysis. For this purpose, again by taking advantage of the dynamics of embedded theory, three SOI applications, which have been initiated by Borusan Port and are still being developed, have been examined and evaluated in terms of a number of elements such as their nature, the impact that they create, the level of innovation, the role of the stakeholders involved, the resistances and obstacles encountered as seen on Table 74. To evaluate the three relevant SOI projects, a brief introduction will first be made within the attributes in Table 73.

The rationales for the evaluation of the pet bottle recycling project -First of all, it is necessary to address the main reasons for choosing these three SOI projects. The substantial surge in the consumption of single-use pet bottles and cups has resulted in the proliferation of terrestrial and marine plastic pollution that is difficult to manage. The act of recycling these materials has the potential to significantly decrease the carbon footprint by effectively eliminating the need for the manufacturing of new plastic materials (Ghosh et al., 2023: 1). The assessment of the circular economy-based pet bottle recycling application conducted in Borusan port has been considered significant due to its influence extending beyond mere recycling.

The rationales for the evaluation of the port lighting transformation project -Since lighting systems are an issue that concerns both OHS in terms of social sustainability (ILO, 2005: 37), economic efficiency (Kim et al. 2023: 82) and environmental efficiency (Xuejing, 2021: 2-6) in port management, it has been deemed appropriate to be evaluated within the scope of SOI. In addition, when

looking at the electrical energy usage rates in ports, the electrical energy usage rate used for lighting the port and its equipment for operational capabilities comes after the electrical energy required to operate the field and coastal equipment for handling purposes (Boile et al., 2016: 22; Xuejing, 2021: 3; Kim et al., 2023: 82). In this respect, electricity consumption for lighting is an important energy consumption factor (Xuejing, 2021: 3) in terms of indirect emission formation (Boile et al., 2016: 25-26) and economic efficiency (Kim et al., 2023: 82). In summary, lighting systems are an area where innovations that touch all three dimensions of sustainability can be realized when managed by establishing the right system structure. For this reason, the transformation of Borusan Port's led lighting systems is the 2nd SOI project examined in this thesis. It should also be noted that the Led lighting transformation project is a continuously developed SOI project carried out with the participation of many stakeholders of Borusan Port.

The rationales for the evaluation of the SafeCardsystem building project

-Port management is a field where sometimes complex activities are carried out, which is among the heavy business branches and includes land, sea, railway and inland waterway connections in transportation (Danacı and Kişi, 2014: 316-317-318). Naturally, it is one of the business lines that has a very risky status in terms of heavy work accidents (ILO, 2015: 1; Motter and Santos, 2017: 120). Accurate and regular communication stands out as an important issue in preventing work accidents in ports (Silva, 2011: 26; Motter and Santos, 2017: 117). On the other hand, regulations and controls created to prevent free interpersonal communication in workplaces in order to increase work efficiency not only appear as a major obstacle to freedom in the workplace (Motter and Santos, 2017: 117), but also reduce the flexibility in communication necessary for communication regarding occupational health and safety (Motter and Santos, 2017: 119). In addition, communication with the use of port machinery horns, gesture communication and verbal communication, which were observed and revealed by Motter and Santos (2017: 119) in port work areas, consist of the use of traditional communication channels. In this sense, with the use of these traditional communication channels used in port areas in terms of occupational health and safety, mistakes can be made, forgetting, not noticing, not seeing (Motter and Santos, 2017: 119; Tasdelen and Ozpinar, 2020: 2; Arana-Landín,

2023: 13), due to distracting factors such as faulty organization, work and other-based stress sources, fatigue, cognitive difficulties, fainting, disease or illness. The risk of occupational accidents caused by blind spots or other reasons is quite high (Arana-Landín, 2023: 13). At this point, IoT-based (Internet of Things) products, applications and systems, one of the innovations brought by developing technology, come to the fore (Tasdelen and Ozpinar, 2020: 1-4; Tepe, 2021: 128; Arana-Landín, 2023: 13). In this sense, IoT-based tracking systems have been used for some time with the emergence of Industry 4.0 as seen in the studies of Tasdelen and Ozpinar (2020: 1), Tepe (2021: 121), Arana-Landín (2023: 1). However, the system design is adapted according to the requirements of Borusan Port, together with an IoT solution partner company and Borusan Port, and is a multifunctional system that includes IoT-based physical and digital elements, and is named SafeCard by Borusan Port. So, this project has been seen as an important initiative and SOI in terms of adapting control and evaluation features to the port management ecosystem. In addition, while doing preliminary research on the SafeCard product and its application, we realized that this innovation has both social dimensions (in terms of being a facilitator for OHS applications), environmental dimensions (in terms of contributions to emission improvement provided by the use of efficient equipment) and economic dimensions (in terms of economical benefits of energy efficiency). In summary, it is the third SOI application that is considered worth examining within the scope of this thesis study, thanks to its benefits and its suitability for the system design and continuous development purposes expected from SOIs.

Problem description of the pet bottle recycling project -As seen on Table 73, The onset of the Covid-19 pandemic in 2019 has led to a notable surge in the utilization of plastic bottles and plastic cups at the Borusan Port. The imperative to mitigate environmental harm through the practice of recycling has become apparent in response to the escalating utilization of pet bottles and cups in Borusan port.

SOI type of the pet bottle recycling project -The pet bottle recycling project is an SOI-based process innovation as it touches all dimensions of sustainability and is a set of processes for the port.

The stakeholders involved in the pet bottle recycling project -The parties (stakeholders) in the Pet bottle recycling Project are Borusan Port employees and

their families, a start-up enterprise that produces polyester yarn from pet material waste and a company that produces the job attires of the Borusan Port. In addition, SOI process in this project has been initiated with the premise that these materials possess the potential for utilization in the manufacturing of polyester yarn. So, it has been realized that by incorporating these materials into the weaving process, a significant change can be made in the creation of port job attires. This proposition is particularly relevant given the escalating wastes of pet bottles and cups during the ongoing pandemic.

Introduction of the innovation related to the pet bottle recycling project -

Polyethylene terephthalate (PET) is that a thermoplastic polyester that possesses several desirable characteristics, including exceptional transparency, strength, dimensional stability, moisture and oxygen barrier properties, and chemical resistance. Furthermore, PET is non-toxic, non-renewable, and available at a relatively low cost (Telli and Özdil, 2015: 47). So, it is seen that the yarns obtained from plastic bottles contain the features that job attires of port need. In this sense, since waste polyethylene terephthalate (PET) bottles are not biodegradable and create a serious waste problem, the use of recycled fibers in clothing is seen as one of the most important ways to ensure sustainability and circular economy in the textile industry (Majumdar et al., 2020: 1). In addition, Production of pet bottle recycled yarn is a method that has been used for a long time and the reason why it is seen as an innovation for Borusan port and especially as a sustainability-oriented innovation is that a port operator takes an initiative on a subject that touches on social, environmental and economic issues and reacts to this at a time of a global health crisis such as the covid-19 pandemic. by showing it as a solution to the increasing use of plastic bottles. In this sense, it has been accepted in the light of the findings obtained in this thesis that this innovation is a SOI-based Process innovation for Borusan Port.

The role of stakeholders involved in the pet bottle recycling project -

Considering the stakeholders in the project and their roles in the SOI process, the top management of Borusan Port has took on the role of financier and the the infrastructure-holder on which the project has been developed as their corporate entities. Borusan Port employees have took on the role of corporate problem holder

on which the project has been developed with their corporate entities. Also, Borusan Port employees have took on the role of corporate problem holder on which the project has been developed as their corporate entities. Also they have took on the role of innovation champion and user on which the project has been developed as their intrapreneur and individual consumer. The start-up company, which has collected plastic bottles from the other two stakeholders involved in the pet bottle conversion to yarn project and converted them into polyester yarn, has took place in the project as the role of innovation champion on which the project has been developed as their entrepreneur. The other stakeholder company, which produces the job attires of Borusan Port, has took place in the project as the role of Innovation champion on which the project has been developed as their entrepreneur.

Problem description of the port lighting transformation project -As seen on Table 73, The problems arising from the short economic life of old type bulbs and the necessity of renewing them every year, the problem of their safe disposal after replacement, the problems caused by the decrease in lighting over time, the problems of ballast system failures and high energy consumption have revealed the necessity of innovation in old type lighting systems of Borusan port.

SOI type of the port lighting transformation project -The LED lighting transformation project at Borusan Port is an SOI-based process innovation as it touches all dimensions of sustainability and It is a set of processes for the port.

The stakeholders involved in the port lighting transformation project - The parties (stakeholders) in the Borusan Port lighting transformation project are the Borusan Port top management and employees, and the company that developed the LED lighting system for the Borusan Port.

Introduction of the innovation related to port lighting transformation project -The LED lighting transformation project is basically a SOI project that is carried out in three stages and its spatial aspect predominates. Partially LED lighting conversion application has been carried out in the port with the company that successfully installed the system by making trials between 2006-2011. As of 2011, all field and equipment lighting of the port has been converted to LED system. In addition, a GPS-based control system has been installed to turn the lighting system

on and off during this period. In addition, the opportunities offered by the project started to be used 100% in the entire Borusan Port in 2017.

The role of stakeholders involved in the port lighting transformation project -Considering the stakeholders in the Port LED lighting transformation project, Borusan Port top management have took on the role of financier and the the infrastructure-holder on which the project has been developed as their corporate entities. Borusan Port employees have took on the role of corporate problem holder on which the project has been developed as their corporate entities as been in the Pet bottle recycling project. The other stakeholder company, which has designed the LED lighting system of Borusan Port, has took place in the project as the role of Innovation champion on which the project has been developed as their entrepreneur.

Problem description of the SafeCardsystem building project -Before 2019, 2 near-miss accidents at Borusan port had been avoided without death or injury, as a result of the attention and attentive attitude of the staff. Relevant departments of Borusan Port thought that a preventive system should be established due to the need to prevent work accidents and the risk of working alone. As a result of the meetings held with the port senior management, it became necessary to develop a system to keep track of employees and vehicles and to monitor the interaction between employees, between machines and between employees and machines.

SOI type of the SafeCardsystem building project -SafeCard system design project at Borusan Port is an SOI-based product and process innovation as it touches all dimensions of sustainability, is a set of processes for the port, and integrates a physical product into human interaction.

The stakeholders involved in the SafeCardsystem building project -The parties (stakeholders) in the Borusan Port SafeCard System Building Project are the Borusan Port top management and employees, and the solution partner company that took place in developing SafeCard system building project.

Introduction of the innovation related to the SafeCard system building project - The system, developed and adapted for Borusan Port and named SafeCard, is a product of the need arising from near-miss incidents within the scope of OHS. The system has been developed with the solution partner IoT company as a project of

adapting the basic Wi-Fi tracking system that can be used in a company to Borusan port's own business operations and pioneered the adaptation of the system to the port management sector. This project attracts attention with its openness to continuous improvement in terms of the expected outputs described in Table 74. These developmental elements have been explained separately with reference to Table 74.

The role of stakeholders involved in the SafeCard system building project - Considering the stakeholders in the SafeCard system building project, as in other two project, Borusan Port top management has took on the role of financier and the infrastructure-holder on which the project has been developed as their corporate entities. Borusan Port employees have took on the role of corporate problem holder on which the project has been developed as their corporate entities. The other stakeholder company, which has designed and made the system setup the SafeCard system building project with Borusan Port according to the requirements of Borusan Port, has took place in the project as the role of innovation champion on which the project has been developed as their entrepreneur.

Table 73: A Brief Description Related to the Assessment of Three Selected SOI Applications in Borusan Port

Attribute	Pet Bottle Recycling	Led Lighting System	SafeCard System
1. Problem	• With the pandemic in 2019, there was a significant increase in the use of plastic bottles and plastic glasses at Borusan port. • The necessity of recycling these increasing pet bottles and preventing harm to the environment has emerged.	• The problem arising from the short economic life of old type bulbs and the need to renew every year, • The problem of disposal of old type bulbs after change, • Old bulb lighting decreases over time, • Ballast system faults are experienced on old type bulbs. • Old type bulbs have high energy consumption problem	• The need to prevent accidents in ohs dimension and the problem of working alone, • The problem of filiation tracking brought by the Covid-19 pandemic.
2. SOI Type	Process innovation, Social innovation based on SOI	Process innovation based on SOI	Process, Product and social innovation based on SOI
3. Involved stakeholders	• Borusan Port employees and their families, • A start-up enterprise that produces polyester yarn from pet material waste, • An company that produces the work clothes of the Borusan Port.	Top management and employees of the company that developed the LED lighting system for the Borusan Port.	• Borusan port top management, • Port employees • Solution partner company that develops SafeCard
4. Introduction of Innovation	The project has started with the idea that these materials can be used in the production of polyester yarn with the increasing use of plastic bottles and plastic glasses with the pandemic and a transformation will be achieved by using them in the weaving of port workwear.	• The project was carried out in three phases. Trials were conducted between 2006 and 2011. • Partial application was made at the port with the company that made the appropriate installation. By 2011, all the field lighting of the port was converted to LED system.	Due to the events mentioned in the problem box of the SafeCard system row in this table, Borusan Port has carried out a project to customize a company's basic Wi-Fi tracking system for its own business operations and pioneered its adaptation to the industry by developing the relevant system specifically for port operations.
5. Role of Stakeholders	• <u>Borusan Port Top management:</u> <i>Financier (Corporate Entity, Infrastructure-Holder)</i> • <u>Borusan Port Employees:</u> <i>Corporate problem holder (corporate entity), Innovation Champion (Intrapreneur), User (Individual consumer).</i> • <u>Start-up enterprise:</u> <i>Innovation Champion (Entrepreneur)</i> • <u>Company that produces workwear:</u> <i>Innovation Champion (Entrepreneur)</i>	• <u>Borusan Port Top management:</u> <i>Financier (Corporate Entity, Infrastructure-Holder)</i> • <u>Borusan Port Employees:</u> <i>Corporate problem holder (Corporate entity), Innovation Champion (Intrapreneur), User (Individual consumer).</i> • <u>Led Lighting company:</u> <i>Innovation Champion (Entrepreneur).</i>	• <u>Borusan Port Top management:</u> <i>Financier ((Corporate Entity, Infrastructure-Holder).</i> • <u>Borusan Port Employees:</u> <i>Corporate problem holder (Corporate entity), Innovation Champion (Intrapreneur), User (Individual consumer).</i> • <u>Solution partner company for SafeCard:</u> <i>Innovation Champion (Entrepreneur).</i>

3.8.4.4.1. A Circular Economy Based SOI Case: Pet Bottle Recycling

Under the Previous 3.8.4.4 numbered title, the reasons for choosing the three SOI projects at Borusan Port for evaluation, the innovation types and formation of the innovative aspects of the projects, the stakeholders and their roles in the projects have been briefly explained based on the elements in Table 73. These three selected SOI projects, under this title, the following 3.8.4.4.2 and 3.8.4.4.3 titles, will be evaluated based on the 12 evaluation elements in Table 74.

The pet bottle recycling project, which is a circular economy-based SOI project, provides environmental benefits by preventing pet bottles from becoming waste. In addition, by producing woven polyethylene yarn by recycling, economic gains have been achieved for the recycling company. At the same time, Borusan Port has been instrumental in producing recycled polyester weaving yarn, with the regular delivery of pet bottles and glasses collected at Borusan port to a start-up company that produces polyester yarn. It has created an economic and environmental impact by obtaining the woven polyester yarn required for the company making the production regarding the agreement made by the port with the company that produces the workwear, from the recycling of pet bottles. In the negotiations about Borusan Port SOI projects, the process of transforming the existing material as open-loop recycling (Wang, 2006: 62) for different usage areas has been used in the transformation of plastic bottles into yarn within the scope of the circular economy. In addition, the open-loop recycling process is a much more complex and laborious process than the closed-loop recycling process, which involves using the material for the same purpose (Demir, 2022: 134). In this context, Participant R-3 stated that the pet bottles collected during the Covid-19 pandemic were used in the production of all winter clothing needed by Borusan Port in 2022.

R-3: ...We ensured that the plastic bottle waste we collected during the pandemic period was used for the polyester content of port work clothes, which consists of 30% polyester and 70% cotton. In 2022, the port's need for polyester thread for all winter clothing was met from these plastic bottles. We collected 216 thousand (2560kg.) pet bottles and helped them to be collected in recycling facilities and turned into polyester yarn, and we ensured that these yarns were used in our port work clothes...

However, since not enough PET bottles were collected for polyester yarn production after 2022, the project has reached a level where awareness will be raised by making pen holders from the small amounts of collected PET bottles and giving them as gifts to the children of port employees. In this respect, the employees, whose ideas were properly mixed and supported by the management (Govindarajan and Trimble, 2005: 54; Bressan and Pedrini, 2020: 508-510), turned the pet bottle recycling project they carried out with process-based work teams into an awareness-oriented project without experiencing any loss of performance (Nafei, 2015: 130). While doing this, staff's ability to cope with project obstacles (Braga, A and Braga, V, 2013: 338-346) is another important issue. In this sense, Participant R-3 stated that although pet bottles continue to be accumulated as of 2023, they have made the project different for children's environmental awareness focused on recycling, as the sufficient number for polyester yarn production has not been reached.

***R-3:** ...We are still collecting plastic bottles as of 2023... However, this year there will not be enough plastic bottles to produce job attires in our port. Because we completely removed the use of plastic bottles. Only a small amount of plastic bottles were collected. We aimed to raise environmental awareness by making a small amount of plastic bottles into pencil holders for children, and by putting an information note inside, "We made pencil holders out of them, we did not throw them away, "come on, and don't throw them in the trash, recycle them...*

In this sense, SOI applications run the risk of offering products and services that are much more expensive than their competitors when compared to traditional innovation. This situation brings market risk that the other means non-appropriability of the returns on investment in innovation (Andreas et al., 2009: 29) since Borusan Port has installed remarkable collection boxes for the collection of plastic bottles and assumed the responsibility of storing the collected plastic bottles for a certain period of time. In addition, the business development and administrative affairs unit spent overtime for this project. In addition, uncertainties in the environmental and social impacts of SOI (De et al., 2020: 420), another risk that can be encountered in all SOI projects, bring along directional risks in innovation for example externalized environmental costs (Andreas et al., 2009: 29). In other words, while this situation may result in the detriment of the port in terms of externalized costs (Andreas et

al.,2009: 29), it has been seen that the project process has been carried out successfully with the work of the relevant sustainability committee structure.

The pet bottle recycling project is carried out within the climate theme put forward by Borusan Holding, and it is also an SOI project that is related to the innovation theme as it includes closed-loop recycling processes (Demir, 2022: 134) within the scope of circular economy. The Borusan Port sustainability working group committee responsible for the project is the circular economy committee. In terms of United Nations Sustainable Development Goals, the pet bottle recycling project is related to industry, innovation and infrastructure (Goal 9), responsible consumption and production (Goal 12), climate action (Goal 13) and partnerships for the goals (Goal 17). There are gains for environmental benefit (in terms of prevention of pet bottle waste), economic benefit (not for the port, but for the recycling company and the company producing job attires) and the social benefit (in terms of raising recycling awareness to the children of the port workers) in the second phase of the project. Regarding the resistance to the project, the Participant R-3 stated that there was no resistance in the implementation of the pet bottle recycling project. Participant R-6 stated that the ultimate goal of the project is to completely eliminate the use of pet bottles by 2030 (the expected output of the project), and in this direction, first benefit from the recycling of pet waste is to reduce the amount of pet bottles to almost nothing by the end of 2023. And, He stated that the project turned to raise awareness (the project's stated that they are leaning towards their current outputs).

R-3: *...On the contrary, our employees started to bring plastic bottle waste from their homes for the project...*

R-6: *...No numerical success metric has been determined for the project, our preliminary goal is to evaluate plastic bottle waste and our ultimate goal is to completely eliminate the use of plastic bottles in our port by 2030.*

When the SOI structure designed in the project has been examined in terms of SOI model innovation levels of Jay and Gerard (2015: 185), it is seen that the SOI application in the project is an innovation at the component level change (Jay and Gerard, 2015: 57-91). Since component level changes in the pet bottle recycling project aim to mitigate and rectify adverse effects without altering the underlying processes and systems that give rise to these negative effects as Jay and Gerard

(2015: 91) stated. When the SOI structure of the project has been examined in terms of Adams et al. (2016: 57)'s SOI model innovation levels, it has been seen that the SOI application in the project has been operational optimization in terms of approach; reactive, incremental and internal in terms of context; reducing harm as innovation output; and incremental improvements business as usual in terms of the innovation's relationship of with the business.

3.8.4.4.2. A Transformative Based SOI Case: Led Lighting System

The second SOI project examined within the scope of this thesis study is the project of converting the lighting systems of the Port to LED lighting system. Since the maintenance requirements of LED lighting systems are very low, it has significantly reduced the maintenance obligation on the workload of the employees, which reveals the social aspect of this project for the employees. Disposal process of bulbs in lighting systems consisting of old-style bulbs containing toxic gases poses a serious environmental problem. In this sense, LED lighting transformation project reveal the environmental aspect of the project. However, thanks to LED lighting systems, the economic problem caused by the frequent replacement of ballast systems and gas bulbs in old type systems and the high energy requirements of these old systems has been eliminated. While low electricity consumption reveals the environmental benefit of the project in terms of reducing indirect emissions, it also reveals the social aspect of the project in terms of port-city interaction (Peris-Mora et al., 2005: 1649; Xiao and Lam, 2017: 260; Chen and Lam, 2018: 255; Lam and Yap, 2019: 1; Carpenter and Lozano, 2020: 45) by preserving electrical energy that can be used for more productive purposes for the settlement in the region where the port is located (Hall, 2007: 97). Participant R-5 stated that the project was put into operation after testing with approximately 40 companies between 2006 and 2011 and after a long period of research and system tests.

***R-5:** ...When we decided to switch to this system in 2006, many companies claimed to produce LED lighting, but we found the right company and the right product only in 2011. We experimented with at least 40 companies during this 5-year period... ...In addition, in order to say that a company's product is OK, we first need to see the field tests of the product. We tested each of the LED systems installed for testing for nearly 1 year. Sometimes LED bulbs may lose*

illumination over time. So, we tested the lighting lux for 1 year, installed meters on the LEDs and determined the energy consumption values. We conducted these tests with at least 40 companies until 2011.

As stated by Participant R-5, the fact that experiments have been carried out with many possible project partners for a long time shows that the senior management of Borusan Port is supportive of new ideas (Govindarajan and Trimble, 2005: 54; Bressan and Pedrini, 2020: 508-510) and that by giving process authorization (Nafei, 2015: 130), talented employees (Braga, A. and Braga, V., 2013: 338-346) can use it through their the entrepreneurial role (Warren et al., 2018: 1787-1791) based on organizational learning and cooperation (Dedehayir et al., 2018: 24).



Table 74: A Detailed Comparative Assessment of Three Selected SOI Applications in Borusan Port

Assessment Elements	Pet Bottle Recycling	Led Lighting System	Safe Card System
1. Related Sustainability Dimensions	Social, Environmental, Economical.	Social, Environmental, Economical.	Social, Environmental, Economical.
2. Related Borusan SOI Themes (*: Responsible; +: Related)	*Climate Theme, + Innovation Theme.	*Climate Theme, + People Theme, + Innovation Theme.	*People Theme, + Climate Theme, + Innovation Theme.
3. Related Borusan SOI Committees (*: Responsible; +: Related)	*Circular Economy Committee.	*Decarbonization Committee, + Occupational health & Safety Committee, + Digitalization Committee.	*Occupational health & Safety Committee, + Decarbonization Committee, + Digitalization Committee.
4. Related United Nations sustainable development goals (UNSDG)	Goal 9: Industry, Innovation and Infrastructure Goal 12: Responsible Consumption and Production Goal 13: Climate Action Goal 17: Partnerships for The Goals	Goal3: Good Health and Well-Being Goal 7: Affordable and Clean Energy Goal 9: Industry, Innovation and Infrastructure Goal 11: Sustainable Cities and Communities Goal 17: Partnerships for The Goals	Goal3: Good Health and Well-Being Goal 7: Affordable and Clean Energy Goal 9: Industry, Innovation and Infrastructure Goal 11: Sustainable Cities and Communities Goal 16: Peace, Justice and Strong Institutions Goal 17: Partnerships for The Goals
5. Prevention of resistance to the project by employees	• The children of port workers were also included in the coastal cleaning carried out with primary school students, and the project was encouraged in the event. • Pen holders have been made with the plastic bottles collected in 2022 and presented to the children of the employees.	• When the field operators changed from yellow light to white light, they reacted like “this is shining, it is reflecting from the ground when it is raining”. • Because of the illusion of the operators, the lighting lux measurement was made and the operators were interviewed about the increase in the lighting power and if it was required, the necessary adjustments were made in the system.	• Correcting the misconception of privacy that employees are being tracked and following-up everywhere. • Matching the requirements of the project with the routine obligations and requirements of the employees. • In order to reduce the workload on the security department, if the alarmed employees don’t not answer the call, they will be checked. • Changes were made in the labor legislation for SafeCard System, Because of avoiding of Carrying and Possession of the SafeCard Physical Device. •

Assessment Elements	Pet Bottle Recycling	Led Lighting System	Safe Card System
5. Prevention of resistance to the project by employees <i>(Continuation of the 5th numbered element)</i>			• Adaptations have been made because unnecessary warning and vibration are disturbed for employees. • The image and trust created on employees by the elimination of near miss work accidents. • Regular user-friendly introductory meetings and teaching activities for the phases of SOI project.
6. Metrics set for project success	• There is no KPI assigned. The aim is to prevent the use of pet bottles and to raise awareness for it.	• Current ROI	• The requirements of the People theme and OHS committee is important than Current ROI, • It is a future ROI based SOI project, • Early adaptors/birth/innovators in People theme and OHS Committee related SOI projects.
7. Expected (+) outputs of the project	• Eliminating the use of plastic bottles completely by 2030.	• Much lower energy consumption in the long term for Borusan Port, • Much less indirect emissions for Borusan Port in the long term, • Ensuring that more energy is available for the use of Gemlik city.	• A much safer work environment suitable for OHS for employees, • An accurate labor force database for Borusan Port, Operational efficiency, • Ease of filiation (in the Covid-19 pandemic), • The providing of the existence of a more acceptable and a desirable employment area for the labor force of Gemlik City.
8. Actual (+) outputs of the project	• As of 2023, the amount of Pet bottle using has decreased to almost non-existence.	• OHS appropriated lighting for employees of Borusan Port, • Low energy consumption for Borusan Port in short term, • Less indirect emissions for Borusan Port in short term.	• A safe work environment suitable for OHS for employees, • Ease of filiation (in the Covid-19 pandemic), • The providing of the existence of an acceptable and desirable employment area for the labor force of Gemlik City.
9. Innovation levels according to SOI model levels of Jay and Gerard (2015: 185)	• Component level Change	• Component level Change, • Sub-System Change.	• Sub-system Change, • System Change.

Assessment Elements	Pet Bottle Recycling	Led Lighting System	Safe Card System
10. Innovation levels according to SOI model levels of Adams et al. (2016: 57)	• <u>Approach</u>: Operational Optimization • <u>Context</u>: Reactive, incremental, internal. • <u>Innovation Output</u>: Reducing Harm • <u>Innovation's Relationship to the firm</u>: Incremental Improvements business as usual.	• <u>Approach</u>: Operational Optimization, Organizational Transformation. • <u>Context</u>: Reactive, incremental, internal, and Embedding. • <u>Innovation Output</u>: Reducing Harmand Creating Shared Value. • <u>Innovation's Relationship to the firm</u>: Incremental improvements to business as usual, Fundamental shift in firm purposes.	• <u>Approach</u>: Organizational Transformation, System Building. • <u>Context</u>: Embedding, and System change. • <u>Innovation Output</u>: Creating Shared Value, and Net Positive Impact. • <u>Innovation's Relationship to the firm</u>: Fundamental shift in firm purposes, Extent beyond the firm to drive institutional change.
11. Infrastructure requirements for the project	• Remarkable boxes were created where only plastic bottles and plastic glasses could be collected, and continuous information was provided through the employee communication portal. • Information about the recycling of collected plastic bottle wastes was shared.	• 80 lighting poles, • Developing, testing and putting into operation LED luminaires suitable for lighting distances.	• 2.4ghz Wi-Fi radio frequency system for port area and closed areas, • Obtaining necessary permits for Wi-Fi radio frequency broadcasting, • Supplying, pairing and testing SafeCard units for all employees and all equipment.
12. Possible development process of the project (Planned Improvements)	• Raising awareness of employees and their children on waste reduction. • Eliminating the use of pet packaging in the institution.	• Increasing energy efficiency. • Providing and continuity site lighting suitable for OHS.	• Monitoring and to immediate ability interfering of employees in terms of occupational health and safety (such as accident prevention, disease, and sudden illness), • Tracking and follow-up of employees in terms of Human Resources, • Monitoring and tracking energy efficiency and optimum operability situations. • Monitoring and tracking of technical situation of equipments, • Elimination of unnecessary preventative or predictive maintenance and efficient maintenance planning for equipments.

However, although sustainability themes have not yet been determined within Borusan Holding in the relevant period, it is thought that the LED lighting transformation project, based on the themes determined by the holding in 2019, will have emerged in relation to the themes of People and Innovation, assuming that the Climate theme is under the responsibility. In this sense, giving different companies the opportunity to try their projects for the changing and developing business environment and its requirements is an indication that Borusan Port has adopted lean and agile practices (Bushuyeva et al., 2019: 77-78) by placing SOI activities at the center of the innovation ecosystem (Adams et al., 2016: 190) as a set of processes carried out consciously and regularly within the business and taking into account the requirements for continuous improvement (Dooms et al., 2004: 16; Pérez-Rave et al., 2023: 126). Participant R-5 also stated that the project is still ongoing and that different LED lighting systems have been tried with the developing technology and different companies have been accepted for these trials.

R-5: ...In addition to the current company, we started working with another company so that it could be a backup for the current company. The important criteria for our success regarding our lighting systems are that there is no loss of lighting over time, that our solution partner can design lighting specifically for our field and operations, and that they do this with domestic technology that is available at any time. Imported products may cause problems in terms of both cost and availability... ...As a backup, we are running the same tests again with the company we are currently working with.

Participant R-5 stated that after the LED lighting transformation project was initiated in 2006, the LED lighting conversions of the lighting systems of all parts of Borusan Port SSC, RTG and MHC equipment, including the pier and dock, were completed as of 2017, and added that they weren't charged any fee or expense for the lighting system conversion trials. He stated that as a port, they made performance measurements (such as lighting lux, energy consumption, lighting area measurement) and started the final installations for the appropriate system. The fact that Borusan Port did not incur any expenses for these trials is a result of the trust factor accepted by the collaborating businesses and startups (Wartick, 1992: 34; Petrick et al., 1999: 63) and the economic benefit that can be achieved due to the high perceived organizational reputation (Carmeli and Tishler, 2005: 13; Yoon et al., 1993: 215) of Borusan Port in the sector and business environment in which Borusan Port

operates. Participant R-5 stated that they took the current ROI into account as the performance indicator of the project and stated that the bulbs, which are an important part of the lighting system, can be accepted for performance if their lifespan is at least 25% longer than the depreciation period.

***R-5:** ...We measured these criteria, luxury value and energy consumption, on a monthly and annual basis. We saw that the illumination lux on the first day and the value 1 year later are the same, there is no loss or it is very low, which is quite reasonable. On this occasion, we decided to use related product and work with related company. But of course, we did a series of trials and tests for 5 years until we achieved this. And as we achieved success, we began to investigate whether there was a point where we could fail. We thought, these bulbs pay for themselves in 2 years. We said that if it lasts at least 2.5 years, it does not matter even if the company providing the solution goes bankrupt. We have already made a decision saying that we will make money in 2 years and make a profit in the remaining 6 months....*

Borusan Port, which found it appropriate to carry out the LED lighting transformation project in stages, have completed the conversion of half of the lighting system in the first stage, after a 5-year trial period. In this sense, it can be stated that the long trial period of the transformation regarding the relevant technology enables the formation of a structure that will support organizational learning and support the development of cooperation with the project partner as stated by Braga, A. and Braga, V. (2013: 44) and Warren et al. (2018: 1788). Both, it can be stated that carrying out the project incrementally in parts (Henderson and Clark, 1990: 12) supports the continuous improvement capabilities (Dooms, et al., 2004: 16; Pérez-Rave et al., 2023: 126) of Borusan Port and allows technology-driven changes (Myers and Marquis, 1969) to be changed in the process with lean and agile principles, and adaptation to change and innovation will be supported by reducing the factors that will cause employees to show resistance due to sudden lack of information about the change (Bordia et al., 2004: 525; Reichers et al., 1997: 48-52).

***R-5:** ...First, we converted half of the port to LED, so that we would not fall behind the development, and we thought that if there were new systems in the other half with the developing technology, we would proceed in that way. In other words, we found it appropriate to make a gradual transition rather than a 100% transition all at once.*

Kunze et al. (2012: 754) put forward, older employees, who may often encounter explicit or implicit difficulties in supporting and adapting to the organizational transformation efforts of the business, sooner or later internalize the change and transformation efforts of the organization if they receive the help of other employees who will support them for the change. Thus, it will be seen that they accepted their new roles, which were subject to change, and fulfilled their duties. It has been observed that this situation, reflected in the literature, also occurred in Borusan Port. In this sense, Participant R-3 stated that training was given in which employees interacted with each other for the changes and project implementations, and that the applications were put into use after the training, and for example, stated that only a few elderly operators had difficulty adapting to the e-signature application.

***R-3:** ...However, we put the applications into operation after the training...
...For example, we told everyone to attend the meeting with their phones for the e-signature application, and we explained it at the meeting. Those who understood it taught it to those who did not understand it by describing it, and now we use e-signature without any problems in our field employees. Currently, all our field personnel, except for a few operators who are very old, use the e-signature application...*

Ford et al. (2008: 365) argued that trust problems and disagreements will arise in employees who are excluded from business development processes, and this will increase resistance to change. In this sense, it has been also stated by participant R-2 that Blue-collar employees are included in the project processes in the LED lighting transformation project, as in all other innovation and SOI applications at Borusan port. Additionally, the participant stated that they made measurements by evaluating the complaints from the field employees regarding the R-5 lighting transformation project. However, he stated that the resistance to the lighting system disappeared in a short time due to misconceptions arising from breaking habits. This situation matches the view of Bordia et al. (2004: 525) and Reichers et al. (1997: 48-52) that employee resistance based on misconceptions will disappear by eliminating the staff's misconceptions. At the same time, eliminating the misconceptions of employees (Bordia et al., 2004: 525; Reichers et al., 1997: 48-52) at Borusan Port related to the new duties and roles expected from them is supportive of the

innovation climate (Voelpel et al., 2004: 40) by ensuring internal customer satisfaction (Ansoff, 1965: 34; Voelpel et al., 2004: 40).

R-2: *...In all field projects, we include employees in relevant projects directly from the very beginning... ...Because the person involved in the project tells other operators what he has learned about the project and what needs to be done. Thus, trying to transfer the projects by one of the operators themselves facilitates the acceptance of SOIs and the spread from private to general. For example, sometimes in some of our renovation projects, the operator's add-on and change demands may not be partially covered. In this case, we take the relevant operator to a meeting with the IT team and explain why the element of the project cannot be done, in terms of technical capabilities, and we try to meet at a common point to carry out the work efficiently. In short, if you act with the awareness that the other person is a human being and include them in the processes from beginning to end, they will try to do the job as it should be in the transactions...*

R-5: *...Regarding the conversion to LED lighting, when operators switched from yellow light to white light, reactions such as these shines, it reflects off the ground when it rains' were received. Actually, there is no such thing, but the operator thinks so. For example, the operator says it is too dark. Then we go and measure the lux. We see that lighting lux values are doubled than normal. When we explained this situation technically, we saw that this misconception disappeared over time...*

The LED lighting transformation SOI project is a project carried out under the responsibility of the Decarbonization committee of Borusan Port's sustainability working group. However, it has been seen that the gains provided by the project go beyond the job descriptions of the Decarbonization committee. As participant R-5 stated, the LED lighting transformation SOI project is a project that makes positive contributions in terms of OHS as it provides much better clarity in port lighting. In this sense, it is a project that is also related to the Occupational Health & Safety Committee of Borusan Port. In addition, the LED lighting transformation SOI project is related to the digitalization committee job descriptions by implementing a satellite-supported sunlight-sensitive system and an automated on-off system. Moreover, thanks to the lighting system being turned on and off at the right time, regardless of summer or winter, it prevented the formation of dark periods in the field. This situation is again important for OHS. Furthermore, the system shuts down on time, preventing unnecessary energy consumption. This situation again shows the relationship of the project with Decarbonization. In this sense, it can be seen that the LED lighting transformation project is also an SOI project in that it touches all three dimensions of sustainability. In terms of United Nations Sustainable Development

Goals, The LED lightning transformation SOI project is related to Good Health and Well-Being (Goal 3), Affordable and Clean Energy (Goal 7), Industry, Innovation and Infrastructure (Goal 9), Sustainable Cities and Communities (Goal 11) and Partnerships For The Goals (Goal 17). The positive outcomes expected in the LED lighting transformation SOI project of Borusan port are aimed at much less electrical energy consumption and much less emission in the long term, and ensuring that more electricity energy is available for the use of Gemlik city is also a possible social goal. Again, the positive outcomes of this project are the reduction of electricity energy consumption and emissions in the short term.

When the SOI structure in the in the LED lighting transformation project has been examined in terms of SOI model innovation levels of Jay and Gerard (2015: 185), it is seen that the SOI application in the project is an innovation at the component level change and sub-system change (Jay and Gerard, 2015: 57-91). The component level changes aim to reduce and correct negative impacts without changing underlying processes and systems (Jay and Gerard, 2015: 91) as in the LED lighting transformation SOI project. In summary, some important components of the lighting system have remained basically the same, so the project has the specifications of the component level change. However, the functional capabilities of the lighting system have been partially modified to create social, environmental and economic benefits. This situation in the functional improvements indicates that the project has also specifications of the sub-system change level. Since it has been found that the implementation of subsystem regulations effectively reduces negative impacts in improving the production of products and services and also minimizes resource consumption, waste generation and pollution (Jay and Gerard, 2015: 91).

When the SOI structure in the in the LED lighting transformation project has been examined in terms of Adams et al. (2016: 57)'s SOI model innovation levels, it has seen that the SOI application in the project is at the levels of operational optimization and organizational transformation in terms of approach. The project has also been determined as reactive, incremental, internal and embedding SOI in terms of context. When examined the project in terms of innovation output, it has been determined that it is aimed reducing harm and creating shared value. It has been found that The LED project is a incremental improvements for business as usual and

fundamental shift in firm purposes in terms of the innovation's relationship of with the Borusan Port business. Basic requirements for the LED lighting transformation SOI project are 80 lighting poles, unit connections and the development, testing, activating of LED fixtures suitable for specific lighting distances for Borusan Port area and the integration of the entire system with the satellite-based lighting system. In addition, the ultimate goal of continuing the project is increasing energy efficiency and providing field lighting suitable for OHS. In summary, All findings of the SOI assessment, have been supported by the literature, show that the LED lighting transformation project has become an SOI project for Borusan Port.

3.8.4.4.3. A System Building Based SOI Case: SafeCard System

The SafeCard system, which is the third and last SOI project examined within the scope of this thesis, is an IoT and Wi-Fi supported project. The project is initially a tracking system that serves a very basic need for use in open-closed areas within the port for OHS purposes, especially for the tracking and monitoring of employees working in the field and who have to pass to the field during work. The project has been initially used as an OHS-based tracking system. However, when the project was first put into operation in 2019, it was used to being used both for OHS tracking and monitoring of employees and was a solution to the contact tracing problem experienced during the Covid-19 pandemic. In this sense, the project has demonstrated its achievements regarding the social dimension in the first year of its implementation. Participant R-1 Since the SafeCard system, which has been designed to prevent accidents in the sense of OHS and to solve the problem of working alone, can optimize the filiation tracking in the Covid-19 pandemic and reduce the pressure created by the filiation uncertainty on operational continuity and human life is at stake, the SafeCard system is a solution for filiation tracking. So, he stated that they ensured its development with their partner company. In this sense, Participant R-1 stated that they kept ROI in the background while carrying out SOI innovations within the scope of human contact and especially regarding the OHS committee, but they prioritized about social benefit and Human life.

R-1:*In the Covid-19 pandemic, contact tracing (filiation) was a big problem and uncertainty. SafeCard provided us with a benefit that we had not considered before in order to perform correct filiation. We saw that when we evaluate SafeCard from a social perspective, it has a basic OHS dimension, but it also indirectly would have an economic benefit in the long term. However, since short-term filiation control is effective in ensuring operational continuity safely, we decided to bear this cost, which will have a return in the long term, in order to provide social benefit.... In summary, there is no immediate return on the investment we spend on SafeCard, but both we and the senior management accepted this for social benefit. So, essentially, launching the safe card opened a horizon for us to step into the digital world. There is an urgent need on the OHS side, meeting the need has no economic benefit for us in the short term. But, we started SafeCard without any doubt due to OHS. Afterwards, we saw that SafeCard opened such a big horizon for us in the long term that, as a corporate reflex, we made the necessary investment to benefit from the OHS benefits that SafeCard will provide us, by showing the ability to postpone some of the gains we will achieve through investment and innovation, especially the economic ones, to the future.*

The participant emphasized that after the R-1 SafeCard project was used as a pilot project and for monitoring employees and contact tracing, which is an issue they attach importance to, the project can evolve to more advanced stages and be used to monitor operations. Thus, he stated that practices that touch the economic and environmental dimensions of sustainability can be integrated into the system.

R-1: *...SafeCard was useful as a pilot project for OHS purposes in broadening our horizons. Then there are the benefits it will provide us in terms of efficiency. There is the issue of digitalization of operations and capabilities related to automation. This situation motivates us and our future expectations in this SafeCard project...*

The participant stated that they implemented the RTG automatic positioning system before the R-2 SafeCard system project and that this project helped the transformation for SafeCard. He also stated that Borusan Port equipment is like a playground for innovation and change. In this sense, the fact that Borusan Port is a playground for employees to make changes and innovations is a result of the autonomy provided to them, as Lertxundi et al. (2019: 197) stated. Of course, employees have made this freedom of autonomy valuable by complementing it with talented employees interaction (Braga, A. and Braga, V., 2013: 338-346). In addition, the cooperation they demonstrated while developing the RTG positioning system project and the maturation of their organizational learning capabilities (Braga, A. and Braga, V., 2013: 44; Warren et al., 2018: 1788) ensured that their continuous

improvement capabilities remained vigorous (Dooms, et al., 2004: 16; Pérez-Rave et al., 2023: 126), triggering the formation of a structure that will support the ideas that will build the SafeCard system (Bowonder et al., 2010: 20; Dedehayir et al., 2018: 22; Erlandsson and Gaylong, 2019: 39), that is, the creation of an innovation climate in the organization (Adams et al., 2016: 190).

***R-2:** ...Before we realized the SafeCard project, we also had toys to play with while making the RTG positioning system. In other words, our equipment is our playground where we will innovate and improve. Borusan culture provides us with this space and opportunity to play with these... ... Naturally, we have many products, but when we take them, turn them into something, flesh them out according to the needs and support them with software, they become meaningful. Otherwise, all of these exist as separate products, and we brought them together with RTG to meet our needs. For example, by purchasing a sensor used in the market to count the products passing through the belt, we started to move the RTGs automatically to eliminate the risk of accidents by using this sensor. Naturally, the fact that we went through such a change and transformation in RTGs was an element that improved us in terms of transformation. For example, SafeCard is the same for us. You introduce a product, and as you use it, you say, "We will use it here too, it will meet our needs with these additions," and we proceed incrementally.*

SafeCard system SOI project is carried out by the OHS committee under the human contact responsibility of the Borusan Port sustainability working group. However, the project is also inherently related to the themes of Climate and Innovation. In this sense, the SafeCard system SOI project is related to the Decarbonization and digitalization committees, and due to this relationship, the claim that it is an SOI project proves itself. The reason for this relationship, its connection with all dimensions of sustainability and the claim that it is a SOI project will be further explained by connecting it with the expected positive outcomes of the project in the future.

In terms of United Nations sustainable development goals, The SafeCard system SOI project is related to Good Health and Well-Being (Goal 3), Affordable and Clean Energy (Goal 7), Industry, Innovation and Infrastructure (Goal 9), Sustainable Cities and Communities (Goal 11), Peace, Justice and Strong Institutions (Goal 16) and Partnerships For The Goals (Goal 17). Participant R-1 stated that Borusan Port took Future ROI, human contact and the requirements of the OHS Committee into consideration as a performance indicator in the SafeCard system project, and he also stated the reason for this has been due to the importance Borusan

Holding attaches to human contact. He also emphasized that Borusan Port is early birth or early adapters in making innovations when it comes to human life and OHS. In this sense, it has been observed that Borusan Port is among the few entrepreneurs who prefer to be innovators (2,5% of adoption lifecycle) and early adapters (13,5% of adoption lifecycle), one of the innovation adoption structures expressed by Rogers (1962: 353) and Robinson (2009: 5), while introducing human-related innovations in SOI projects. In summary, it has been observed that Borusan Port, while developing SOI, acted with an attitude between early majority and late majority, as Rogers (1962: 353) and Robinson (2009: 5) stated, on issues other than people theme.

***R-1:** Yes, we are not the first user as an innovation adopter. But for example, we can be the first in things that we see high potential for. For example, we were the first to use SafeCard. However, due to the importance of filiation under human contact, which is one of our 3 themes in developing SafeCard, we said 'we must do this.' We said, 'the value of this cannot be measured with money' and we enabled the development of SafeCard. In this sense, we postponed the economic output of the safe card until later. Because in such matters, we become early adapters or early birthers. But we say let's be a little calmer on other issues, let someone use it, let the product mature a little...*

Thus, it can be said that Borusan Port prioritized the requirements of people theme in the SafeCard system project and carried out SOI projects based on mimetic isomorphism (DiMaggio and Powell, 1983), taking into account the benefits of OHS arising from coercive isomorphism (DiMaggio and Powell, 1983).

***R-1:** ...SafeCard is not primarily and solely an economic opportunity; First of all, it is a social responsibility. When you invest in it, the creator of the product continues to improve it, so it not only benefits you but also serves as a nucleation and promotion for subsequent users. Naturally, we prioritize the issues we see from the human perspective a little more.... ...In summary... ...when common interest, common benefit and public benefit come together, the issue of sustainability starts with people...*

In terms of the expected outcomes of the SafeCard project described in Table 74, at first only gains related to the social dimension of sustainability has occurred. However, as the project progresses, gains in the economic dimension will have begun to emerge as it will provide Borusan Port with an accurate workforce database and operational efficiency for various constraints such as employees, equipment and shifts. In this sense, Participant R-2 stated that in terms of the expected benefits of

SafeCard, the interaction of load, equipment and personnel will be optimized and there will be an increase in equipment-load efficiency.

***R-2:** ...In the next stage of SafeCard, we will optimize the cargo and equipment with this load and navigation information. The system will tell us which machine should go and pick up which load. The load information will fall on the screen of the relevant operator and he will go and pick it up. But now, all equipment has a screen, the load displayed on the screen, and an operator reserves the load for herself or himself and goes and picks up that load. But maybe a wrong decision might have been made although someone else was much closer to that load, or he might still be on return load duty. Of course, operators still provide efficiency by talking on the radio, but the decisions made by the system will be much more efficient. When we switch to this application, we will achieve a significant increase in equipment-load efficiency.*

In addition, the SafeCard project will create gains regarding the environmental dimension of sustainability in terms of ensuring energy efficiency and emission improvements by monitoring the equipment usage habits of the employees and the efficiency of the equipment. Again, the equipment usage habits of the personnel can provide a reference criterion for human resources policies. This will enable relevant operators to create a good operator reference with successful equipment usage data and gain a gain regarding the social dimension. Additionally, Borusan port will monitor human resources efficiency and this feature will provide to Borusan Port an economic gain element in terms of efficiency human resources management. As a result, the SafeCard project has become an SOI product and process application that can bring change and innovation for different fields after it went into operation in 2019. Although ports are among the heavy and dangerous business lines (Danacı and Kişi, 2014: 316-318; Motter and Santos, 2017: 120); Again, thanks to the safe and secure working environment provided by the SafeCard system SOI project in terms of OHS, Borusan Port has turned into an acceptable and desirable employment area for the city of Gemlik. In this sense, Participant R-2 stated that they will use the SafeCard system for energy efficiency purposes and to detect possible technical or human error flaws in machine-human interactions regarding operations. Another expected benefit of the SafeCard system SOI project at Borusan port is that it will enable preventive and predictive equipment maintenance and will provide a significant gain to the port in terms of lean business practices (Loyd et al., 2009: 36-37).

R-2: ...Another thing we want to follow up is that we will ensure energy efficiency through operator-based energy consumption. For example, in an 8-hour shift, operator A consumed 100 liters of fuel-oil and operator B burned 80 liters by pulling that much more cargo with the same shift. In terms of hourly average, perhaps staff A is using the equipment inefficiently. In this regard, training will be required for A personnel again, or if something has happened to the equipment, we can say that there is a malfunction and that is why it consumed too much fuel. In this way, we will prevent inefficient operations. At another stage, we aim to issue SafeCard to port guests or for example employees of external companies doing construction work within the port...

When the SOI structure designed in the project has been examined in terms of SOI model innovation levels of Jay and Gerard (2015: 185), it is seen that the SOI application in the SafeCard system SOI project is an innovation at the sub-system change and system change (Jay and Gerard, 2015: 57-91). SOI's at the Sub-System change level enable the creation of more goods/services by using fewer resources and reduce negative effects such as waste and pollution (Jay and Gerard, 2015: 91). In this sense, with SafeCard at Borusan Port, efficiency has been achieved in the employees' use of resources related to sub-systems such as cafeteria use, entrance-exit and security control, which are outside the main purpose of this system. In addition, the fact that SafeCard is an SOI at the system change level can be explained by the fact that, as Jay and Gerard (2015: 91) put forward, system changes are designed to reduce the environmental and social impacts on the ecosystem and society in general. When the SOI structure of the project has been examined in terms of Adams et al. (2016: 57)'s SOI model innovation levels, it has seen that the SOI application in the project is organizational transformation, system building in terms of approach; embedding and system change in terms of context; creating shared value and net positive impact, as innovation output; and fundamental shift in firm purposes, extent beyond the firm to drive institutional change in terms of the innovation's relationship of with the business. Participant R-2 stated that they prepared the regulations regarding the basic changes to be made regarding the business processes from the very beginning of the SafeCard system SOI project, and instructions that overlap with the operations in terms of white and blue collar were prepared. In this sense, the statement that basic business processes are integrated with SafeCard can be explained by the fact that it is a Fundamental shift in firm's purposes (Adams et al., 2012: 17-20-21; 2016: 185).

R-2: *...The team continually developed a standard operating procedure from the beginning of their project... ...and we prepared a 200-page project road map before the project even started. In summary, we knew on the first day of the project what would happen when the project was completed... ...We have prepared instructions that match the operations for SafeCard. These instructions were prepared specifically for each terminal and equipment in the field, including field and white collar. Naturally, a change was made in the Personnel Attendance Control System (PACS), in short, the system that calculates employees' working hours, overtime, leaves and absence information, and records and stores their progress payments and deductions...*

In addition, to The Borusan Port, when viewed in terms of the innovation's relationship of with the business, another formation has been seen as extent beyond the firm to drive institutional change (Adams et al. 2012: 17-20-21; 2016: 185). This situation can be explained by the fact that Borusan port representatives interact intensively with external actors with the SOI product and application introduced by the SafeCard system, and the transformations in the port are affected at a systemic level (Schiederig et al., 2012: 190-191; Klewitz and Hansen, 2013: 69-70). In this sense, Participant R-2 stated that with the inclusion of SafeCard in one of the Borusan Holding group companies, the systemicity level of Borusan Port will increase with the interaction of the achievements of this SOI with different actors and He stated that the relevant SOI would reach to the very different points.

R-2: *...For example, Borusan Mannesmann, which operates next door, is currently working on SafeCard. When they complete it, we will integrate with safe card as Borusan Port and Borusan Mannesmann. This SafeCard based system integration will take us to a very different point. So after a point, instead of 1+1 equals 2; It starts to make 3, 4, 5. Therefore, the institution allows and serves this...*

The requirements of the SafeCard system SOI project are installation of 2.4 ghz Wi-Fi radio frequency systems for open and closed areas with the solution partner business, obtaining the necessary permissions and approvals for Wi-Fi radio broadcasting, and supplying, pairing and testing SafeCard units for all employees and all equipment. A series of measures have been developed against Borusan Port employees' resistance to the SafeCard system SOI project. A managerial commitment has been made in accordance with PDPA (Personal Data Protection Authority) in order to correct the misperception regarding employee privacy. The operational and managerial requirements of the project have been matched with the routine obligations and requirements of employees. In addition, it is aimed to prevent

employees from misunderstanding. The functions of the SafeCard system SOI project have started to be used in stages. Obtaining the opinions of employees in the development of portable equipment for the project is another facilitator. Preventing near-miss accidents with SafeCard has helped eliminate employee trust issues. Providing user-friendly training for SafeCard is another facilitator for employees to get rid of resistance and misconceptions and gain confidence.



CONCLUSION

Since countries, businesses and societies focus on the concept of profit only as gaining economic gain, the already scarce world resources are used inefficiently. This approach, which harms the self-sufficient ecosystem of our planet, causes environmental and social disasters that will affect the continuity of the economic resources pursued by humanity. Therefore, the concept of sustainability indicates that interacting parties can efficiently manage the resources and labor they put forward and risk in order to obtain benefits, taking into account environmental, social and economic factors simultaneously and together. This situation of the parties interacting with each other, that is, the stakeholders, was expressed as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”(WCED, 1987: 49) in the Brundtland report published in 1986 with the title "Our Common Future". Based on this, it can be stated that future generations and current generations are stakeholders of each other. In this sense, it is clear that carrying out sustainable activities requires good stakeholder management and interaction. Economic criteria are balanced with a series of social and ecological criteria (Omann and Spangenberg, 2002: 1; Vallanceet al., 2011: 345), and all kinds of resources needed for predetermined purposes are replaced with resources that are more efficient for the world and stakeholders when necessary, transforming into behavior, style of action, production and service delivery understanding, which means sustainability (Salas-Zapata and Ortiz-Munos 2019: 155). This transformation requires balanced harmony for all stakeholders (Polese and Stren, 2000: 16-17). Innovation activities are needed for the process of transforming sustainability activities with balanced harmony. Rogers (1962: 301) stated that the basis of sustainability activities is based on preventive innovations. Rogers (2002: 991) expressed it as “Preventive innovations are new ideas that require action at one point in time in order to avoid unwanted consequences at some future time”. In this sense, sustainability and innovation activities are not separate; are nested structures. This intertwined structure has triggered the emergence of the concept of sustainability-focused innovation, which is a much more clearly targeted approach for the sustainability innovation efforts of businesses, unlike traditional innovation

approaches (Adams et al., 2016: 180). Since much clearer goals are required for the realization of SOIs, business model innovations and interaction with key stakeholders are required, which is another issue that requires clarity for the success of SOIs (Bocken et al., 2014: 43). Thus, in Maritime business research, as in other business research, innovations have become a vital factor in the challenges of competitiveness and sustainability issues (Acciaro and Sys, 2020: 1043). Within port management innovations, a multidisciplinary environment must be provided for different sustainability-oriented innovations that concern the welfare of a wide range of stakeholders, including regulatory innovations. In this multidisciplinary environment, ports can be a suitable environment for SOIs, which also include administrative, operational, and cultural arrangements, if the stakeholders are managed correctly. Based on this, this doctoral thesis research has addressed sustainability and innovation with stakeholder management. The development process of sustainability-oriented innovations in ports has been examined as a case study through Borusan Port and the stakeholder interaction in the port's SOI development process has been analyzed.

In the conclusion of the thesis, the main findings of the stakeholder analysis of the research, determining the impact of SOI improvements in the Borusan Port and solar energy potential on the operation-related emissions of the port, and then evaluating the sustainability-oriented innovation process of Borusan Port have been summarized and discussed. Then, the theoretical and practical contributions of the thesis, limitations of the analysis and suggestions for future work are included.

Main findings and discussion -In light of research question 3 regarding how SOI development processes fit into different sustainability dimensions of a port business, when looking at the change in the port's emission amount, the calculation has been tested to see if Borusan Port has reduced the emission amount despite the increased handling amount, and this assertion has been found to be correct. In particular, despite the 20% increased handling amount of the general cargo terminal, there has been a 10% improvement in emission efficiency compared to 2019 and 12% compared to 2020. When this amount of improvement is evaluated in the light of the literature, it has been seen that it is a very good improvement. In addition, with the 15% improvement that the emission reduction strategies implemented in the

General Cargo and Container terminal will provide in emission efficiency for all diesel handling machines, an additional emission efficiency of 7% in the general cargo terminal will be 14.5% compared to 2019 and 14% compared to 2020, It has been determined that will be more efficient. It has been determined that approximately 15% more energy than the port's own electrical energy needs can be produced with the solar energy system that can be installed on the port area roof assemblies. Naturally, with the possible system to be established, Borusan Port will be able to achieve its carbon zero target. This amount of electrical energy that can be produced is approximately twice the energy need of the port from the field equipment.

In light of research question 2, who are the key stakeholders involved in a port operator's SOI activities and how these stakeholders are involved in SOI activities, looking at the stakeholder analysis findings, Borusan Port, as all other ports, has a diverse stakeholder environment. Some of these stakeholders may have an impact on the port on their own, some together with other stakeholders. Borusan Port can also have an impact on these stakeholders on its own or together with other stakeholders. At this point, according to the stakeholder analysis findings, it can be stated that Borusan Port has established its stakeholder integration specifically in the areas in which it wants to develop. Considering the operational and commercial activities of the port, management, board members, container line operators, wind turbine manufacturers, owners and representatives are among the definite stakeholders. In the literature, while the ministries and similar structures, which are regulatory bodies, are often seen as dominant stakeholders, the Ministry of Commerce, the Ministry of Industry and Trade, the Ministry of Health and the Ministry of Internal Affairs have been identified as definitive stakeholders. However, IMO, most of whose decisions are recommendations for supra-State organizations, has also been identified as the definitive stakeholder of the port. At this point, it can be stated that the port management sees the stakeholders that will be vital for basic operational processes as definitive stakeholders and this perception is reflected in the stakeholder analysis. Regarding definitive stakeholders, class and survey organizations and their representatives, with whom they do not interact directly but are indirectly important for the operation of the port due to their capabilities and

rights, have also been identified as definitive stakeholders. Considering the operational and commercial activities of the port, stakeholders who may be negatively affected by the activities of the port and stakeholders who will benefit from the activities and supports of the port have also been identified in accordance with the port management ecosystem. Customs authorities, which have coercive power over the port due to laws, have been identified as dangerous stakeholders. It is thought that this situation arises as an expression that if the port is involved in a wrong transaction as a result of an error that is not under its responsibility in terms of the customs regime in operations, it will be in a difficult situation if it cannot provide proof of this situation. Dominant stakeholders again consist of stakeholders who are directly effective in carrying out the operational activities of the port. At this point, the emergence of Ro-Ro lines as the dominant stakeholder is due to the necessity of the port to maintain good relations with the Ro-Ro lines as a result of the finished vehicle cargo owners. Another interesting finding is that while shareholders are often seen as definitive stakeholders in the literature, they were identified as the dominant stakeholder in the analysis. General cargo operators have been determined as dormant stakeholders. It can be thought that as a result of the good relations of wind turbine and other project cargo owners with the port, this is general cargo operators remain a dependent and dormant stakeholder against Borusan Port for these loads. Considering sustainability and innovation activities, the fact that port management and board members are definitive stakeholders matches the literature. The findings are consistent regarding sustainability and innovations, which are directly related to the Port. It is also consistent that Ro-Ro line operators, wind turbine manufacturers and the Ministry of Environment and Urbanization are the definitive stakeholders. In the meeting with the port and in the port's last activity report, it has been determined that practices were carried out within the scope of activity of the relevant ministry and that there has been a structuring specific to the relevant customers. The consistent results of the stakeholder analysis conducted before this verification are positive in terms of reliability. In summary, in the port stakeholder analysis, the number of dangerous stakeholders of Borusan port in sustainability and innovation activities is few and their salience scores are low. In addition, it has been observed that the stakeholder structure for sustainability and innovation activities is

compatible since the definitive stakeholders and dominant stakeholders are the stakeholders that the port focuses on. Additionally, dormant stakeholders couldn't be identified and found in terms of sustainability and innovation activities of Borusan Port. This is a positive situation for the open innovation ecosystem.

Regarding the assessment of Borusan Port's SOI applications, it has been determined that Borusan Port carries out sustainability-oriented innovations instead of traditional innovation and sustainability activities. This determination has been examined through the organizational DNA metaphor and 23 SOI capabilities of Borusan Port identified. Some of these capabilities stand out as informal role acceptance of employees for SOI activities, openness to change, top management support, internal and external communication, entrepreneurship and social capital. However, in order to ensure all these elements, preventing employees' resistance to change is the most binding element. According to model of Adams et al. (2016), when three different SOI activities of Borusan Port have been examined, it has been seen that the SOI applications carried out included process innovation, social innovation and product innovation. Each of these three SOI applications incorporates more than one innovation at the same time. This is due to the fact that SOI applications, which require complex management, are preventive innovations stated by Rogers (1962: 301). SOI applications enable many different needs to be met at the same time. According to SOI model of Adams et al. (2016), Borusan Port's SOI applications enabled the port to carry out operational optimization, organizational transformation and system construction, respectively. Thus, it can be stated that the port has reached a level where it can implement a systematic and integrated innovation management at the socio-technical level. Because the ultimate point of implementing SOI applications is system building (Adams et al. 2016: 185). In this sense, the Ped bottle recycling project is aimed at circular economy interests. The pet bottle recycling project is an SOI project that provides operational optimization. Because it is reactive, incremental and internal. LED lighting transformation project is an SOI project that provides organizational transformation along with operational optimization. It also contains an embedded context in which systematic relationships become routine. SafeCard project is an SOI application that provides system building for Borusan Port. A wide range of stakeholders have

interacted for a long time. The end goal of the project has surpassed the intended goal. In addition, facilities, products and systems that will guide the sector have been established. The SafeCard project has provided gains that will shape the port sector by fully integrating this SOI model into the port. In other words, the SafeCard SOI project has become a part of the organizational structure (Adams et al., 2016: 185). In addition, Borusan Port has experimented with a wide range of stakeholders when implementing complex SOI applications. For example, in the LED Lighting System SOI project, the Borusan Port has searched in the external environment for knowledge, skills and competencies that have not been within its own dynamic capabilities. As a result of this situation, they established a venture capital firm in America. In this way, Borusan Port strives to provide the organization with the knowledge, skills and competencies that are lacking in the organizational ecosystem. Naturally, start-up companies are included in the SOI applications carried out by the Port. In addition, the corporate identity of the port fuels the competition of these start-up companies with each other to cooperate with the port. For example, a startup that was left behind among the stakeholders in the LED lighting project in 2006 has improved itself and become an ongoing successful stakeholder of the port as of 2023 for the relevant SOI project. In summary, the port's search for external knowledge, skills and competence has been effective in the self-improvement of startups that want to be stakeholders with the port. So, the SOI assessment study in this dissertation has showed that tracking start-up companies and including them in SOI projects that will bring profit to the port had been effective in the success of the port. In summary, it has been observed in a port management case that start-up companies, with their innovative and dynamic structures, make significant contributions to organizations in the realization of sustainability-oriented innovations with a complex structure.

Theoretical contribution of the dissertation -The theoretical contribution of the dissertation study consists of three parts. The first theoretical contribution, in the maritime and port management literature, it has been determined that although there are 221 ports and piers on the Turkish coastline (DTO, 2023; Turklim, 2023a), they have not yet received enough attention in academic research. Studies in the national literature started to increase especially between 2019-2023. However, there are

repeated studies on maritime and port industry decarbonization strategies and practices on other shipping routes and various ports around the world. Particularly on the Turkish national port industry, only two studies investigating port equipment-based decarbonization strategies have been found. In this sense, this study is one of the few studies in the national literature that offers quantitative hypothetical analyzes by considering decarbonization strategies in the field of port management.

Second theoretical contribution, the stakeholder analysis suggests a different and more consistent measurement than previous studies with similar methods. For example, in their study, Poplawska et al. (2015) associated Mitchell et al. (1997)'s stakeholder model with only eight Rules. As such, it has treated stakeholder classes and salience levels as a single metric. In the stakeholder analysis in this thesis study, 3 different acceptance values have been created and a metric has been established by multiplying and normalizing them. First of these, 3 different acceptance values (weights) have been determined for each of the 8 stakeholder classes that stakeholders can be included in. This has been called group of Salience Level of Stakeholder Class. The second acceptance value has been calculated as a common salience value created with a fuzzy set of power, urgency and legitimacy values for each stakeholder. This value has been called the salience level of stakeholder class. The third Acceptance value has been expressed as stakeholder class group and three different fixed acceptance values are given for each of the 8 stakeholder classes. By multiplying these three acceptance values, the stakeholder profile salience ratio has been created. By normalizing the salience ratio, stakeholder classes have been scored with a value between 0 and 100. In this way, the stakeholder analysis conducted in the thesis study ensured that clear and differentiated stakeholder classes and salience levels have been created.

The third theoretical contribution is that any study couldn't be come across in the port management literature regarding the evaluation of SOIs. In this sense, this situation reveals the theoretical value of this thesis study. Additionally, in the study Mitchell et al. (1997) and Adams et al. (2012)'s SOI models have been evaluated qualitatively on a case study. In the literature, it has been determined that the SOI model of Adams et al. (2012) was tested in some studies. Additionally, it has been observed that SOI applications cannot attract enough attention in the field of port

management. This situation reveals another unique value of this dissertation. The SOI assessment study has theoretically shown that establishing, developing and adding value by modifying SOI applications when necessary is an extremely difficult process. In addition, another theoretical contribution is that, compared to traditional innovations, the implementation and successful maintenance of SOIs requires the combination of elements such as intense stakeholder interaction, trust between stakeholders, and mutual benefit creation. Again, the structure in which SOI capabilities should be formed in the field of port management is presented through the “organizational DNA metaphor” and supported by grounded theory and evidence from the literature. In addition, the importance of start-up companies in the formation of SOI-based Organizational DNA and the ways they interact with them have been revealed. 19 of the 23 SOI capabilities defined for Borusan Port are based on the study of Denktas-Sakar et al. (2014). However, four capabilities, namely strong informal roles in SOI, informal role acceptance, perceived organizational reputation and talented employees, have been determined as a result of this dissertation in terms of specifically for sustainability-oriented innovations.

Practical contribution of the dissertation -In addition to its theoretical contributions, the thesis also provides many practical contributions for practitioners. The first of these is that, unlike the 2-dimensional perspective that stakeholder-oriented power-interest matrices can offer in companies' corporate activity reports; Based on the fuzzy inference system designed in this study, Mitchell et al. (1997)'s stakeholder classification model can provide managers with different perspectives by determining which stakeholder is in which class, the level of power, legitimacy and urgency, and stakeholder class salience from a 3-dimensional perspective. In addition, although the algorithmic model has been built on MATLAB, it will be easily usable by managers when it is converted into a more user-friendly measurement assistant using Simulink and Excel VBA. In addition, in the study, a “what-if” oriented projection was provided for managers who are decision-makers in the field of port management in the calculation of port emission calculations, emission reduction strategies and the solar energy potential of the port.

Another practical contribution is the possible outcomes that port operators will achieve if decarbonization strategies are implemented in ports. These practical

contributions have been examined as equipping port equipment with an emission-reducing catalyst system and providing electrification in field equipment of Borusan Port. Additionally, the amount of emission reduction that would occur if ships would be supplied with shore-based electricity has been determined. As another decarbonization strategy, the possible amount of energy to be obtained and the amount of emissions to be reduced if a solar energy system would be installed in the port are presented. In this sense, this thesis study offers theoretical contributions in terms of setting an example for the results of decarbonization practices in the field of port management in Türkiye. Some of the emission reduction tactics that port operators can do are presented as a projection through a case study. In addition, the success claim of Borusan Port, which is the subject of the case study, in reducing emissions in the last four years has been proven by an academic study. In summary, nationally relevant decarbonization strategies serve as an example for other ports.

Regarding SOI assessment, the effects that will occur if economic and environmental requirements are taken with social requirements in the port management sector, which is among the heavy industry organizations, are emphasized. In addition, this thesis study has presented important findings in terms of identifying innovations, technologies, processes and products that will contribute to all stakeholders. The necessity of open innovations for sustainability-oriented innovations has been proven in the case of the port industry. In this sense, it has been seen that effective stakeholder management must be implemented in order to make sustainability-oriented innovation. It has been demonstrated that start-ups are a trigger for sustainability-oriented innovations. It has been seen in the SOI assessment that one of the important findings is that port operators who want to make sustainability-oriented innovation should create space for start-ups in stakeholder management.

Limitations of the dissertation and further research -Although the study has various limitations, some of these limitations may mean that the findings cannot be fully generalized due to the fact that the analyzes conducted in the study are case-focused. However, the analyzes are inherently suitable for a case-oriented approach. However, applying stakeholder analysis to many ports in different regions, with different capacities and serving different load types can be useful in the field of port

management by determining the status of stakeholders in different terminals and cargo types. In addition, the stakeholder analysis can be differentiated with additional inquiries such as market share capabilities specific to commercial stakeholders in the questionnaire, the frequency of the port communicating with the relevant stakeholder and establishing positive business relationships, and the existence of joint innovation activities. Regarding the emission calculation and energy requirement, the amount of energy and fuel that the port needs periodically throughout the year and the over-capacity or under-capacity situations that will occur on a monthly basis if this energy is provided with solar energy in the relevant months can be determined.

In this sense, the emission calculation of Borusan Port was made as a hypothetical study. The emission calculation in this thesis has two purposes. Firstly, it has been done to see the effects of strategies to reduce and eliminate the amount of emissions arising from the equipment in the operational processes of the port. Secondly, in order to reduce emissions from ships calling at the port, the change in emissions in the port area was tried to be determined in case of shore electricity supplying (cold ironing) to the ships. In addition, the effect of a solar energy facility that can be installed in the port on the emissions from the port and the ships in the port has been tried to be revealed. It is also a hypothetical and exploratory analysis for the carbon emission problem that will arise with the mandatory implementation of the European Union Emission Trading system.

In addition, tugboats that support docking and departure maneuvers of ships calling at the port have not been taken into account in the emission calculations. The study on the evaluation of the SOI applications of the port can gain a different meaning by including the electrical RTG conversion and RTG positioning system which was the first SOI application of Borusan Port in 2004, 3DCoil bridge crane system made in 2021 and double-deck tower loading project made in 2022. Additionally, other port facilities that implement SOI practices can be included in the evaluation to make them comparable.

As suggestions for future work, financial analysis of emission reduction strategies in the field of port management can be made in terms of return on investment. Again, financial analysis can be made based on optimum financing options and ROI for the solar energy system. In terms of stakeholder analysis, an

analysis to evaluate the port of the stakeholders included in the findings of the port subject to analysis may provide different inferences. Additionally, ports' requirements for carbon capture and storage, if the legislation is in compliance, can be analyzed in terms of business management, regulations and financial resources. Again, the topographic distribution area of the emission can be analyzed to determine the effects of the emission originating from the port area in terms of port-city interaction. In this way, effective results will emerge in terms of determining settlements in the development of the city. This subject can be carried out as a study covering different disciplines in terms of environmental and urban studies. Due to the pressure of the criteria set by the relevant commissions of the European Union for green agreements, decarbonization studies in the field of port management will continue to attract attention in the coming years in terms of determining regulations for both implementation and coercive and incentive mechanisms. However, the global nature of maritime trade will ensure that stakeholder management remains important. Circular economy formations in the world will direct businesses to develop sustainability-oriented innovations rather than traditional innovation practices.

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APPENDICES

Appendix 1: Port Stakeholder Identification and Salience Survey (1/10)

Değerli Katılımcı,

Sürdürülebilirlik ve inovasyon gibi birbiriyle bağlantılı iki önemli konunun liman işletmeciliği alanında uygulanmasını inceleyen ve Prof. Dr. Ömür Yaşar Saatçioğlu danışmanlığında Araş. Gör. Burhan Kayıran tarafından hazırlanan bir doktora çalışması için Borusan Limanı özelinde birbiriyle ilişkili bir dizi analiz yapılacaktır. Bu kapsamda, Borusan Limanı'nın değerli bir paydaşı olarak görüşlerinize ihtiyaç duyulmaktadır. Bu çalışma, Borusan limanının sürdürülebilirlik ve inovasyon faaliyetlerinde paydaşların rolünün belirlenmesi ve paydaş ilişkilerinin geliştirilmesi açısından önemli veriler içermektedir. Bu nedenle, ekte yer alan anketi tecrübelerinize dayanarak doldurmanız çalışmanın başarısı açısından önemlidir. Gereğini saygılarımla rica ederim.

Borusan Limanı Yönetimi,

Katılımcının

Çalıştığı İşletmedeki Departmanı:

Çalıştığı İşletmedeki Ünvanı/Görevi:

Liman ve Terminal İşletmeciliği (Ulaştırma, Lojistik Yönetimi) alanındaki iş tecrübesi (yıl):

Sorumlu Araştırmacı:

Doktora Tez Danışmanı:

Araş. Gör. Burhan KAYIRAN - Prof. Dr. Ömür Yaşar SAATÇIOĞLU

DOKUZ EYLÜL ÜNİVERSİTESİ Denizcilik Fakültesi, Buca, İZMİR

İletişim e-posta:

Çalışmanın Amacı: Bu örnek olay çalışmasında *Borusan Limanı*'nın paydaş analizi yapılacaktır.

SORU FORMU İÇİN BAZI TANIMLAR

- **Sürdürülebilirlik Odaklı İnovasyon:** Sürdürülebilirliği temel alan inovasyonlardır. Sürdürülebilirlik faaliyetlerinin inovasyon çözümleriyle gerçekleştirilmesidir.
- **Paydaşın Gücü (Power):** Bir paydaşın yasalardan, politika ve gerekliliklerden kaynaklanan gücünü ve/veya sahip olduğu teknik becerilerden kaynaklanan uzmanlık gücünü ifade eder. Bir paydaşın limana ya da diğer paydaşlara iş yaptırma ve diğer paydaşları etkileme gücüdür. (örneğin: Zorlayarak, fayda sağlayarak ya da ödüllendirerek, cezalandırarak).
- **Paydaşın Aciliyeti (Urgency):** Bir paydaşın aciliyeti, o paydaşın taleplerinin ne ölçüde kritik veya zamana duyarlı olduğunu ve o paydaşa ne kadar öncelik verilmesi gerektiği durumunu ifade eder. **Örneğin:** Limanın bir paydaşının taleplerinin kısa sürede ele alınmasını gerektiren bir durum varsa bu paydaş aciliyeti olan bir paydaş olarak ifade edilir. Aciliyet taşıyan bir paydaşın taleplerine öncelik verilmezse bu paydaş ve Borusan Limanı ya da limanın başka bir paydaşı ciddi bir sıkıntı yaşar.
- **Paydaşın Meşruiyeti/Haklılığı (Legitimacy):** Bir paydaşın meşru olması o paydaşın faaliyetlerinin, diğer paydaşlar ve toplum nezdinde, arzu edilir olmasını ve uygun görülmesi durumunu ifade eder. Bir diğer ifadeyle, bir paydaşın eylemlerinin, diğer paydaşlar nezdinde arzu edilir, uygun veya uygun olduğuna dair genelleştirilmiş bir algı ve hakkaniyet gösterme durumudur.

Borusan Limanı düşünüldüğünde, aşağıdaki soru formunda sıralanan liman paydaşlarının Borusan Limanı üzerindeki “Güç”, “Aciliyet” ve “Meşruiyet (Haklılık)” niteliklerini limanın her bir paydaşını dikkate alarak bu üç niteliği “Yok”, “Düşük düzeyde”, “Orta düzeyde”, ya da “Yüksek düzeyde” olarak işaretleyiniz.

Appendix 1: Port Stakeholder Identification and Saliency Survey (2/10)

!!! Not: Lütfen önce aşağıdaki doldurulmuş form örneğini inceleyiniz ve ardından soru formuna geçiniz.

!!! Not: Formu doldurduktan sonra lütfen “*değişiklikleri kaydet*” diyerek tekrar gönderiniz.

Örnek Form Doldurulması ve ifade ettiği anlam:											
		Yok	Düşük	Orta			Yok	Düşük	Orta		
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Çalışanların...	Gücü		●		Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Çalışanların...	Gücü		●			
	Aciliyeti			●		Aciliyeti			●		
	Meşruiyeti			●		Meşruiyeti			●		
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde... Çalışanların Gücü Düşük düzeydedir. → Anlamı: Limanın operasyonel ve ticari faaliyetlerinde çalışanların yasalardan, politika ve gerekliliklerden kaynaklanan gücü veya sahip olduğu teknik becerilerden kaynaklanan uzmanlık gücü ile liman işletmesine ya da diğer paydaşlara iş yaptırma ve diğer paydaşları etkileme gücü düşük düzeydedir. Çalışanların Aciliyeti Orta düzeydedir. → Anlamı: Limanın operasyonel ve ticari faaliyetlerinin yürütülmesinde çalışanların taleplerinin kritikliği veya zamana duyarlılığı ve onlara öncelik verilmesi gerekliliği orta düzeydedir. Çalışanların Meşruiyeti Orta düzeydedir. → Anlamı: Limanın operasyonel ve ticari faaliyetlerinin yürütülmesinde çalışanların, Borusan Limanı ve diğer paydaşlar açısından görev ve sorumluluklarının arzu edilir olması ve uygun görülmesi durumu orta düzeydedir.					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde... Çalışanların Gücü Orta düzeydedir. → Anlamı: Limanın sürdürülebilirlik ve inovasyon faaliyetlerinde çalışanların yasalardan, politika ve gerekliliklerden kaynaklanan gücü veya sahip olduğu teknik becerilerden kaynaklanan uzmanlık gücü ile Borusan liman işletmesine ya da diğer paydaşlara iş yaptırma gücü ve diğer paydaşları etkileme gücü orta düzeydedir. Çalışanların Aciliyeti Orta düzeydedir. → Anlamı: Limanın sürdürülebilirlik ve inovasyon faaliyetlerinin yürütülmesinde çalışanların taleplerinin kritikliği veya zamana duyarlılığı ve onlara öncelik verilmesi gerekliliği orta düzeydedir. Çalışanların Meşruiyeti Yüksek düzeydedir. → Anlamı: Çalışanların limanın sürdürülebilirlik ve inovasyon faaliyetlerinin yürütülmesinde çalışanların, Borusan Limanı ve diğer paydaşlar açısından görev ve sorumluluklarının, arzu edilir olması ve uygun görülmesi durumu yüksek düzeydedir.						
BORUSAN LİMANI'NIN PAYDAŞ ANALİZİ SORU FORMU											
0=Yok; 1=Düşük düzeyde; 2=Orta düzeyde; 3=Yüksek düzeyde											
LİMAN PAYDAŞLARI	Paydaş Nitelikleri	Limanın Genel Faaliyetleri Düşünüldüğünde...				LİMAN PAYDAŞLARI	Paydaş Nitelikleri	Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde...			
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Çalışanların...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Çalışanların...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Yöneticilerin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Yöneticilerin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Yönetim Kurulu Üyelerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Yönetim Kurulu Üyelerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Salience Survey (3/10)

		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Hissedarların...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Hissedarların...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Bölgedeki Diğer Limanların...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Bölgedeki Diğer Limanların...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Deniz Aşırı Alandaki Ana Liman İşletmecilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Deniz Aşırı Alandaki Ana Liman İşletmecilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Deniz Aşırı Alandaki Aktarma Limanı İşletmecilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Deniz Aşırı Alandaki Aktarma Limanı İşletmecilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Bankalar ve Diğer Finansal Kuruluşlarının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Bankalar ve Diğer Finansal Kuruluşlarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Deniz Sigorta Şirketlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Deniz Sigorta Şirketlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Klas ve Sörvey Kuruluşları ya da Temsilcilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Klas ve Sörvey Kuruluşları ya da Temsilcilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Liman içi ya da dışı Atık Kabul Tesis İşletmelerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Liman içi ya da dışı Atık Kabul Tesis İşletmelerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Salience Survey (4/10)

Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Forwarder'ların...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Forwarder'ların...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Gemi Acentelerinin...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Gemi Acentelerinin...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Gemi/Yük Brokerlerinin...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Gemi/Yük Brokerlerinin...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Diğer 3. ve 4. Taraf Lojistik Hizmet Sağlayıcılarının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Diğer 3. ve 4. Taraf Lojistik Hizmet Sağlayıcılarının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Karayolu Taşımacılığı Firmalarının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Karayolu Taşımacılığı Firmalarının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Limandaki Endüstriyel Kuruluşlarının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Limandaki Endüstriyel Kuruluşlarının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Liman Tedarikçilerinin... (Liman operasyonlarına ekip, ekipman veya malzeme zirdisi sağlayan iş ortakları)	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Liman Tedarikçilerinin... (Liman operasyonlarına ekip, ekipman veya malzeme zirdisi sağlayan iş ortakları)	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Stevedore İşletmelerinin... (Gemi Yükleme ve Boşaltma İşletmeleri)	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Stevedore İşletmelerinin... (Gemi Yükleme ve Boşaltma İşletmeleri)	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				

Appendix 1: Port Stakeholder Identification and Salience Survey (5/10)

Gemi Kumanya ve İkmal İşletmelerinin...	Meşruiyeti					Gemi Kumanya ve İkmal İşletmelerinin...	Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Liman Hinterland'ı (Kara alanındaki) Endüstri Kuruluşlarının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Liman Hinterland'ı (Kara alanındaki) Endüstri Kuruluşlarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Liman Foreland'ı (Deniz aşırı alandaki) Endüstri Kuruluşlarının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Liman Foreland'ı (Deniz aşırı alandaki) Endüstri Kuruluşlarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Konteyner Düzenli Hat Operatörlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Konteyner Düzenli Hat Operatörlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Ro-Ro Düzenli Hat Operatörlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Ro-Ro Düzenli Hat Operatörlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Dökme Yük Gemi Operatörlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Dökme Yük Gemi Operatörlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Rüzgar Türbini Yük Sahipleri veya Temsilcilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Rüzgar Türbini Yük Sahipleri veya Temsilcilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Rüzgar Türbini Üreticilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Rüzgar Türbini Üreticilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Diğer Proje Yük Sahipleri veya Temsilcilerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Diğer Proje Yük Sahipleri veya Temsilcilerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek

Appendix 1: Port Stakeholder Identification and Salience Survey (6/10)

Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde İthalatçıların...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde İthalatçıların...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde İhracatçıların...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde İhracatçıların...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Pilotaj ve Römorkaj İşletmelerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Pilotaj ve Römorkaj İşletmelerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Gemi ve Konteyner Tamir-Bakım İşletmelerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Gemi ve Konteyner Tamir-Bakım İşletmelerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Ulaştırma ve Altyapı Bakanlığının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Ulaştırma ve Altyapı Bakanlığının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Çalışma ve Sosyal Güvenlik Bakanlığının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Çalışma ve Sosyal Güvenlik Bakanlığının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Hazine ve Maliye Bakanlığının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Hazine ve Maliye Bakanlığının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Çevre, Şehircilik ve İklim Değişikliği Bakanlığının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Çevre, Şehircilik ve İklim Değişikliği Bakanlığının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Ticaret Bakanlığının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Ticaret Bakanlığının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Salience Survey (7/10)

Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Sanayi ve Teknoloji Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Sanayi ve Teknoloji Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Enerji ve Tabii Kaynaklar Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Enerji ve Tabii Kaynaklar Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Sağlık Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Sağlık Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Dışişleri Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Dışişleri Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde İçişleri Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde İçişleri Bakanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Sahil Güvenlik Komutanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Sahil Güvenlik Komutanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Karayolları Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Karayolları Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Devlet Su İşleri Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Devlet Su İşleri Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Kıyı Emniyeti Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Kıyı Emniyeti Genel Müdürlüğünün...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Saliency Survey (8/10)

Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Gümrükler Genel Müdürlüğü'nün...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Gümrükler Genel Müdürlüğü'nün...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Gümrükler Muhafaza Genel Müdürlüğü'nün...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Gümrükler Muhafaza Genel Müdürlüğü'nün...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Limn Baskanlığının...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Limn Baskanlığının...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Üniversitelerin...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Üniversitelerin...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Enstitüler ve Araştırma Merkezlerinin...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Enstitüler ve Araştırma Merkezlerinin...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Türkiye Bilimsel ve Teknolojik Araştırma Kurumunun... (TÜBİTAK)	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Türkiye Bilimsel ve Teknolojik Araştırma Kurumunun... (TÜBİTAK)	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Avrupa Birliği Proje Ofislerinin...	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Avrupa Birliği Proje Ofislerinin...	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Altyapı – Üstyapı Proje Yönetim Kuruluşlarının... (ARUP firması vb. gibi)	Gücü	Yok	Düşük	Orta	Yüksek	Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Altyapı – Üstyapı Proje Yönetim Kuruluşlarının... (ARUP firması vb. gibi)	Gücü	Yok	Düşük	Orta	Yüksek
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Saliense Survey (9/10)

		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Ticaret Odalarının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Ticaret Odalarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Türk Sanayicileri ve İş İnsanları Derneğinin... (TÜSİAD)	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Türk Sanayicileri ve İş İnsanları Derneğinin... (TÜSİAD)	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Yerel, Bölgesel ve Küresel Çevre Örgütlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Yerel, Bölgesel ve Küresel Çevre Örgütlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Uluslararası Denizcilik Örgütünün (IMO)...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Uluslararası Denizcilik Örgütünün (IMO)...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Türkiye Liman İşletmecileri Derneğinin... (TÜRLİM)	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Türkiye Liman İşletmecileri Derneğinin... (TÜRLİM)	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Diğer Sivil Toplum Örgütlerinin...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Diğer Sivil Toplum Örgütlerinin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığının... (KOSGEB)	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığının... (KOSGEB)	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığınız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Basın Yayın Kuruluşlarının...	Gücü					Çalıştığınız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Basın Yayın Kuruluşlarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

Appendix 1: Port Stakeholder Identification and Saliense Survey (10/10)

		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Merkezi Yönetimin...	Gücü					Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Merkezi Yönetimin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Yerel Yönetimlerin...	Gücü					Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Yerel Yönetimlerin...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde İşçi Sendikalarının...	Gücü					Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde İşçi Sendikalarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Yerel Sakin (Kent) Topluluklarının...	Gücü					Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Yerel Sakin (Kent) Topluluklarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				
		Yok	Düşük	Orta	Yüksek			Yok	Düşük	Orta	Yüksek
Çalıştığımız Limanın Operasyonel ve Ticari Faaliyetleri Düşünüldüğünde Amatör/Ticari Balıkçı gemileri, Balıkçı Barınaklarının...	Gücü					Çalıştığımız Limanın Sürdürülebilirlik ve İnovasyon Faaliyetleri Düşünüldüğünde Amatör/Ticari Balıkçı gemileri, Balıkçı Barınaklarının...	Gücü				
	Aciliyeti						Aciliyeti				
	Meşruiyeti						Meşruiyeti				

*Paydaş analizi soru formu bitmiştir.
Sabrınız ve Değerli Katkılarınız için çok teşekkür ederiz.*

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Appendix 2: Profile of the Stakeholders in terms of Operational and Trade Activities of Borusan Port (1/2)

Possible Stakeholder List	Power - Urgency - Legitimacy	Salience Level of Stakeholder Class	Stakeholder Class (Salience Profile)	Group of Salience Level of Stakeholder Class * (for Weight1)	Stakeholder Class Group ** (for Weight2)	*Weight1	**Weight2	Stakeholder Profile Salience Ratio	100 equivalent Normalized Stakeholder Profile Salience Ratio
Management	(2,694 - 2,639 - 2,583)	2,54	Definitive	Very High	High	5	3	38,1	100
Board Members	(3 - 2,278 - 2,694)	2,54	Definitive	Very High	High	5	3	38,1	100
Container Line Operators	(2,639 - 2,694 - 2,583)	2,54	Definitive	Very High	High	5	3	38,1	100
Wind Turbine Manufacturers	(2,639 - 2,472 - 2,417)	2,54	Definitive	Very High	High	5	3	38,1	100
Other Project Cargo Owners or Representatives	(2,417 - 2,361 - 2,361)	2,54	Definitive	Very High	High	5	3	38,1	100
Importers	(2,361 - 2,417 - 2,417)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Treasury and Finance	(2,583 - 2,528 - 2,472)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Environment, Urbanization and Climate Change	(2,694 - 2,528 - 2,639)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Trade	(2,528 - 2,417 - 2,417)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Industry and Technology	(2,472 - 2,417 - 2,361)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Health	(2,111 - 2,111 - 2,056)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Interior	(2,583 - 2,222 - 2,111)	2,54	Definitive	Very High	High	5	3	38,1	100
International Maritime Organization (IMO)	(2,167 - 2,222 - 2,111)	2,54	Definitive	Very High	High	5	3	38,1	100
The Ministry of Foreign Affairs	(2,056 - 2,056 - 2,056)	2,45	Definitive	High	High	4	3	29,4	77,17
Classification and Survey Societies or Representatives	(2,111 - 2 - 2)	2,42	Definitive	High	High	4	3	29,04	76,22
Port Suppliers	(2 - 2,167 - 2,111)	2,42	Definitive	High	High	4	3	29,04	76,22
Inner or Outside Port Waste Acceptance Facilities	(2 - 2,056 - 2,167)	2,38	Definitive	High	High	4	3	28,56	74,96
Industrial Establishments in the Port Foreland (Overseas)	(2,056 - 2 - 1,889)	2,37	Definitive	High	High	4	3	28,44	74,65
Major Port Operators Overseas	(2,111 - 1,944 - 1,944)	2,36	Definitive	High	High	4	3	28,32	74,33
Wind Turbine Cargo Owners or Representatives	(2,111 - 1,944 - 2,056)	2,36	Definitive	High	High	4	3	28,32	74,33
Forwarders	(2 - 2 - 1,944)	2,33	Definitive	High	High	4	3	27,96	73,39
Other 3rd and 4th Party Logistics Service Providers	(1,944 - 2,056 - 2,056)	2,32	Definitive	High	High	4	3	27,84	73,07
Road Transport Companies	(1,889 - 2 - 2,111)	2,22	Definitive	High	High	4	3	26,64	69,92
Ship Agents	(1,833 - 1,944 - 1,889)	2,13	Definitive	High	High	4	3	25,56	67,09
Shareholders	(2,694 - 2,278 - 2,639)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
Other Ports in the Region	(2,472 - 2,222 - 2,361)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
Maritime Insurance Companies	(2,167 - 2,278 - 2,056)	2,54	Dangerous	Very High	Moderate	5	2	25,4	66,67
Industrial Establishments in the Port Hinterland (Land area)	(2,528 - 2,222 - 2,417)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
Ro-Ro Line Operators	(2,222 - 2,167 - 2,417)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
Exporters	(2,528 - 2,222 - 2,528)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
The Ministry of Transport and Infrastructure	(2,528 - 2,111 - 2,417)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
the Ministry of Labor and Social Security	(2,583 - 2,111 - 2,167)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
The Ministry of Energy and Natural Resources	(2,167 - 2,111 - 2,417)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
The Directorate General of Coastal Safety	(2,472 - 2,167 - 2,417)	2,54	Dominant	Very High	Moderate	5	2	25,4	66,67
General Directorate of Customs	(2,583 - 2,278 - 2,222)	2,54	Dangerous	Very High	Moderate	5	2	25,4	66,67

Appendix 2: Profile of the Stakeholders in terms of Operational and Trade Activities of Borusan Port (2/2)

Possible Stakeholder List	Power - Urgency - Legitimacy	Saliency Level of Stakeholder Class	Stakeholder Class (Saliency Profile)	Group of Saliency Level of Stakeholder Class *(for Weight1)	Stakeholder Class Group ** (for Weight2)	*Weight1	**Weight2	Stakeholder Profile Saliency Ratio	100 equivalent Normalized Stakeholder Profile Saliency Ratio
General Directorate of Customs Enforcement	(2,583 - 2,278 - 2,222)	2,34	Dangerous	Very High	Moderate	5	2	25,4	66,67
Pilotage and Towage Enterprises	(1,833 - 1,889 - 1,944)	2,09	Definitive	High	High	4	3	25,08	63,83
Employees	(2,528 - 2,056 - 2,111)	2,49	Dominant	High	Moderate	4	2	19,92	52,28
Banks and Other Financial Institutions	(2,361 - 2,056 - 1,944)	2,48	Dangerous	High	Moderate	4	2	19,84	52,07
Port Authority	(2,694 - 1,917 - 2,583)	2,33	Dominant	High	Moderate	4	2	18,64	48,92
Ship/Cargo Brokers	(1,889 - 2,056 - 2,056)	2,27	Dependent	High	Moderate	4	2	18,16	47,66
Turkish Coast Guard Command	(2,583 - 1,806 - 2,222)	2,23	Dominant	High	Moderate	4	2	17,84	46,82
Central Government	(2,167 - 1,694 - 2,694)	2,13	Dominant	High	Moderate	4	2	17,04	44,72
Local Governments	(2,167 - 1,694 - 2,639)	2,13	Dominant	High	Moderate	4	2	17,04	44,72
Overseas Transshipment Port Operators	(1,75 - 1,694 - 1,694)	1,86	Definitive	Moderate	High	3	3	16,74	43,94
Port Operators Association of Türkiye (TÜRKİLİM)	(1,722 - 2 - 2,167)	2,08	Dependent	High	Moderate	4	2	16,64	43,67
Infrastructure - Superstructure Project Management Organizations (such as ARUP company, etc.)	(1,889 - 1,889 - 1,583)	1,99	Dangerous	Moderate	Moderate	3	2	11,94	31,34
Local, Regional and Global Environmental Organizations	(1,889 - 1,833 - 1,583)	1,95	Dangerous	Moderate	Moderate	3	2	11,7	30,71
Turkish Industry & Business Association	(1,583 - 1,889 - 1,889)	1,91	Dependent	Moderate	Moderate	3	2	11,46	30,08
The General Directorate of Highways	(1,944 - 1,778 - 1,528)	1,88	Dangerous	Moderate	Moderate	3	2	11,28	29,61
Stevedore Enterprises	(1,472 - 1,694 - 1,639)	1,72	Dependent	Moderate	Moderate	3	2	10,32	27,09
General Directorate of State Hydraulic Works	(1,472 - 1,639 - 1,528)	1,63	Dependent	Moderate	Moderate	3	2	9,78	25,67
General Cargo / Bulk Cargo Ship Operators	(2,361 - 2 - 2)	2,42	Dormant	High	Low	4	1	9,68	25,41
Ship and Container Repair and Maintenance Enterprises	(1,583 - 1,528 - 1,472)	1,56	Definitive	Low	High	1	3	4,68	12,28
Ship Chandlers and Supply Enterprises	(0,583 - 1,472 - 1,528)	1,16	Dependent	Very Low	None	1	0	0	0
Universities	(1,472 - 1,722 - 1,417)	1,49	Demanding	Very Low	None	1	0	0	0
Institutes and Research Centers	(1,417 - 1,722 - 1,417)	1,49	Demanding	Very Low	None	1	0	0	0
Scientific and Technological Research Council of Türkiye	(1,417 - 1,528 - 1,417)	1,49	Definitive	Very Low	None	1	0	0	0
European Union Project Offices	(1,111 - 1,417 - 1,056)	1,01	Non-stakeholder	None	None	0	0	0	0
Chambers of Commerce	(1,222 - 1,583 - 1,222)	1,16	Demanding	Very Low	None	1	0	0	0
Other Non-Governmental Organizations	(1,417 - 1,111 - 1,417)	1,48	Non-stakeholder	None	None	0	0	0	0
Small and Medium Enterprises Development Organization of Türkiye (KOSGEB)	(1,361 - 1,417 - 1,361)	1,37	Non-stakeholder	None	None	0	0	0	0
Press Organizations	(1,472 - 1,528 - 1,167)	1,25	Dangerous	Very Low	None	1	0	0	0
Trade Unions	(1,25 - 1,472 - 1,194)	1,1	Non-stakeholder	None	None	0	0	0	0
Local Resident (Urban) Communities	(1,722 - 1,583 - 1,222)	1,34	Dangerous	Very Low	None	1	0	0	0
Amateur/Commercial Fishing Vessels, Fishing Shelters	(1,056 - 1,361 - 1,056)	0,916	Non-stakeholder	None	None	0	0	0	0

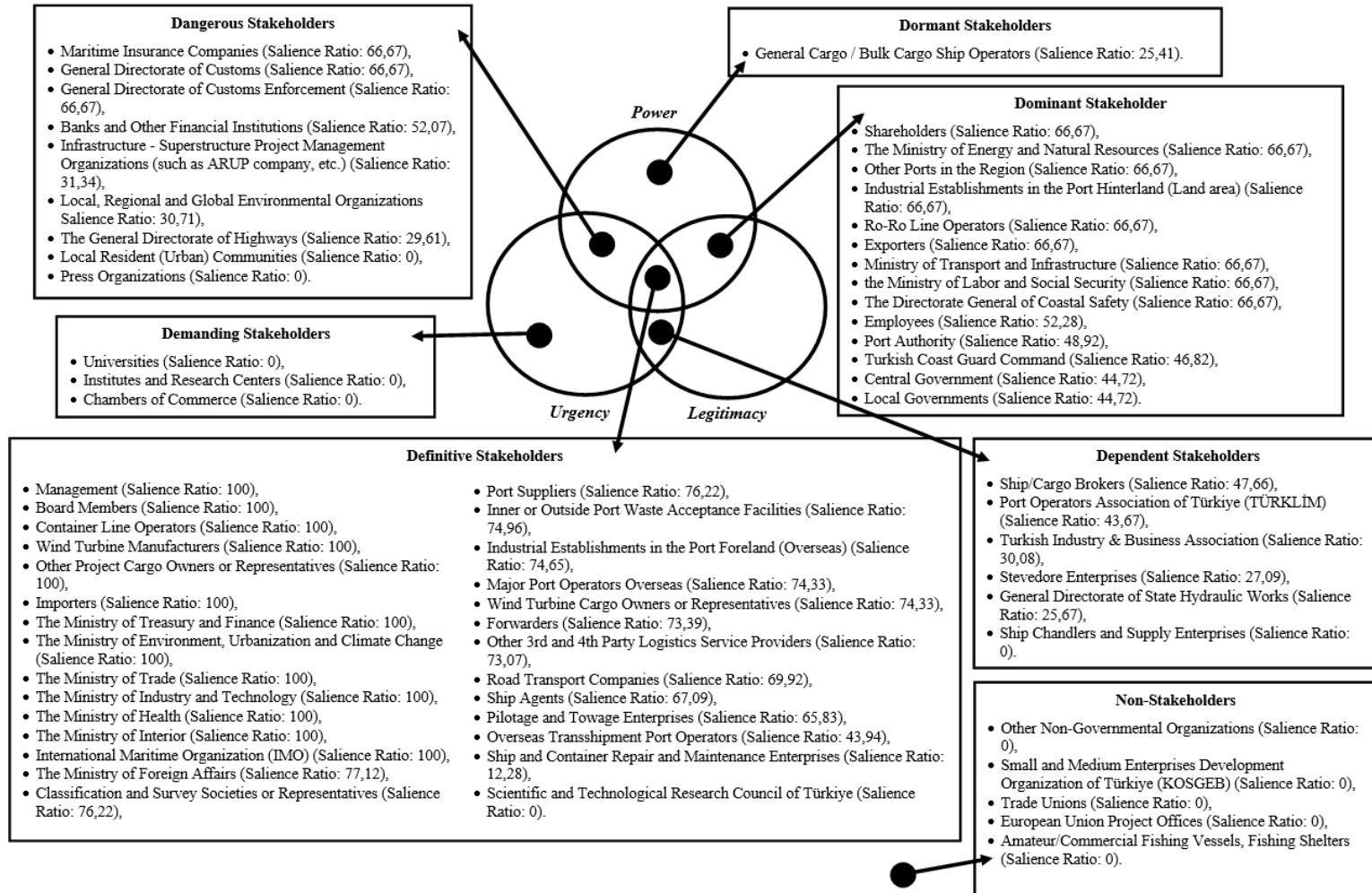
Appendix 3: Profile of the Stakeholders in terms of Sustainability and Innovation Activities of Borusan Port (1/2)

Possible Stakeholder List	Power - Urgency - Legitimacy	Saliency Level of Stakeholder Class	Stakeholder Class (Saliency Profile)	Group of Saliency Level of Stakeholder Class *(for Weight1)	Stakeholder Class Group ***(for Weight2)	*Weight1	**Weight2	Stakeholder Profile Saliency Ratio	100 equivalent Normalized Stakeholder Profile Saliency Ratio
Management	(2,639 - 2,472 - 2,472)	2,54	Definitive	Very High	High	5	3	38,1	100
Board Members	(2,694 - 2,472 - 2,528)	2,54	Definitive	Very High	High	5	3	38,1	100
Banks and Other Financial Institutions	(2,222 - 2,111 - 2,222)	2,54	Definitive	Very High	High	5	3	38,1	100
Ro-Ro Line Operators	(2,111 - 2,417 - 2,417)	2,54	Definitive	Very High	High	5	3	38,1	100
Wind Turbine Manufacturers	(2,417 - 2,417 - 2,417)	2,54	Definitive	Very High	High	5	3	38,1	100
International Maritime Organization (IMO)	(2 - 2,111 - 2,167)	2,46	Definitive	High	High	4	3	29,52	77,48
Importers	(1,944 - 1,833 - 1,944)	2,17	Definitive	High	High	4	3	26,04	68,35
The Ministry of Environment, Urbanization And Climate Change	(1,917 - 1,806 - 1,861)	2,13	Definitive	High	High	4	3	25,56	67,09
Container Line Operators	(2,111 - 2,056 - 2,417)	2,51	Dominant	Very High	Moderate	5	2	25,1	63,88
Employees	(2,167 - 2 - 2,528)	2,46	Dominant	High	Moderate	4	2	19,68	51,65
Shareholders	(2,028 - 1,861 - 1,917)	2,28	Dominant	High	Moderate	4	2	18,24	47,87
Wind Turbine Cargo Owners or Representatives	(2 - 1,889 - 2,056)	2,27	Dominant	High	Moderate	4	2	18,16	47,66
Major Port Operators Overseas	(1,944 - 1,889 - 2,056)	2,21	Dominant	High	Moderate	4	2	17,68	46,40
Maritime Insurance Companies	(1,75 - 1,75 - 1,75)	1,93	Definitive	Moderate	High	3	3	17,37	45,59
The Ministry of Transport and Infrastructure	(2,472 - 1,639 - 2,694)	2,16	Dominant	High	Moderate	4	2	17,28	45,35
Industrial Establishments in the Port Hinterland (Land area)	(2,056 - 1,639 - 2)	2,13	Dominant	High	Moderate	4	2	17,04	44,72
The Ministry of Trade	(1,75 - 1,694 - 1,694)	1,88	Definitive	Moderate	High	3	3	16,92	44,41
The Ministry of Industry And Technology	(1,75 - 1,694 - 1,694)	1,88	Definitive	Moderate	High	3	3	16,92	44,41
The Ministry of Energy And Natural Resources	(1,75 - 1,694 - 1,694)	1,88	Definitive	Moderate	High	3	3	16,92	44,41
Other Project Cargo Owners or Representatives	(1,944 - 1,639 - 1,889)	2,03	Dominant	High	Moderate	4	2	16,24	42,62
General Directorate of Customs	(1,694 - 1,528 - 1,583)	1,73	Definitive	Moderate	High	3	3	15,57	40,87
General Directorate of Customs enforcement	(1,694 - 1,528 - 1,583)	1,73	Definitive	Moderate	High	3	3	15,57	40,87
Scientific and Technological Research Council of Türkiye	(1,528 - 1,694 - 1,583)	1,73	Definitive	Moderate	High	3	3	15,57	40,87
General Cargo / Bulk Cargo Ship Operators	(1,889 - 1,528 - 1,583)	1,87	Dominant	Moderate	Moderate	3	2	11,22	29,45
Central Government	(1,778 - 1,583 - 2,306)	1,87	Dominant	Moderate	Moderate	3	2	11,22	29,45
Local Governments	(1,778 - 1,583 - 2,306)	1,87	Dominant	Moderate	Moderate	3	2	11,22	29,45
Other Ports in the Region	(1,944 - 1,639 - 1,528)	1,86	Dangerous	Moderate	Moderate	3	2	11,16	29,29
Port Authority	(1,806 - 1,583 - 1,639)	1,86	Dominant	Moderate	Moderate	3	2	11,16	29,29
Classification and Survey Societies or Representatives	(1,694 - 1,583 - 1,694)	1,81	Dominant	Moderate	Moderate	3	2	10,86	28,50
Overseas Transshipment Port Operators	(1,639 - 1,583 - 1,694)	1,77	Dominant	Moderate	Moderate	3	2	10,62	27,87
Other 3rd and 4th Party Logistics Service Providers	(1,889 - 1,778 - 1,472)	1,73	Dangerous	Moderate	Moderate	3	2	10,38	27,24
The Ministry of Treasury And Finance	(1,694 - 1,417 - 1,639)	1,71	Dominant	Moderate	Moderate	3	2	10,26	26,93
Forwarders	(1,583 - 1,528 - 1,639)	1,7	Definitive	Low	High	2	3	10,2	26,77
Inner or Outside Port Waste Acceptance Facilities	(1,639 - 1,528 - 1,583)	1,69	Definitive	Low	High	2	3	10,14	26,61

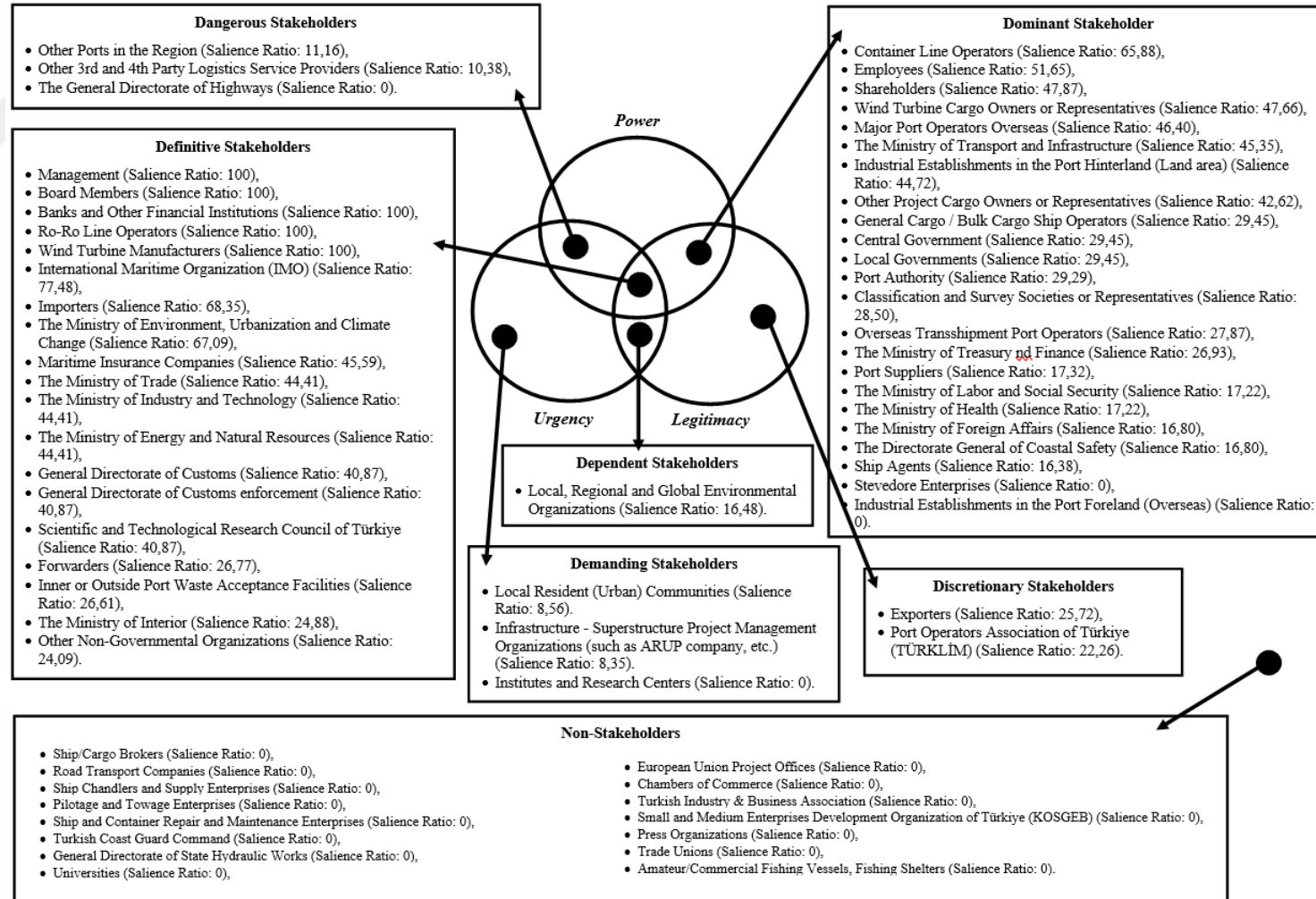
Appendix3: Profile of the Stakeholders in terms of Sustainability and Innovation Activities of Borusan Port (2/2)

Possible Stakeholder List	Power - Urgency - Legitimacy	Salience Level of Stakeholder Class	Stakeholder Class (Salience Profile)	Group of Salience Level of Stakeholder Class *(for Weight1)	Stakeholder Class Group ** (for Weight2)	*Weight1	**Weight2	Stakeholder Profile Salience Ratio	100 equivalent Normalized Stakeholder Profile Salience Ratio
<i>Exporters</i>	(2,056 - 2,056 - 2)	2,45	Discretionary	High	Low	4	1	9,8	25,72
<i>The Ministry of Interior</i>	(1,528 - 1,528 - 1,528)	1,58	Definitive	Low	High	2	3	9,48	24,88
<i>Other Non-Governmental Organizations</i>	(1,417 - 1,528 - 1,472)	1,53	Definitive	Low	High	2	3	9,18	24,09
<i>Port Operators Association of Türkiye (TÜRKLİM)</i>	(1,861 - 1,861 - 2,222)	2,12	Discretionary	High	Low	4	1	8,48	22,26
<i>Port Suppliers</i>	(1,694 - 1,278 - 1,528)	1,65	Dominant	Low	Moderate	2	2	6,6	17,32
<i>The Ministry of Labor and Social Security</i>	(1,639 - 1,472 - 1,528)	1,64	Dominant	Low	Moderate	2	2	6,56	17,22
<i>The Ministry of Health</i>	(1,639 - 1,472 - 1,528)	1,64	Dominant	Low	Moderate	2	2	6,56	17,22
<i>The Ministry of Foreign Affairs</i>	(1,583 - 1,417 - 1,528)	1,6	Dominant	Low	Moderate	2	2	6,4	16,80
<i>The Directorate General of Coastal Safety</i>	(1,583 - 1,361 - 1,528)	1,6	Dominant	Low	Moderate	2	2	6,4	16,80
<i>Local, Regional and Global Environmental Organizations</i>	(1,417 - 1,528 - 1,528)	1,57	Dependent	Low	Moderate	2	2	6,28	16,48
<i>Ship Agents</i>	(1,583 - 1,417 - 1,472)	1,56	Dominant	Low	Moderate	2	2	6,24	16,38
<i>Local Resident (Urban) Communities</i>	(1,472 - 1,694 - 1,472)	1,63	Demanding	Low	Low	2	1	3,26	8,56
<i>Infrastructure - Superstructure Project Management Organizations (such as ARUP company, etc.)</i>	(1,472 - 1,639 - 1,472)	1,59	Demanding	Low	Low	2	1	3,18	8,35
<i>Ship/Cargo Brokers</i>	(1,417 - 1,472 - 1,417)	1,49	Non-stakeholder	None	None	0	0	0	0
<i>Road Transport Companies</i>	(1,472 - 1,472 - 1,111)	1,22	Non-stakeholder	None	None	0	0	0	0
<i>Stevedore Enterprises</i>	(1,528 - 1,111 - 1,472)	1,46	Dominant	Very Low	None	1	0	0	0
<i>Ship Chandlers and Supply Enterprises</i>	(1,361 - 0,944 - 1,056)	0,84	Non-stakeholder	None	None	0	0	0	0
<i>Industrial Establishments in the Port Foreland (Overseas)</i>	(1,583 - 1,167 - 1,278)	1,15	Dominant	Very Low	None	1	0	0	0
<i>Pilotage and Towage Enterprises</i>	(1 - 1,056 - 1)	1	Non-stakeholder	None	None	0	0	0	0
<i>Ship and Container Repair and Maintenance Enterprises</i>	(1,361 - 1,417 - 1,417)	1,49	Non-stakeholder	None	None	0	0	0	0
<i>Turkish Coast Guard Command</i>	(1,361 - 1,306 - 1,361)	1,35	Non-stakeholder	None	None	0	0	0	0
<i>The General Directorate of Highways</i>	(1,528 - 1,417 - 1,111)	1,12	Dangerous	Very Low	None	1	0	0	0
<i>General Directorate of State Hydraulic Works</i>	(1,417 - 1,417 - 1,472)	1,5	Non-stakeholder	None	None	0	0	0	0
<i>Universities</i>	(1,222 - 1,472 - 1,278)	1,18	Non-stakeholder	None	None	0	0	0	0
<i>Institutes and Research Centers</i>	(1,222 - 1,583 - 1,278)	1,18	Demanding	Very Low	None	1	0	0	0
<i>European Union Project Offices</i>	(1,167 - 1,417 - 1,167)	1,05	Non-stakeholder	None	None	0	0	0	0
<i>Chambers of Commerce</i>	(1,167 - 1,472 - 1,167)	1,03	Non-stakeholder	None	None	0	0	0	0
<i>Turkish Industry & Business Association</i>	(1,167 - 1,417 - 1,167)	1,05	Non-stakeholder	None	None	0	0	0	0
<i>Small and Medium Enterprises Development Organization of Türkiye (KOSGEB)</i>	(1,083 - 1,194 - 1,25)	1,24	Non-stakeholder	None	None	0	0	0	0
<i>Press Organizations</i>	(1,167 - 1,056 - 1,361)	1,4	Non-stakeholder	None	None	0	0	0	0
<i>Trade Unions</i>	(1,25 - 1,306 - 1,194)	1,16	Non-stakeholder	None	None	0	0	0	0
<i>Amateur/Commercial Fishing Vessels, Fishing Shelters</i>	(0,944 - 1,361 - 0,944)	0,84	Non-stakeholder	None	None	0	0	0	0

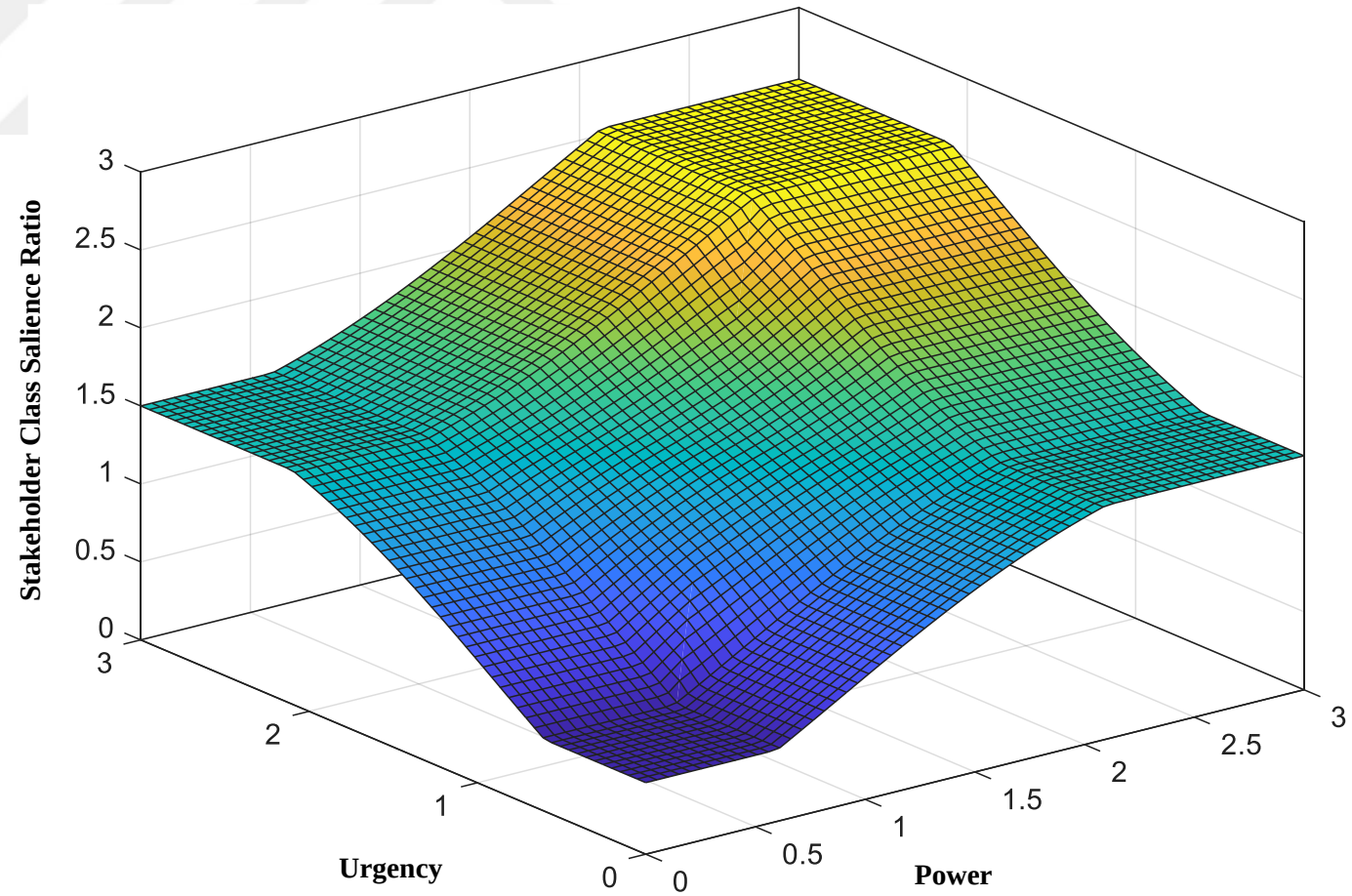
Appendix 4: Borusan Port Stakeholders' Profile and Salience Levels Considering the Port's Operational and Commercial Activities



Appendix 5: Borusan Port Stakeholders' Profile and Salience Levels Considering the Port's Sustainability and Innovation Activities

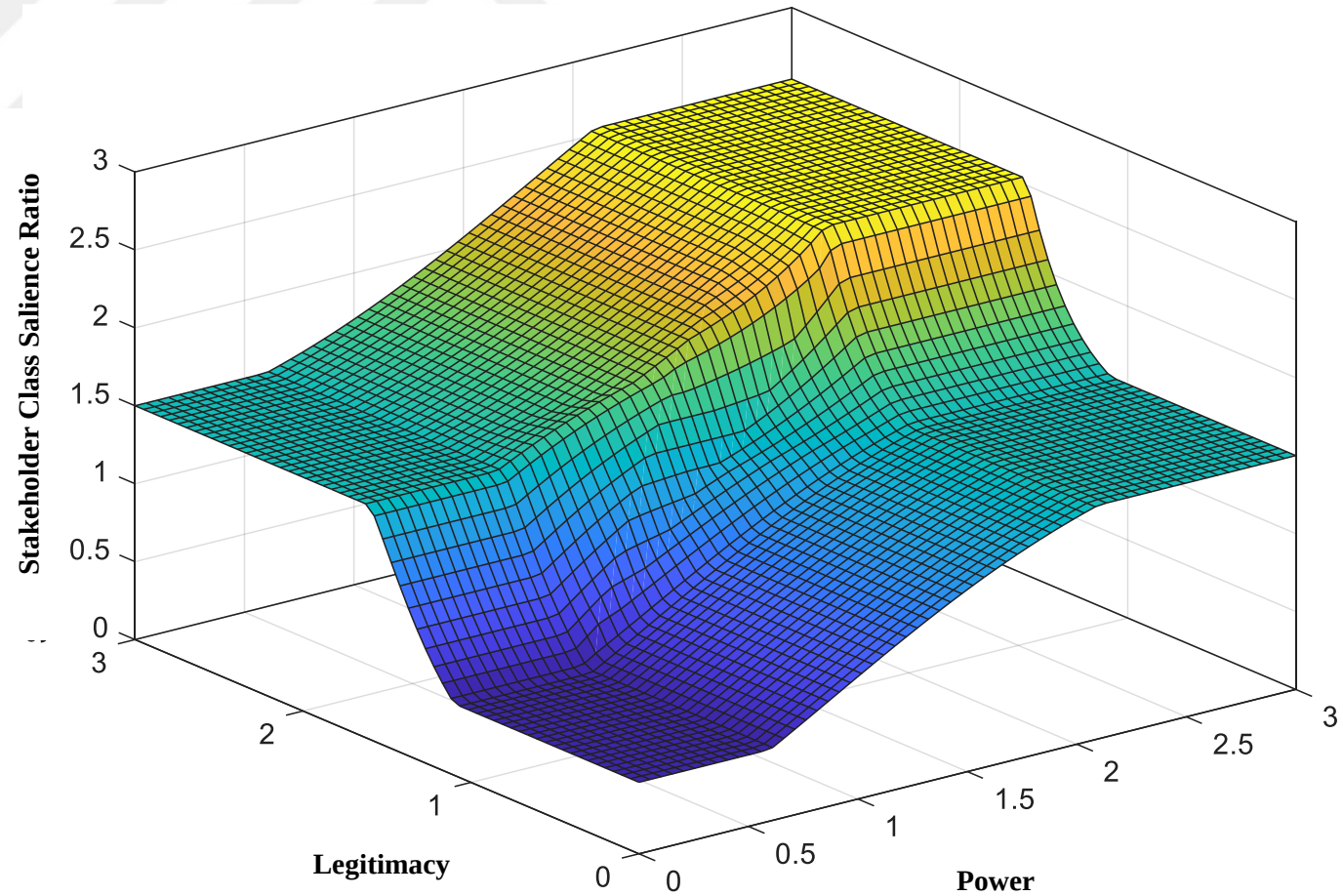


Appendix 6: Fuzzy Logic Decision Surface for the Relationship Between Urgency, Power and Stakeholder Class Salience Ratio*



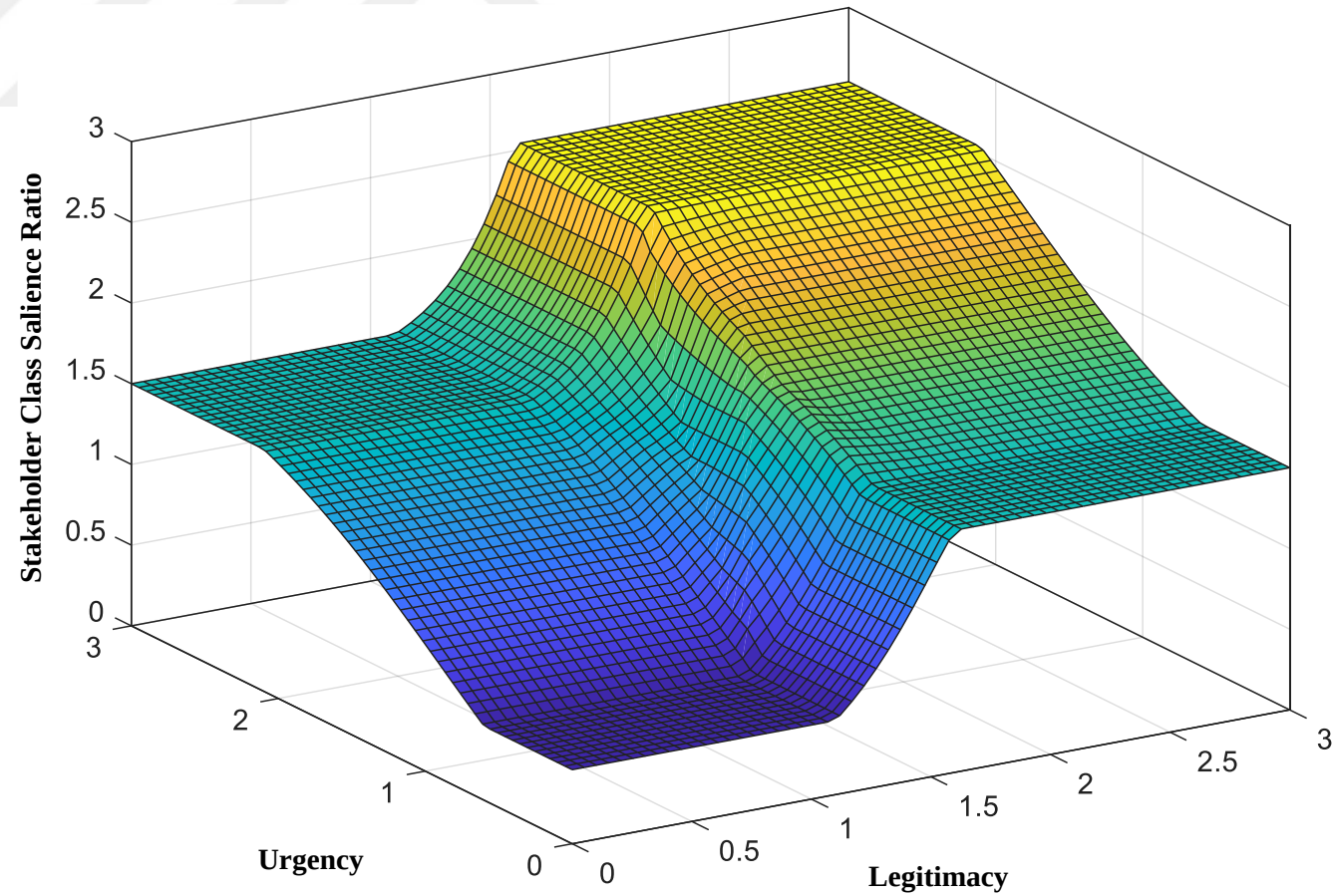
*The Vectoral Screenshot of MatLab 2023b Fuzzy Toolbox Decision Control Surface Module.

Appendix 7: Fuzzy Logic Decision Surface for the Relationship Between Legitimacy, Power and Stakeholder Class Salience Ratio*



*The Vectoral Screenshot of MatLab 2023b Fuzzy Toolbox Decision Control Surface Module.

Appendix 8: Fuzzy logic decision surface for the relationship between Urgency, Legitimacy and Stakeholder Class Saliency Ratio*



*The Vectoral Screenshot of MatLab 2023b Fuzzy Toolbox Decision Control Surface Module.

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 1/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Employees</i>	Power	2	2	3	2	3	3	3	3	2	2,528
	Urgency	2	2	2	2	3	3	2	2	1	2,056
	Legitimacy	2	2	2	1	3	3	3	2	2	2,111
<i>Management</i>	Power	3	3	3	2	3	3	3	3	3	2,694
	Urgency	3	3	3	3	3	3	3	2	2	2,639
	Legitimacy	3	3	3	2	3	3	3	2	2	2,583
<i>Board Members</i>	Power	3	3	3	3	3	3	3	3	3	3
	Urgency	3	3	3	2	3	3	1	2	3	2,278
	Legitimacy	3	3	3	3	3	3	3	2	3	2,694
<i>Shareholders</i>	Power	3	3	3	3	3	3	2	3	3	2,694
	Urgency	3	3	1	2	3	3	2	3	3	2,278
	Legitimacy	3	3	3	2	3	3	2	3	3	2,639
<i>Other Ports in the Region</i>	Power	2	3	3	2	3	3	2	2	2	2,472
	Urgency	2	3	2	3	3	3	1	2	3	2,222
	Legitimacy	2	2	2	2	3	2	2	2	3	2,361
<i>Major Port Operators Overseas</i>	Power	1	2	2	3	2	3	3	2	2	2,111
	Urgency	1	2	2	2	2	3	1	2	2	1,944
	Legitimacy	1	2	2	1	2	3	2	2	2	1,944
<i>Overseas Transshipment Port Operators</i>	Power	0	2	2	3	2	3	2	2	2	1,75
	Urgency	0	2	2	2	2	3	2	2	2	1,694
	Legitimacy	0	2	2	3	2	2	2	2	2	1,694

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 2/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Banks and Other Financial Institutions</i>	Power	2	2	2	2	2	3	2	2	3	2,361
	Urgency	2	2	2	3	2	2	1	2	3	2,056
	Legitimacy	2	2	2	1	2	3	1	2	2	1,944
<i>Maritime Insurance Companies</i>	Power	1	2	3	2	2	3	3	2	3	2,167
	Urgency	1	2	3	3	3	3	3	2	3	2,278
	Legitimacy	1	2	3	2	2	3	1	2	3	2,056
<i>Classification and Survey Societies or Representatives</i>	Power	1	2	3	3	2	3	1	2	3	2,111
	Urgency	1	2	2	2	2	3	1	2	3	2
	Legitimacy	1	2	2	2	2	3	1	2	3	2
<i>Inner or Outside Port Waste Acceptance Facilities</i>	Power	1	2	2	2	2	2	2	3	2	2
	Urgency	1	2	1	2	2	2	3	3	3	2,056
	Legitimacy	1	2	2	2	3	2	3	3	3	2,167
<i>Forwarders</i>	Power	1	2	2	3	2	3	1	2	2	2
	Urgency	1	2	2	2	3	3	1	2	2	2
	Legitimacy	1	2	2	2	2	3	1	2	2	1,944
<i>Ship Agents</i>	Power	1	2	1	2	3	1	1	2	2	1,833
	Urgency	1	1	2	3	2	2	2	2	2	1,944
	Legitimacy	1	2	1	2	2	3	1	2	2	1,889
<i>Ship/Cargo Brokers</i>	Power	1	1	2	2	2	3	1	2	2	1,889
	Urgency	1	3	2	3	2	3	1	2	2	2,056
	Legitimacy	1	3	2	2	3	3	1	2	2	2,056
<i>Other 3rd and 4th Party Logistics Service Providers</i>	Power	1	1	2	3	2	3	1	2	2	1,944
	Urgency	1	3	2	2	2	2	3	2	2	2,056
	Legitimacy	1	3	2	3	2	2	2	2	2	2,056

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 3/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Road Transport Companies</i>	Power	1	3	1	3	2	2	1	1	2	1,889
	Urgency	1	3	2	2	2	2	2	2	2	2
	Legitimacy	1	3	2	2	3	3	2	2	2	2,111
<i>Port Suppliers</i>	Power	1	3	1	2	2	3	2	2	2	2
	Urgency	1	2	2	3	2	3	3	2	3	2,167
	Legitimacy	1	2	2	2	3	3	2	2	3	2,111
<i>Stevedore Enterprises</i>	Power	1	1	1	1	2	3	0	2	2	1,472
	Urgency	1	2	2	2	2	3	0	2	3	1,694
	Legitimacy	1	2	2	2	2	2	0	2	3	1,639
<i>Ship Chandlers and Supply Enterprises</i>	Power	0	1	1	1	1	1	0	1	0	0,583
	Urgency	0	1	1	2	2	3	0	1	3	1,472
	Legitimacy	0	0	1	2	2	3	2	1	3	1,528
<i>Industrial Establishments in the Port Hinterland (Land area)</i>	Power	2	3	3	2	2	3	3	2	3	2,528
	Urgency	1	3	3	2	2	3	3	2	3	2,222
	Legitimacy	2	3	3	2	2	2	2	2	3	2,417
<i>Industrial Establishments in the Port Foreland (Overseas)</i>	Power	1	3	2	2	2	3	1	2	3	2,056
	Urgency	1	2	2	2	2	3	1	2	3	2
	Legitimacy	1	2	2	1	2	2	1	2	3	1,889
<i>Container Line Operators</i>	Power	3	3	3	3	3	3	3	2	2	2,639
	Urgency	3	3	3	2	3	3	3	3	3	2,694
	Legitimacy	3	3	3	3	2	3	3	2	2	2,583
<i>Ro-Ro Line Operators</i>	Power	3	3	3	1	2	3	3	2	2	2,222
	Urgency	3	3	2	2	2	3	3	2	1	2,167
	Legitimacy	3	3	2	2	2	3	2	2	2	2,417

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 4/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>General Cargo / Bulk Cargo Ship Operators</i>	Power	2	2	2	2	2	3	3	2	2	2,361
	Urgency	2	1	2	2	2	3	3	2	1	2
	Legitimacy	2	1	2	2	2	3	2	2	2	2
<i>Wind Turbine Cargo Owners or Representatives</i>	Power	1	2	3	2	2	3	2	2	3	2,111
	Urgency	1	2	1	1	2	3	2	2	3	1,944
	Legitimacy	1	2	2	2	2	3	2	2	3	2,056
<i>Wind Turbine Manufacturers</i>	Power	3	2	3	3	3	3	3	2	3	2,639
	Urgency	3	2	2	2	2	3	3	2	3	2,472
	Legitimacy	3	2	2	2	2	3	2	2	3	2,417
<i>Other Project Cargo Owners or Representatives</i>	Power	2	3	2	2	2	3	2	2	3	2,417
	Urgency	2	2	2	2	2	3	2	2	3	2,361
	Legitimacy	2	2	2	2	2	3	2	2	3	2,361
<i>Importers</i>	Power	2	2	2	2	2	3	2	2	3	2,361
	Urgency	2	2	2	2	2	3	3	2	3	2,417
	Legitimacy	2	2	2	2	2	3	3	2	3	2,417
<i>Exporters</i>	Power	2	3	3	2	2	3	3	2	3	2,528
	Urgency	2	3	3	1	2	3	3	2	3	2,222
	Legitimacy	2	3	3	2	2	3	3	2	3	2,528
<i>Pilotage and Towage Enterprises</i>	Power	1	1	1	2	2	3	1	2	2	1,833
	Urgency	1	1	2	2	2	3	1	2	2	1,889
	Legitimacy	1	1	2	2	2	3	2	2	2	1,944
<i>Ship and Container Repair and Maintenance Enterprises</i>	Power	0	2	3	2	2	3	0	1	2	1,583
	Urgency	0	1	3	2	2	3	0	1	2	1,528
	Legitimacy	0	1	3	1	2	3	0	1	2	1,472

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 5/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Ministry of Transport and Infrastructure</i>	Power	3	3	2	2	2	3	3	2	3	2,528
	Urgency	2	2	2	1	2	3	3	2	3	2,111
	Legitimacy	3	2	2	2	2	2	3	2	3	2,417
<i>the Ministry of Labor and Social Security</i>	Power	3	3	3	2	2	3	3	2	3	2,583
	Urgency	2	1	1	3	2	3	3	2	3	2,111
	Legitimacy	3	1	3	2	2	2	3	2	3	2,167
<i>The Ministry of Treasury And Finance</i>	Power	3	3	3	2	2	3	3	2	3	2,583
	Urgency	3	2	2	3	2	3	3	2	3	2,528
	Legitimacy	3	2	3	2	2	2	3	2	3	2,472
<i>The Ministry of Environment, Urbanization And Climate Change</i>	Power	3	3	3	3	2	3	3	3	3	2,694
	Urgency	3	3	2	2	2	2	3	3	3	2,528
	Legitimacy	3	3	3	3	2	2	3	3	3	2,639
<i>The Ministry of Trade</i>	Power	2	3	2	3	2	3	3	2	3	2,528
	Urgency	2	2	2	3	2	3	2	2	3	2,417
	Legitimacy	2	2	2	3	2	2	3	2	3	2,417
<i>The Ministry of Industry And Technology</i>	Power	2	3	2	3	2	3	2	2	3	2,472
	Urgency	2	2	2	3	2	3	2	2	3	2,417
	Legitimacy	2	2	2	3	2	2	2	2	3	2,361
<i>The Ministry of Energy And Natural Resources</i>	Power	2	3	1	3	2	3	2	2	3	2,167
	Urgency	2	3	1	2	2	3	2	2	3	2,111
	Legitimacy	2	2	3	3	2	2	2	2	3	2,417
<i>The Ministry of Health</i>	Power	2	2	2	3	2	3	1	2	3	2,111
	Urgency	2	2	2	3	2	3	1	2	3	2,111
	Legitimacy	2	2	2	3	2	2	1	2	3	2,056

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 6/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>The Ministry of Foreign Affairs</i>	Power	1	3	1	2	2	3	2	2	3	2,056
	Urgency	1	3	1	2	2	3	2	2	3	2,056
	Legitimacy	1	3	1	2	2	2	3	2	3	2,056
<i>The Ministry of Interior</i>	Power	3	3	3	2	2	3	3	2	3	2,583
	Urgency	3	2	1	3	2	3	3	2	3	2,222
	Legitimacy	3	2	1	2	2	2	3	2	3	2,111
<i>Turkish Coast Guard Command</i>	Power	2	3	3	2	2	3	3	3	3	2,583
	Urgency	2	3	1	2	2	3	0	3	3	1,806
	Legitimacy	2	3	1	3	2	2	3	3	3	2,222
<i>The General Directorate of Highways</i>	Power	1	1	2	2	2	3	1	2	3	1,944
	Urgency	1	1	1	1	2	3	1	2	2	1,778
	Legitimacy	1	1	1	2	2	2	1	2	2	1,528
<i>General Directorate of State Hydraulic Works</i>	Power	1	0	1	1	1	2	2	2	3	1,472
	Urgency	1	0	1	2	2	3	3	2	2	1,639
	Legitimacy	1	2	1	1	1	2	2	2	2	1,528
<i>The Directorate General of Coastal Safety</i>	Power	2	3	2	2	2	3	3	2	3	2,472
	Urgency	2	3	1	2	2	3	3	2	3	2,167
	Legitimacy	2	3	2	2	2	2	3	2	3	2,417
<i>General Directorate of Customs</i>	Power	3	3	3	2	2	3	3	2	3	2,583
	Urgency	3	3	3	1	2	3	3	2	3	2,278
	Legitimacy	3	3	3	2	2	2	3	1	3	2,222
<i>General Directorate of Customs Enforcement</i>	Power	3	3	3	2	2	3	3	2	3	2,583
	Urgency	3	3	3	1	2	3	3	2	3	2,278
	Legitimacy	3	3	3	2	2	2	3	1	3	2,222

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 7/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Port Authority</i>	Power	3	3	3	3	2	3	3	3	3	2,694
	Urgency	2	3	3	2	2	3	0	3	3	1,917
	Legitimacy	2	3	3	3	2	2	3	3	3	2,583
<i>Universities</i>	Power	1	1	1	2	2	1	1	2	2	1,472
	Urgency	1	1	1	1	2	3	1	2	1	1,722
	Legitimacy	1	1	1	2	2	1	1	2	1	1,417
<i>Institutes and Research Centers</i>	Power	1	1	1	2	1	1	1	2	2	1,417
	Urgency	1	1	1	1	1	3	1	2	2	1,722
	Legitimacy	1	1	1	2	1	1	1	2	2	1,417
<i>Scientific and Technological Research Council of Türkiye</i>	Power	1	1	1	1	2	1	0	3	2	1,417
	Urgency	1	1	1	2	2	3	0	3	1	1,528
	Legitimacy	1	1	1	2	2	1	0	3	1	1,417
<i>European Union Project Offices</i>	Power	0	1	1	2	2	2	0	2	1	1,111
	Urgency	0	1	1	3	2	3	0	2	0	1,417
	Legitimacy	0	1	1	2	2	2	0	2	0	1,056
<i>Infrastructure - Superstructure Project Management Organizations (such as ARUP company, etc.)</i>	Power	1	2	1	2	2	1	2	2	3	1,889
	Urgency	1	2	1	1	2	3	2	2	2	1,889
	Legitimacy	1	2	1	2	2	1	2	2	2	1,583
<i>Chambers of Commerce</i>	Power	1	2	2	1	2	1	0	2	2	1,222
	Urgency	1	1	2	2	2	3	0	2	2	1,583
	Legitimacy	1	1	2	2	2	1	0	2	2	1,222

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 8/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Turkish Industry & Business Association</i>	Power	1	2	2	2	2	1	2	2	1	1,583
	Urgency	1	2	2	1	2	3	2	2	1	1,889
	Legitimacy	1	2	2	2	2	1	3	2	1	1,889
<i>Local, Regional and Global Environmental Organizations</i>	Power	1	1	3	2	2	1	1	2	3	1,889
	Urgency	1	1	2	1	2	3	1	2	2	1,833
	Legitimacy	1	1	2	2	2	1	2	2	2	1,583
<i>International Maritime Organization (IMO)</i>	Power	1	3	2	3	3	1	3	2	3	2,167
	Urgency	1	3	2	2	3	3	3	2	3	2,222
	Legitimacy	1	3	2	2	3	1	3	2	3	2,111
<i>Port Operators Association of Türkiye (TÜRKLİM)</i>	Power	1	3	2	1	1	2	1	1	1	1,722
	Urgency	1	1	1	2	2	3	2	3	3	2
	Legitimacy	2	3	2	1	3	2	2	3	3	2,167
<i>Other Non-Governmental Organizations</i>	Power	0	1	2	3	1	1	0	2	2	1,417
	Urgency	0	0	2	2	2	1	0	2	2	1,111
	Legitimacy	1	0	2	3	1	1	0	2	2	1,417
<i>Small and Medium Enterprises Development Organization of Türkiye (KOSGEB)</i>	Power	0	0	1	3	3	0	0	3	1	1,361
	Urgency	0	0	1	2	3	3	0	3	0	1,417
	Legitimacy	0	0	1	3	3	1	0	3	0	1,361
<i>Press Organizations</i>	Power	1	1	1	3	2	1	0	2	2	1,472
	Urgency	1	1	1	2	2	3	0	2	2	1,528
	Legitimacy	1	1	1	2	2	1	0	2	2	1,167

Appendix 9: Participants' Answers to the Stakeholder Survey Related to Operational and Commercial Activities (Table 9/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Central Government</i>	Power	2	2	3	3	2	1	3	2	3	2,167
	Urgency	2	0	1	3	2	3	1	2	3	1,694
	Legitimacy	3	3	3	3	3	3	3	2	3	2,694
<i>Local Governments</i>	Power	2	3	3	3	2	1	3	2	2	2,167
	Urgency	2	0	2	3	2	3	1	2	2	1,694
	Legitimacy	2	3	3	3	2	3	3	3	3	2,639
<i>Trade Unions</i>	Power	1	0	1	1	2	1	0	3	0	1,25
	Urgency	0	0	1	1	2	3	3	3	0	1,472
	Legitimacy	0	0	1	1	2	1	0	3	0	1,194
<i>Local Resident (Urban) Communities</i>	Power	1	1	3	1	2	1	1	2	1	1,722
	Urgency	2	1	2	2	2	3	0	2	1	1,583
	Legitimacy	2	1	2	2	2	1	0	2	1	1,222
<i>Amateur/Commercial Fishing Vessels, Fishing Shelters</i>	Power	1	0	2	2	2	1	0	2	0	1,056
	Urgency	2	0	1	1	2	3	0	2	0	1,361
	Legitimacy	2	0	1	2	2	1	0	2	0	1,056

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 1/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Employees</i>	Power	1	1	2	3	3	3	3	3	2	2,167
	Urgency	1	1	2	2	3	3	2	2	2	2
	Legitimacy	2	3	2	3	3	3	3	2	2	2,528
<i>Management</i>	Power	2	3	3	2	3	3	3	3	3	2,639
	Urgency	2	2	2	3	3	3	3	2	2	2,472
	Legitimacy	2	3	2	2	3	3	3	2	2	2,472
<i>Board Members</i>	Power	2	3	3	3	3	3	3	3	3	2,694
	Urgency	2	3	2	2	3	3	2	2	3	2,472
	Legitimacy	3	3	2	2	3	3	2	2	3	2,528
<i>Shareholders</i>	Power	2	3	3	3	3	3	3	0	3	2,028
	Urgency	2	3	2	2	3	2	3	0	3	1,861
	Legitimacy	3	3	2	1	3	3	3	0	3	1,917
<i>Other Ports in the Region</i>	Power	1	1	3	2	2	3	1	2	2	1,944
	Urgency	1	0	2	3	2	3	1	2	2	1,639
	Legitimacy	1	0	2	1	2	3	1	2	2	1,528
<i>Major Port Operators Overseas</i>	Power	2	2	2	2	2	3	1	2	1	1,944
	Urgency	2	2	2	1	2	3	1	2	1	1,889
	Legitimacy	3	2	2	2	2	3	2	2	1	2,056
<i>Overseas Transshipment Port Operators</i>	Power	1	2	2	3	2	3	0	2	1	1,639
	Urgency	1	2	2	2	2	3	0	2	1	1,583
	Legitimacy	2	2	2	3	2	3	0	2	1	1,694

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 2/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Banks and Other Financial Institutions</i>	Power	2	3	3	3	2	3	1	2	3	2,222
	Urgency	2	3	3	2	2	2	1	2	3	2,111
	Legitimacy	2	3	3	3	2	3	1	2	3	2,222
<i>Maritime Insurance Companies</i>	Power	1	2	3	2	2	3	0	2	3	1,75
	Urgency	1	2	3	3	2	2	0	2	3	1,75
	Legitimacy	1	2	3	2	2	3	0	2	3	1,75
<i>Classification and Survey Societies or Representatives</i>	Power	1	1	3	2	2	3	0	2	3	1,694
	Urgency	1	1	2	2	2	2	0	2	3	1,583
	Legitimacy	1	1	2	3	2	3	0	2	3	1,694
<i>Inner or Outside Port Waste Acceptance Facilities</i>	Power	1	1	2	3	2	2	0	3	2	1,639
	Urgency	1	1	1	2	2	2	0	3	2	1,528
	Legitimacy	1	1	2	2	2	2	0	3	2	1,583
<i>Forwarders</i>	Power	1	2	1	3	2	3	0	2	1	1,583
	Urgency	1	2	1	2	2	3	0	2	1	1,528
	Legitimacy	2	2	1	3	2	3	0	2	1	1,639
<i>Ship Agents</i>	Power	1	2	1	3	2	3	0	2	1	1,583
	Urgency	1	0	1	2	2	3	0	2	1	1,417
	Legitimacy	1	0	1	3	2	3	0	2	1	1,472
<i>Ship/Cargo Brokers</i>	Power	1	0	1	2	2	3	0	2	1	1,417
	Urgency	1	0	1	3	2	3	0	2	1	1,472
	Legitimacy	1	0	1	2	2	3	0	2	1	1,417
<i>Other 3rd and 4th Party Logistics Service Providers</i>	Power	1	2	1	2	2	3	2	2	1	1,889
	Urgency	1	1	1	3	2	2	1	2	1	1,778
	Legitimacy	1	1	1	2	2	2	1	2	1	1,472

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 3/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Road Transport Companies</i>	Power	0	2	1	2	2	3	0	2	1	1,472
	Urgency	0	2	1	3	2	2	0	2	1	1,472
	Legitimacy	0	1	1	2	2	2	0	2	1	1,111
<i>Port Suppliers</i>	Power	1	3	1	3	2	3	0	2	2	1,694
	Urgency	1	1	2	2	2	2	0	2	2	1,278
	Legitimacy	1	1	1	2	2	3	0	2	2	1,528
<i>Stevedore Enterprises</i>	Power	0	2	1	3	2	2	0	2	2	1,528
	Urgency	0	1	1	2	2	1	0	2	2	1,111
	Legitimacy	0	1	1	3	2	2	0	2	2	1,472
<i>Ship Chandlers and Supply Enterprises</i>	Power	0	0	1	3	2	2	0	1	2	1,361
	Urgency	0	0	0	2	2	1	0	1	2	0,944
	Legitimacy	0	0	1	2	2	2	0	1	2	1,056
<i>Industrial Establishments in the Port Hinterland (Land area)</i>	Power	1	3	2	2	2	2	3	2	2	2,056
	Urgency	1	2	2	2	2	1	2	2	2	1,639
	Legitimacy	1	2	2	2	2	2	3	2	2	2
<i>Industrial Establishments in the Port Foreland (Overseas)</i>	Power	1	3	1	2	2	2	0	2	2	1,583
	Urgency	1	2	1	1	2	1	0	2	2	1,167
	Legitimacy	1	2	1	2	2	2	0	2	2	1,278
<i>Container Line Operators</i>	Power	2	3	2	2	2	3	3	2	1	2,111
	Urgency	2	3	2	1	2	2	3	2	2	2,056
	Legitimacy	2	3	2	2	2	3	3	2	2	2,417
<i>Ro-Ro Line Operators</i>	Power	2	3	2	2	2	3	3	2	1	2,111
	Urgency	2	3	2	3	2	2	3	2	2	2,417
	Legitimacy	2	3	2	2	2	3	3	2	2	2,417

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 4/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>General Cargo / Bulk Cargo Ship Operators</i>	Power	1	1	1	2	2	3	3	2	1	1,889
	Urgency	1	0	1	2	2	1	3	2	2	1,528
	Legitimacy	1	0	1	1	2	3	3	2	2	1,583
<i>Wind Turbine Cargo Owners or Representatives</i>	Power	1	3	2	1	2	3	2	2	2	2
	Urgency	1	3	2	1	2	1	2	2	2	1,889
	Legitimacy	1	3	2	2	2	3	2	2	2	2,056
<i>Wind Turbine Manufacturers</i>	Power	3	3	2	2	2	3	2	2	2	2,417
	Urgency	3	3	2	2	2	3	2	2	2	2,417
	Legitimacy	3	3	2	2	2	3	2	2	2	2,417
<i>Other Project Cargo Owners or Representatives</i>	Power	2	2	1	2	2	3	1	2	2	1,944
	Urgency	2	2	1	2	2	2	1	2	2	1,639
	Legitimacy	2	2	1	1	2	3	1	2	2	1,889
<i>Importers</i>	Power	1	1	1	2	2	3	3	2	2	1,944
	Urgency	1	1	1	1	2	2	3	2	2	1,833
	Legitimacy	1	1	1	2	2	3	3	2	2	1,944
<i>Exporters</i>	Power	1	3	2	1	2	3	3	2	2	2,056
	Urgency	1	2	2	2	2	3	3	2	2	2,056
	Legitimacy	1	1	2	2	2	3	3	2	2	2
<i>Pilotage and Towage Enterprises</i>	Power	1	0	1	2	1	1	0	1	2	1
	Urgency	1	0	1	2	1	2	0	1	2	1,056
	Legitimacy	1	0	1	1	1	1	0	2	2	1
<i>Ship and Container Repair and Maintenance Enterprises</i>	Power	0	0	2	1	2	3	0	1	2	1,361
	Urgency	0	0	2	2	2	3	0	1	2	1,417
	Legitimacy	0	0	2	2	2	3	0	1	2	1,417

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 5/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Ministry of Transport and Infrastructure</i>	Power	2	3	2	2	2	3	1	2	3	2,111
	Urgency	2	3	2	1	2	1	0	2	3	1,639
	Legitimacy	2	3	2	2	2	3	1	2	3	2,111
<i>the Ministry of Labor and Social Security</i>	Power	1	3	1	1	2	3	0	2	3	1,639
	Urgency	1	1	1	2	2	1	0	2	3	1,472
	Legitimacy	1	1	1	2	2	2	0	2	3	1,528
<i>The Ministry of Treasury And Finance</i>	Power	1	2	1	3	2	3	0	2	3	1,694
	Urgency	1	1	1	2	2	0	0	2	3	1,417
	Legitimacy	1	1	1	3	2	3	0	2	3	1,639
<i>The Ministry of Environment, Urbanization And Climate Change</i>	Power	3	3	1	3	2	3	0	3	3	1,917
	Urgency	3	3	1	2	2	2	0	3	3	1,806
	Legitimacy	3	3	1	3	2	2	0	3	3	1,861
<i>The Ministry of Trade</i>	Power	1	3	1	3	2	3	0	2	3	1,75
	Urgency	1	3	1	2	2	3	0	2	3	1,694
	Legitimacy	1	3	1	3	2	2	0	2	3	1,694
<i>The Ministry of Industry And Technology</i>	Power	1	3	1	3	2	3	0	2	3	1,75
	Urgency	1	3	1	2	2	3	0	2	3	1,694
	Legitimacy	1	3	1	3	2	2	0	2	3	1,694
<i>The Ministry of Energy And Natural Resources</i>	Power	1	3	1	3	2	3	0	2	3	1,75
	Urgency	1	3	1	2	2	3	0	2	3	1,694
	Legitimacy	1	3	1	3	2	2	0	2	3	1,694
<i>The Ministry of Health</i>	Power	1	1	1	3	2	3	0	2	3	1,639
	Urgency	1	0	1	3	2	1	0	2	3	1,472
	Legitimacy	1	0	1	3	2	2	0	2	3	1,528

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 6/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>The Ministry of Foreign Affairs</i>	Power	0	1	1	3	2	3	0	2	3	1,583
	Urgency	0	1	1	2	2	1	0	2	3	1,417
	Legitimacy	0	1	1	3	2	2	0	2	3	1,528
<i>The Ministry of Interior</i>	Power	1	1	1	1	2	3	0	2	3	1,528
	Urgency	2	1	1	2	2	1	0	2	3	1,528
	Legitimacy	1	1	1	2	2	2	0	2	3	1,528
<i>Turkish Coast Guard Command</i>	Power	0	0	1	2	2	0	0	3	3	1,361
	Urgency	0	0	1	1	2	0	0	3	3	1,306
	Legitimacy	0	0	1	2	2	0	0	3	3	1,361
<i>The General Directorate of Highways</i>	Power	1	0	1	2	2	3	0	2	3	1,528
	Urgency	0	0	1	3	2	2	0	2	2	1,417
	Legitimacy	1	0	1	1	2	2	0	2	2	1,111
<i>General Directorate of State Hydraulic Works</i>	Power	1	0	0	1	2	3	0	2	3	1,417
	Urgency	1	0	0	2	2	2	0	2	3	1,417
	Legitimacy	1	0	0	3	2	2	0	2	3	1,472
<i>The Directorate General of Coastal Safety</i>	Power	1	1	1	2	2	3	0	2	3	1,583
	Urgency	1	1	1	1	2	0	0	2	3	1,361
	Legitimacy	1	1	1	2	2	2	0	2	3	1,528
<i>General Directorate of Customs</i>	Power	2	2	1	2	2	3	0	2	3	1,694
	Urgency	2	1	1	1	2	2	0	2	3	1,528
	Legitimacy	2	1	1	2	2	2	0	2	3	1,583
<i>General Directorate of Customs Enforcement</i>	Power	2	2	1	2	2	3	0	2	3	1,694
	Urgency	2	1	1	1	2	2	0	2	3	1,528
	Legitimacy	2	1	1	2	2	2	0	2	3	1,583

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 7/9)

Stakeholders	Attributes	R1	R2	R3	R4	R5	R6	R7	R8	R9	Weighted Average
Port Authority	Power	2	3	1	2	2	3	0	3	3	1,806
	Urgency	1	1	1	1	2	3	0	3	3	1,583
	Legitimacy	1	1	1	3	2	2	0	3	3	1,639
Universities	Power	1	1	2	2	2	1	0	2	2	1,222
	Urgency	1	1	2	1	2	3	0	2	1	1,472
	Legitimacy	2	1	2	2	2	1	0	2	2	1,278
Institutes and Research Centers	Power	1	1	2	2	2	1	0	2	2	1,222
	Urgency	1	1	2	2	2	3	0	2	2	1,583
	Legitimacy	2	1	2	2	2	1	0	2	2	1,278
Scientific and Technological Research Council of Türkiye	Power	1	1	2	2	2	1	0	3	2	1,528
	Urgency	1	1	2	3	2	3	0	3	2	1,694
	Legitimacy	2	1	2	2	2	1	0	3	2	1,583
European Union Project Offices	Power	1	1	1	2	2	2	0	2	1	1,167
	Urgency	1	1	1	2	2	3	0	2	0	1,417
	Legitimacy	2	1	1	2	2	2	0	2	0	1,167
Infrastructure - Superstructure Project Management Organizations (such as ARUP company, etc.)	Power	1	1	1	2	2	1	0	2	3	1,472
	Urgency	1	1	1	3	2	3	0	2	3	1,639
	Legitimacy	1	1	1	2	2	1	0	2	3	1,472
Chambers of Commerce	Power	1	1	1	2	2	1	0	2	2	1,167
	Urgency	1	1	1	1	2	3	0	2	2	1,472
	Legitimacy	1	1	1	2	2	1	0	2	2	1,167

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 8/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Turkish Industry & Business Association</i>	Power	1	1	1	2	2	2	0	2	1	1,167
	Urgency	1	1	1	1	2	3	0	2	1	1,417
	Legitimacy	2	1	1	2	2	1	0	2	1	1,167
<i>Local, Regional and Global Environmental Organizations</i>	Power	1	0	1	2	2	1	0	2	3	1,417
	Urgency	1	0	1	3	2	3	0	2	2	1,528
	Legitimacy	2	0	1	2	2	3	0	2	2	1,528
<i>International Maritime Organization (IMO)</i>	Power	2	3	1	2	3	1	1	2	3	2
	Urgency	2	3	1	2	3	3	1	2	3	2,111
	Legitimacy	2	3	1	3	3	3	1	2	3	2,167
<i>Port Operators Association of Türkiye (TÜRKLİM)</i>	Power	2	3	1	3	3	2	0	3	3	1,861
	Urgency	1	3	1	3	3	3	0	3	3	1,861
	Legitimacy	2	3	2	3	3	2	1	3	3	2,222
<i>Other Non-Governmental Organizations</i>	Power	0	1	1	3	2	1	0	2	2	1,417
	Urgency	0	2	1	2	2	3	0	2	2	1,528
	Legitimacy	1	1	1	3	2	1	0	2	2	1,472
<i>Small and Medium Enterprises Development Organization of Türkiye (KOSGEB)</i>	Power	0	0	1	1	3	0	0	0	1	1,083
	Urgency	0	0	1	1	3	3	0	0	0	1,194
	Legitimacy	1	0	1	1	3	2	0	1	0	1,25
<i>Press Organizations</i>	Power	1	2	1	2	2	0	0	2	2	1,167
	Urgency	1	0	1	2	2	0	0	2	2	1,056
	Legitimacy	1	0	1	3	2	0	0	2	2	1,361

Appendix 10: Participants' Answers to the Stakeholder Survey Related to Sustainability and Innovation Activities (Table 9/9)

<i>Stakeholders</i>	<i>Attributes</i>	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>	<i>R9</i>	<i>Weighted Average</i>
<i>Central Government</i>	Power	1	1	1	2	2	1	1	2	3	1,778
	Urgency	1	1	1	2	2	3	0	2	3	1,583
	Legitimacy	3	3	3	2	3	3	3	2	3	2,639
<i>Local Governments</i>	Power	1	1	1	2	2	1	1	2	3	1,778
	Urgency	1	1	1	2	2	3	0	2	3	1,583
	Legitimacy	2	2	2	2	2	2	2	2	3	2,306
<i>Trade Unions</i>	Power	1	0	1	1	2	1	0	3	0	1,25
	Urgency	0	0	1	1	2	3	0	3	0	1,306
	Legitimacy	0	0	1	1	2	1	0	3	0	1,194
<i>Local Resident (Urban) Communities</i>	Power	2	3	1	1	2	1	0	2	1	1,472
	Urgency	3	3	1	2	2	3	0	2	1	1,694
	Legitimacy	2	3	1	1	2	1	0	2	1	1,472
<i>Amateur/Commercial Fishing Vessels, Fishing Shelters</i>	Power	1	0	1	1	2	1	0	2	0	0,944
	Urgency	2	0	1	1	2	3	0	2	0	1,361
	Legitimacy	1	0	1	1	2	1	0	2	0	0,944

Appendix 11: The Questions Regarding Borusan Port Stakeholder Analysis Findings and Evaluation (1/2)

!Aşağıdaki soruları ve bulguları sizinle paylaşılan analiz sonuçlarını içeren paydaş haritasındaki paydaş dağılımına göre değerlendiriniz.

Borusan Limanı Paydaş Analizi Bulguları ve Değerlendirilmesine İlişkin Sorular

1. Bölgedeki diğer limanlar operasyonel faaliyetler açısından baskın paydaş olarak konumlanırken, sürdürülebilirlik ve inovasyon faaliyetleri açısından tehlikeli paydaş olarak görülmektedir. Özetle, bölgedeki diğer limanlar limanın operasyonel faaliyetleri için baskın olarak görülürken sürdürülebilirlik ve inovasyon faaliyetlerinde tehlikeli paydaş olarak görülmüştür. Sizce bunun nedeni nedir?
2. Operasyonel ve ticari faaliyetlerde Konteyner düzenli hat operatörleri kesin paydaş ve Ro-Ro düzenli hat operatörleri baskın paydaş olarak belirlenmiştir. Sürdürülebilirlik ve inovasyon faaliyetleri açısından sırasıyla baskın ve kesin paydaşlar olarak görüldüğü tespit edilmiştir.
3. Uluslararası denizcilik örgütü (IMO) hem operasyonel ve ticari faaliyetler açısından hem de sürdürülebilirlik ve inovasyon faaliyetleri açısından kesin paydaş olarak tespit edilmiştir.
4. Genel kargo ve dökme yük gemi operatörleri operasyonel ve ticari faaliyetler açısından sessiz (gizil-dormant) paydaş olarak tespit edilmiştir; sürdürülebilirlik ve inovasyon faaliyetleri açısından baskın paydaş olarak tespit edilmiştir.
5. Rüzgar türbini yük sahipleri ve temsilcileri operasyonel ve ticari faaliyetler açısından kesin paydaş iken; sürdürülebilirlik ve inovasyon faaliyetleri açısından baskın paydaş olarak tespit edilmiştir.
6. Rüzgar türbini üreticileri hem operasyonel ve ticari faaliyetler hem de sürdürülebilirlik ve inovasyon faaliyetleri açısından kesin paydaşlar olarak tespit edilmiştir.
7. Liman hinterlandı (kara alanındaki) endüstri kuruluşları hem operasyonel ve ticari faaliyetlerde hem de sürdürülebilirlik ve inovasyon faaliyetlerinde baskın paydaş olarak tespit edilmiştir.
8. Çalışanların hem operasyonel ve ticari faaliyetlerde hem de sürdürülebilirlik ve inovasyon faaliyetlerinde baskın paydaş olarak görüldüğü tespit edilmiştir.
9. Üniversiteler, enstitüler ve araştırma merkezleri operasyonel ve ticari faaliyetler talepkâr olarak görülürken; sürdürülebilirlik ve inovasyon faaliyetlerinde üniversiteler paydaş dışı; enstitüler ve araştırma merkezleri talepkâr paydaşlar olarak tespit edilmiştir. Bu kapsamda, ilgili kurumlar ile ilişkide bulunmanızı engelleyen faktörler nelerdir?
10. Hissedarlar hem operasyonel ve ticari faaliyetlerde hem de sürdürülebilirlik ve inovasyon faaliyetlerinde baskın paydaşlar olarak görüldükleri tespit edilmiştir.
11. Deniz aşırı alandaki ana liman işletmecileri operasyonel ve ticari faaliyetlerde kesin paydaşlar olarak görülürken; sürdürülebilirlik ve inovasyon faaliyetlerinde baskın paydaşlar olarak görüldükleri tespit edilmiştir.
12. Deniz aşırı alandaki aktarma liman işletmecileri operasyonel ve ticari faaliyetlerde kesin paydaşlar olarak görülürken; sürdürülebilirlik ve inovasyon faaliyetlerinde baskın paydaşlar olarak görüldükleri tespit edilmiştir.

Appendix 11: The Questions Regarding Borusan Port Stakeholder Analysis Findings and Evaluation (2/2)

13. Enerji ve Tabii Kaynaklar Bakanlığı operasyonel ve ticari faaliyetlerde baskın paydaş olarak görülürken; sürdürülebilirlik ve inovasyon faaliyetlerinde kesin paydaş olarak görüldüğü tespit edilmiştir.
14. Çevre, şehircilik ve İklim Değişikliği Bakanlığı hem operasyonel ve ticari faaliyetlerde hem de sürdürülebilirlik ve inovasyon faaliyetlerinde kesin paydaş olarak görüldüğü tespit edilmiştir.
15. Türkiye Liman İşletmecileri Derneği (TÜRKLİM) operasyonel ve ticari faaliyetlerde bağımlı paydaş olarak görülürken; sürdürülebilirlik ve inovasyon faaliyetlerinde isteğe bağlı (gerek duyulduğunda dikkate alınacak) paydaş olarak görüldüğü tespit edilmiştir.



BORUSAN LİMANI EMİSYON HESAPLANMASINA İLİŞKİN GELECEK PROJEKSİYONU

Çalışmanın bu bölümünde, Borusan Limanı'na ilişkin bazı emisyon hesaplamaları aşağıda maddeler halinde ifade edildiği şekilde ve projeksiyon oluşturma amacıyla yapılmıştır:

- Konteyner terminali operasyonlarına ilişkin emisyon hesaplaması İhracat, İthalat ve Transit rejimine ilişkin konteyner operasyonları dikkate alınarak yapılmıştır. Rejim oranlarının hesaplanmasında Ulaştırma Denizcilik ve Haberleşme Bakanlığı, Deniz Ticareti Daire Başkanlığı'ndan alınan Gemlik Körfezi 2006-2022 yılları arasındaki Konteyner Elleçleme verileri dikkate alınmıştır.

- Ro-Ro terminalinde bitmiş araç elleçlemesine ilişkin emisyon hesaplamasına yer verilmiştir. Yapılan analizler Borusan Limanı yerleşim ve operasyon düzeni dikkate alınarak bir dizi projeksiyon halinde gerçekleştirilmiştir. Oluşturulan projeksiyonda bitmiş araç elleçlemesine konu yükler binek otomobil olarak kabul edilen değerler ile oluşturulmuştur.

- Limana uğrak yapan Konteyner, Ro-Ro ve Genel kargo gemileri için kurumunuz tarafından bize iletilen gemi uğrak sayıları dikkate alınarak gemilerin yanaşma, operasyon ve ayrılma emisyonları hesaplanmıştır.

- Son olarak, Yapılan emisyon hesaplamalarına ilişkin olarak, limanınızda kurulu olan güneş enerjisi sisteminden elde edilen enerji kazanımı dikkate alınarak hesaplamalarda düzeltme yapılmıştır. Ayrıca, konteyner terminali operasyonlarında kullanılan terminal traktörler (80ton), Reach Stacker ekipmanlarının emisyon azaltma stratejileri (katalitik bağlantısı) olması durumları oransal olarak duyarlılık etkisi hesaplanmıştır. Bu ekipmanların 2019, 2020, 2021 ve 2022 yıllarındaki yakıt ve/veya enerji kullanım miktarları üzerinden olası emisyon miktarları analiz edilmiştir.

! İlerleyen sayfalarda yer alan limanınız bilgileriyle ilgili kısımda hesaplamamızda kabul aldığımız değerler yer almaktadır. Lütfen limanınızı dikkate alarak sizin öngördüğünüz değerleri belirtiniz. Sizin öngördüğünüz farklı değerler olması halinde emisyon analizi bu doğrultuda güncellenecektir.

Yukarıda maddeler halinde sıralanan tüm bu analizler aşağıda sıralanan düzenlemelere ve rehberlere uygun olarak ve ekipman verimlilikleri dikkate alınarak yapılmıştır:

- IMO 2019 Annex VI,
- Global Logistics Emission Council (GLEC),
- GEF-UNDP-IMO-GloMEEP-IAPH Port Emissions Toolkit No:1 Assessment of Port Emission,

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- GEF-UNDP-IMO-GloMEEP-IAPH Port Emissions Toolkit No:2 Reduction of Emissions Development of Port
- Entec, 2010 UK Ship Emissions Inventory Final Report ve
- Avrupa Birliđi Egzos Emisyon Normları.



Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (3/9)

2. Borusan Limanı Konteyner ve Ro-Ro Terminali Emisyon Doğrudan ve Dolaylı Emisyon Hesaplaması:

2.1. Liman Dolaylı Emisyon Hesaplanması

(DOLAYLI Emisyon:kuruluşun satın alınan enerjiden kaynaklanan emisyonlardır)

2.1.1. Liman Bölgesine Yerinde Etki Eden Dolaylı Emisyonlar:

(YERİNDE ETKİ EDEN DOLAYLI Emisyon:kuruluşun ilişkili olduğu bir faaliyet nedeniyle ilişkili olunan tarafın kuruluşun faaliyet bölgesindeyken kullandığı enerjiden kaynaklanan emisyonlardır)

- Gemi Geliş Manevrası Ana makine Emisyonu
- Gemi Geliş Manevrası Yrd. Makine Emisyonu
- Gemi Ayrılış Manevrası Ana makine Emisyonu
- Gemi Ayrılış Manevrası Yrd. Makine Emisyonu
- Gemi rıhtım Operasyon Yrd. Makine Emisyonu
- Karayolundan Limana Konteyner Ulaştırın ve Limandan Konteyner Alan Harici Tırların Liman Sahası içindeki Yakıt Tüketimi
- Harici Tırların Liman Sahası içindeki Emisyon Hesaplaması
- Elleçlenen Bitmiş Araç Başına Liman Sahası içindeki Emisyon Hesaplaması

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2.2. Liman Doğrudan Emisyon Hesaplanması

(DOĞRUDAN Emisyon: Sahip olunan veya kontrol edilen varlıklarda (binalar, araçlar, ekipmanlar vb.) yakılan yakıttan kaynaklanan doğrudan emisyonlardır.)

2.2.1. Liman Bölgesine Yerinde Etki Eden Doğrudan Emisyonları:

(YERİNDE ETKİ EDEN DOĞRUDAN Emisyon: Sahip olunan veya kontrol edilen varlıklarda (binalar, araçlar, ekipmanlar vb.) yakılan yakıtın kuruluşun faaliyet bölgesinde oluşturduğu doğrudan emisyonlardır.)

- Terminal Traktör Yakıt Tüketimi
- Terminal Traktör Emisyon Hesaplaması
- TEU Başına Terminal Traktör Emisyon Hesaplaması
- Reach Stacker Yakıt Tüketimi
- Reach Stacker Emisyon Hesaplaması
- TEU Başına Reach Stacker Emisyon Hesaplaması

2.2.2. Liman Bölgesine Yerinde Etki Etmeyen Doğrudan Emisyonlar:

(YERİNDE ETKİ ETMEYEN DOLAYLI Emisyon: kuruluşun satın alınan enerjiden kaynaklanan emisyonlarının faaliyet bölgesinde değil; enerjinin çevrildiği kaynakta oluşturduğu emisyonlardır.)

- RTG Elektrik Tüketimi
- RTG Emisyon Hesaplaması
- TEU Başına RTG Emisyon Hesaplaması
- Raylı Rıhtım Vinci (SSG) Elektrik Tüketimi
- Raylı Rıhtım Vinci (SSG) Emisyon Hesaplaması
- Reefer Konteyner Depolama Esnası Elektrik Tüketimi
- Reefer Konteyner Depolama Esnası Emisyon Hesaplaması

Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (5/9)

Tablo 1. Borusan Limanına Uğrak Yapan Gemilerin Demirleme, Yanaşma-Ayrılma ve Liman Operasyon Sürelerine ilişkin Bilgiler

Borusan Limanına Gelen Gemilerin Ortalama Demirde bekleme süresi (Saat)		
Gemi tipleri	Hesaplamada Kullanılan Değer (Saat)	Sizin Öngördüğünüz Değer Nedir? (Saat)
Konteyner Gemisi	6 saat	11 saat
Genel Kargo	6 saat	40 saat
Ro-Ro / Araç Taşıma Gemisi	6 saat	11 saat
Gemilerin Borusan Limanında Ortalama Rıhtım Operasyon süresi (Saat)		
Gemi tipleri	Hesaplamada Kullanılan Değer (Saat)	Sizin Öngördüğünüz Değer Nedir? (Saat)
Konteyner Gemisi	3 saat	9 saat
Genel Kargo	6 saat	72 saat
Ro-Ro / Araç Taşıma Gemisi	10 saat	12 saat
Gemilerin Borusan Limanından Ortalama Geliş Manevrası süresi (Dakika) *Gemlik Kılavuzluk hizmetleriyle yapılan görüşmeye istinaden		
Gemi tipleri	*Hesaplamada Kullanılan Değer (Dakika)	Sizin Öngördüğünüz Değer Nedir? (Dakika)
Konteyner Gemisi	40 dakika	45 dakika
Genel Kargo	40 dakika	40 dakika
Ro-Ro / Araç Taşıma Gemisi	40 dakika	40 dakika
Gemilerin Borusan Limanından Ortalama Ayrılma Manevrası süresi (Dakika) *Gemlik Kılavuzluk hizmetleriyle yapılan görüşmeye istinaden		
Gemi tipleri	*Hesaplamada Kullanılan Değer (Dakika)	Sizin Öngördüğünüz Değer Nedir? (Dakika)
Konteyner Gemisi	30 dakika	45 dakika
Genel Kargo	30 dakika	60 dakika
Ro-Ro / Araç Taşıma Gemisi	30 dakika	45 dakika

Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (6/9)

Tablo 2. Borusan Limanına Uğrak Yapan Gemi Tiplerinin Kapasite ve Büyüklüklerine Göre Dağılım Oranları

Borusan Limanına Uğrak Yapan Gemilerin Ortalama Kapasite/Büyüklük Dağılımı (YILLIK)			
Gemi tipleri	Gemi Büyüklükleri	Hesaplama Kullanan Dağılım (%)	Sizin Öngördüğünüz Dağılım Nedir? (%)
Konteyner Gemisi (TEU)	0-999 (Feeder, feeder-max)	%30	-
	1000-1999 (handy)	%30	%4
	2000-2999 (sub panamax)	%20	-
	3000-4999 (panamax)	%10	%27
	5000-7999 (post panamax 1)	%10	%4
	8000-11999 (post panamax 2)	%0	%3
	12000-14499 (VLCS)	%0	-
	14500 ve Üstü	%0	%62
Gemi tipleri	Gemi Büyüklükleri	Hesaplama Kullanan Dağılım (%)	Sizin Öngördüğünüz Dağılım Nedir? (%)
Genel Kargo (DWT)	4999 ve altı	%40	%32
	5000-9999 arası	%20	%31
	10000 ve yukarısı	%40	%37
Gemi tipleri	Gemi Büyüklükleri	Hesaplama Kullanan Dağılım (%)	Sizin Öngördüğünüz Dağılım Nedir? (%)
Ro-Ro / Araç Taşıma Gemisi (Adet)	3999 ve altı	%80	-
	4000 ve yukarısı	%20	%100

Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (7/9)

Tablo 3. Borusan Limanına Uğrak Yapan Gemilerin Operasyonlarında Ana Makine ve Yardımcı Makine Ortalama Yük Faktörleri

Borusan Limanına Uğrak Yapan Gemilerin Operasyonlarında <u>Ana Makine ve Yardımcı Makine Ortalama Yük Faktörleri</u>								
	Hesaplama Kullanan Dağılım (%)				Sizin Öngördüğünüz Dağılım Nedir? (%)			
	Liman Giriş Çıkış		Rıhtımda		Liman Giriş Çıkış		Rıhtımda	
	Ana	Yrd.	Ana	Yrd.	Ana	Yrd.	Ana	Yrd.
Konteyner Gemisi	%20	%50	0	%17				
Genel Kargo / Dökme	%20	%50	0	%22				
Ro-Ro / Araç Taşıyıcı	%20	%50	0	%30				

Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (8/9)

Tablo 4. Borusan Limanındaki Konteyner Operasyonlarının İlgili Rejimlere Göre Dağılım Oranları

UYGUNDUR		<u>İHRACAT</u> REJİMİNDEKİ OPERASYONLARIN KENDİ İÇİNDE YILLIK DAĞILIM ORANI (%)	
No	Konteyner İhracat Operasyonları	Hesaplamamızda Kullanılan Oranlar	Sizin Öngördüğünüz Oranlar Nedir?
1	CFS iç dolum + Gemiye yükleme	%0,029840	Uygundur
2	CFS iç dolum + Depolama + Gemiye yükleme	%5	Uygundur
3	Kapıdan giriş + Depolama + Gemiye yükleme	%91,58525	Uygundur
4	Kapıdan giriş + REEFER Depolama + Gemiye yükleme	%1,384910	Uygundur
5	Kapıdan giriş + Gemiye yükleme	%2	Uygundur
UYGUNDUR		<u>İTHALAT</u> REJİMİNDEKİ OPERASYONLARIN KENDİ İÇİNDE YILLIK DAĞILIMI (%)	
No	Konteyner İthalat Operasyonları	Hesaplamamızda Kullanılan Oranlar	Sizin Öngördüğünüz Oranlar Nedir?
6	Gemiden tahliye + CFS iç boşaltma	%0,029840	Uygundur
7	Gemiden tahliye + Depolama + CFS iç boşaltma	%5	Uygundur
8	Gemiden tahliye + Depolama + Kapıdan çıkış	%91,58525	Uygundur
9	Gemiden tahliye + REEFER Depolama + Kapıdan çıkış	%1,384910	Uygundur
10	Gemiden tahliye + Kapıdan çıkış	%2	Uygundur
UYGUNDUR		<u>TRANSİT</u> REJİMİNDEKİ OPERASYONLARIN KENDİ İÇİNDE YILLIK DAĞILIMI (%)	
No	Konteyner Transit Operasyonları	Hesaplamamızda Kullanılan Oranlar	Sizin Öngördüğünüz Oranlar Nedir?
11	Gemiden tahliye + Gemiye yükleme	%3,615090	Uygundur
12	Gemiden tahliye + Depolama + Gemiye yükleme	%95	Uygundur
13	Gemiden tahliye + REEFER Depolama + Gemiye yükleme	%1,384910	Uygundur

Appendix 12: Port Opinion and Information Form About the Restrictions Regarding Borusan Port Emission Calculation (9/9)

Tablo 5. Borusan Limanındaki Elleçlenen Konteyner Miktarının İlgili Konteyner Rejimlerine Göre Dağılım Oranları

ELLEÇLENEN KONTEYNER YÜKLERİNİN YÜK REJİMLERİNE GÖRE YILLIK DAĞILIM ORANLARI (%)		
Konteyner Yük Rejimi	Hesaplamamızda Kullanılan Oranlar	Sizin Öngördüğünüz Oranlar Nedir?
İhracat Konteyner	%50,42369601	Uygundur
İthalat Konteyner	%48,92587978	Uygundur
Transit Konteyner	%0,65042421	Uygundur

Tablo 6. Borusan Limanındaki Konteyner Operasyonlarında Ekipman Yakıt/Enerji Hesaplamalarında Varsayılan Değerler

LİMAN EKİPMANLARININ YAKIT/ENERJİ KULLANIM MİKTARLARI					
UYGUNDUR	Yakıt/Enerji Türü	Hesaplamamızda Kullanılan Oranlar		Sizin Öngördüğünüz Oranlar Nedir?	
Konteyner Terminali Ekipman ve Donanım Tipleri					
Limana Konteyner Giriş Çıkışı sağlayan Tır Çekiciler	Dizel	0,326 lt/km	-	Uygundur	Uygundur
Limanın Terminal Traktörleri	Dizel	0,71 lt/km	-	Uygundur	Uygundur
RTG (Yeni sistem E-RTG)	Elektrik			Uygundur	Uygundur
RTG (eski sistem hali dizel)	Dizel	0,53 lt/km	30 TEU/saat	Uygundur	Uygundur
Raylı Rıhtım Vinci SSG	Elektrik	7,9 kw/TEU	90 TEU/saat	Uygundur	Uygundur
Reach Stacker	Dizel	1,07 lt/TEU	15 TEU/saat	Uygundur	Uygundur
Reefer Konteyner Priz (224 Adet)	Elektrik	5,8 kw/TEU/saat	4 gün (Ort. Reefer Ardiye)	Uygundur	Uygundur

BORUSAN LİMANI'NIN İNOVASYON YÖNETİM ÇERÇEVESİNİN İNCELENMESİNE YÖNELİK YARI YAPILANDIRILMIŞ GÖRÜŞME SORULARI

Bu bölümde Borusan Limanı'ndaki İnovasyonların gerçekleştirilmesine Yönelik Yapılanma İncelenecektir. Bu amaçla limanınızdaki inovasyon yönetimi konusunda katkı sunabilecek ekip ve/veya çalışanlarınızla aşağıda yer alan soru formumuza istinaden görüşmeyi istiyoruz.

1. Lütfen şirket genelindeki inovasyon geliştirme sürecinizi açıklayınız.
2. Fikir geliştirme, konsept oluşturma, seçim, varsa uygulama, işlevlik kazandırma vb. gibi inovasyon faaliyetleri şirketin organizasyon şemasında nasıl yer almaktadır (örneğin: Şirketin inovasyon faaliyetlerinde hangi kilit ekipler/iş birimleri yer alıyor?)
3. Herhangi bir inovasyon projesini göz önünde bulundurarak, içinde meydana gelen olayları/anları tarif ederek ve/veya çizerek ve açıklayınız.
4. İnovasyon projelerinde karşılaştığınız engeller/tetikleyiciler nelerdir? (beceriler, bilgi, tutum, diğer ortaklarla, paydaşlarla ve/veya çevrenizdeki insanlarla ve tüzel yapılarla olan deneyimleriniz, iletişim, finansman vb.).
5. Sürdürülebilirlik projelerinde karşılaştığınız engeller/tetikleyiciler nelerdir? (beceriler, bilgi, tutum, diğer ortaklarla, paydaşlarla ve/veya çevrenizdeki insanlarla ve tüzel yapılarla olan deneyimleriniz, iletişim, finansman vb.).
6. Kurumunuz açısından inovasyon ve sürdürülebilirlik arasındaki ilişkiyi tanımlayınız. Sürdürülebilirlik ile ilgili konular inovasyon proje süreçlerinizde nerelerde rol oynuyor? (Bu soruyu inovasyon projelerinde sürdürülebilirliğin önemi ve sürdürülebilirlik projelerinde inovasyonun önemini dikkate alarak cevaplayınız).
7. Bilindiği üzere inovasyon projelerinde farklı bilgi-beceriye sahip birey ve kurumlar çalışmaktadır. Buradan hareketle, inovasyon projelerinde kurum içinden ve/veya dışından inovasyon projelerinde yer alacak olan bireylerin ve tüzel kişiliklerin seçim sürecini ve seçim kriterlerini açıklayınız.
8. Herhangi bir inovasyon ve sürdürülebilirlik projesi gerçekleştirilirken proje uygunluk değerlendirilmesi için kullanılan kriterler nelerdir?
9. Limanınızda gerçekleştirilen sürdürülebilirlik odaklı inovasyon faaliyetlerinizin fayda ve katma değer oluşturan çıktıları hangi paydaşlarınız dikkate alınarak önceliklendirilmektedir? Nedenleriyle açıklayınız. Bu anlamda, inovasyon ve sürdürülebilirlik projelerinizde paydaş beklentilerinin rolü ve önemi hakkında bilgi veriniz. Birincil (*Çalışanlar, Hissedarlar, Yönetim Kurulu Üyeleri, Diğer Üst Yönetim, vb.*) ve ikincil (*Müşteriler, ve diğer işletme dışı, vb.*) paydaşlar inovasyon ve sürdürülebilirlik projelerinizin hangi aşamalarında yer alıyor?

Appendix 13: Semi-Structured Interview Questions for Examining Borusan Port's Innovation Management Framework (2/2)

10. Sektörünüzde şimdiye kadar ihmal edilen pazar segmentlerine ve iş fırsatlarına ulaşmak için inovasyonu “*kapı açıcı kilit bir unsur*” olarak kullandınız mı? Varsa Örnek veriniz? (Örneğin: Borusan Lojistik bünyesinde uygulanan e-taşımacılık (ETA) vb. uygulamalar, Borusan Limanı bünyesinde de örnekleri mevcut mudur?)
11. Birden fazla yük grubuna hizmet veren bir liman olarak limanınızın rekabetçi olduğu alanlar nelerdir? Bu rekabetçiliği korumak için hizmet verdiğiniz yük gruplarınız özelinde ortaya koyduğunuz sürdürülebilirlik-odaklı inovasyonlar nelerdir?
12. Kurumunuzun gerçekleştirdiği sürdürülebilirlik faaliyetleri ve bu faaliyetlere ilişkin inovasyonlarınız hakkında, kamuya açık şirket raporlarınız ve sosyal medya platformları ve elektronik haber kaynaklarında yer alan paylaşımlardan elde ettiğimiz bilgilerle sürdürülebilirlik-odaklı inovasyonlarınız hakkında bilgi sahibi olduk. Fakat, bununla birlikte, bazı sürdürülebilirlik-odaklı inovasyonlarınızın gözden kaçırılmış olabileceği düşüncesiyle, Borusan Limanı bünyesindeki sürdürülebilirlik odaklı inovasyonlarınızı ve bu inovasyonların kısa açıklamalarını bir liste halinde paylaşmanızdan memnun oluruz.

**BORUSAN LİMANI'NIN SÜRDÜRÜLEBİLİRLİK ODAKLI
İNOVASYONLARININ DEĞERLENDİRİLMESİNE YÖNELİK YARI
YAPILANDIRILMIŞ GÖRÜŞME SORULARI**

Bu bölümde Sürdürülebilirlik Odaklı İnovasyonlara konu olan projelerin değerlendirilmesi amaçlanmaktadır.

**Pet şişe atıklarının döngüsel ekonomi ile iş kısıfalarına
dönüştürülmesiyle ilgili olarak**

1. Projenin oluşturulmasına neden olan problem nedir?
2. Bu projede sürdürülebilirlik ile ilgili olarak amaçlanan nedir? Bu proje Birleşmiş Milletler Sürdürülebilirlik amaçları açısından hangi amaç ya da amaçlar ile ilişkilendirilebilir?
3. Proje süreci içerisinde başarı/başarısızlıkta etkili olan faktörler nelerdir? Örneklerle açıklayınız.
4. Bu projedeki adımları açıklayınız? (Her adımda görev alan birim ve paydaşlar kimlerdir)
5. Projenin uygulanmasında, kullanıcıların direnç gösterdiği noktalar var mı? Bu projenin uygulanması noktasında kullanıcılar tarafından kabul edilmesini nasıl sağladınız?
6. Bu projenin işletme içinde kullanılmasını/uygulanmasını nasıl yaydınız?
7. Bu projede yönetim size hangi konularda ve nasıl destek verdi?
8. Projenize başlanması ve yürütülmesiyle ilgili olarak üniversiteler ve araştırma kuruluşlarıyla temasınız oldu mu?
9. Proje için Eğitim verildi mi? Eğitim sürecini detaylandırınız.
10. Proje yönetiminde başarının belirlenmesi için genelde uygulanan yöntem proje başlamadan başarı kriterleri belirlenmesi ve daha sonra periyodik olarak başarı kriterlerinin değerlendirilmesidir. Projeniz açısından başarı kriterlerinizin belirlenmesi sürecini açıklayınız. Proje için belirlediğiniz başarı kriterleri nelerdir? Proje faaliyete geçtikten sonra bu kriterlerin ölçümünü nasıl gerçekleştiriyorsunuz? (Örneğin: sayısal bir metrik kullanımı gibi).
11. Projenin başarılı olup olmadığını nasıl değerlendiriyorsunuz?
12. Bu projenin etkileri açısından (ekonomik, sosyal, çevresel) ne bekliyordunuz? Neler gerçekleşti? Beklenti ve gerçekleşen sonuçları değerlendirir misiniz?
13. Bu proje için altyapı gereksinimleri nelerdir? (Yasal/düzenleyici; Finansal; Fiziksel)

Appendix 14: Semi-Structured Interview Questions for Evaluating Borusan Port's Sustainability-Oriented Innovation Practices - Bringing Pet Bottle Waste Into A Circular economy (2/2)

14. Önümüzdeki 10 yıllık süreç içerisinde (sürdürülebilir liman işletmeciliği açısından, karşılaşılabilecek engeller, ARGE merkezi faaliyetleri, ihtiyaç duyulacak yetkinlikler ve bilgi düzeyleri gibi vb.) , işletmeniz açısından bu projenin beraberinde neler getireceğini düşünüyorsunuz? Bunlarla ilgili planlarınız nelerdir?
15. Proje yürütme kurullarınız var mı?
16. Projeyi gerçekleştirecek/yürütecek ekibi nasıl belirlediniz?
17. Projedeki ekip ve paydaşların yönetimini nasıl sağladınız?
18. Projeye ilişkin inovasyon süreçlerinizde çatışma unsurları oluştu mu? Bu çatışma unsurlarının çözümünü nasıl sağladınız? (örneğin paydaşlar arasındaki çatışma, kullanıcılar ve sistem arasındaki çatışmanın çözümü gibi).

Appendix 15: Semi-Structured Interview Questions for Evaluating Borusan Port's Sustainability-Oriented Innovation Practices - Sunlight Sensitive LED Lighting System transformation (1/2)

**BORUSAN LİMANI'NIN SÜRDÜRÜLEBİLİRLİK ODAKLI
İNOVASYONLARININ DEĞERLENDİRİLMESİNE YÖNELİK YARI
YAPILANDIRILMIŞ GÖRÜŞME SORULARI**

Bu bölümde Sürdürülebilirlik Odaklı İnovasyonlara konu olan projelerin değerlendirilmesi amaçlanmaktadır.

Güneş Işığına Duyarlı Led Aydınlatma Sistemleri ile ilgili olarak

1. Projenin oluşturulmasına neden olan problem nedir?
2. Bu projede sürdürülebilirlik ile ilgili olarak amaçlanan nedir? Bu proje Birleşmiş Milletler Sürdürülebilirlik amaçları açısından hangi amaç ya da amaçlar ile ilişkilendirilebilir?
3. Proje süreci içerisinde başarı/başarısızlıkta etkili olan faktörler nelerdir? Örneklerle açıklayınız.
4. Bu projedeki adımları açıklayınız? (Her adımda görev alan birim ve paydaşlar kimlerdir)
5. Projenin uygulanmasında, kullanıcıların direnç gösterdiği noktalar var mı? Bu projenin uygulanması noktasında kullanıcılar tarafından kabul edilmesini nasıl sağladınız?
6. Bu projenin işletme içinde kullanılmasını/uygulanmasını nasıl yaydınız?
7. Bu projede yönetim size hangi konularda ve nasıl destek verdi?
8. Projenize başlanması ve yürütülmesiyle ilgili olarak üniversiteler ve araştırma kuruluşlarıyla temasınız oldu mu?
9. Proje için Eğitim verildi mi? Eğitim sürecini detaylandırınız.
10. Proje yönetiminde başarının belirlenmesi için genelde uygulanan yöntem proje başlamadan başarı kriterleri belirlenmesi ve daha sonra periyodik olarak başarı kriterlerinin değerlendirilmesidir. Projeniz açısından başarı kriterlerinizin belirlenmesi sürecini açıklayınız. Proje için belirlediğiniz başarı kriterleri nelerdir? Proje faaliyete geçtikten sonra bu kriterlerin ölçümünü nasıl gerçekleştiriyorsunuz? (Örneğin: sayısal bir metrik kullanımı gibi).
11. Projenin başarılı olup olmadığını nasıl değerlendiriyorsunuz?
12. Bu projenin etkileri açısından (ekonomik, sosyal, çevresel) ne bekliyordunuz? Neler gerçekleşti? Beklenti ve gerçekleşen sonuçları değerlendirir misiniz?
13. Bu proje için altyapı gereksinimleri nelerdir? (Yasal/düzenleyici; Finansal; Fiziksel)
14. Önümüzdeki 10 yıllık süreç içerisinde (sürdürülebilir liman işletmeciliği açısından, karşılaşılabilecek engeller, ARGE merkezi faaliyetleri, ihtiyaç duyulacak yetkinlikler ve bilgi düzeyleri gibi vb.) , işletmeniz açısından bu projenin beraberinde neler getireceğini düşünüyorsunuz? Bunlarla ilgili planlarınız nelerdir?
15. Proje yürütme kurullarınız var mı?
16. Projeyi gerçekleştirecek/yürütecek ekibi nasıl belirlediniz?
17. Projedeki ekip ve paydaşların yönetimini nasıl sağladınız?

Appendix 15: Semi-Structured Interview Questions for Evaluating Borusan Port's Sustainability-Oriented Innovation Practices - Sunlight Sensitive LED Lighting System transformation (2/2)

18. Projeye ilişkin inovasyon süreçlerinizde çatışma unsurları oluştu mu? Bu çatışma unsurlarının çözümünü nasıl sağladınız? (örneğin paydaşlar arasındaki çatışma, kullanıcılar ve sistem arasındaki çatışmanın çözümü gibi).



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YAPILANDIRILMIŞ GÖRÜŞME SORULARI**

Bu bölümde Sürdürülebilirlik Odaklı İnovasyonlara konu olan projelerin değerlendirilmesi amaçlanmaktadır.

SafeCard Uygulaması ve kullanımının değerlendirilmesi ile ilgili olarak

1. Projenin oluşturulmasına neden olan problem nedir?
2. Bu projede sürdürülebilirlik ile ilgili olarak amaçlanan nedir? Bu proje Birleşmiş Milletler Sürdürülebilirlik amaçları açısından hangi amaç ya da amaçlar ile ilişkilendirilebilir?
3. Proje süreci içerisinde başarı/başarısızlıkta etkili olan faktörler nelerdir? Örnekler açıklayınız.
4. Bu projedeki adımları açıklayınız? (Her adımda görev alan birim ve paydaşlar kimlerdir)
5. Projenin uygulanmasında, kullanıcıların direnç gösterdiği noktalar var mı? Bu projenin uygulanması noktasında kullanıcılar tarafından kabul edilmesini nasıl sağladınız?
6. Bu projenin işletme içinde kullanılmasını/uygulanmasını nasıl yaydınız?
7. Bu projede yönetim size hangi konularda ve nasıl destek verdi?
8. Projeye başlanması ve yürütülmesiyle ilgili olarak üniversiteler ve araştırma kuruluşlarıyla temasınız oldu mu?
9. Proje için Eğitim verildi mi? Eğitim sürecini detaylandırınız.
10. Proje yönetiminde başarının belirlenmesi için genelde uygulanan yöntem proje başlamadan başarı kriterleri belirlenmesi ve daha sonra periyodik olarak başarı kriterlerinin değerlendirilmesidir. Projeniz açısından başarı kriterlerinizin belirlenmesi sürecini açıklayınız. Proje için belirlediğiniz başarı kriterleri nelerdir? Proje faaliyete geçtikten sonra bu kriterlerin ölçümünü nasıl gerçekleştiriyorsunuz? (Örneğin: sayısal bir metrik kullanımı gibi).
11. Projenin başarılı olup olmadığını nasıl değerlendiriyorsunuz?
12. Bu projenin etkileri açısından (ekonomik, sosyal, çevresel) ne bekliyordunuz? Neler gerçekleşti? Beklenti ve gerçekleşen sonuçları değerlendirir misiniz?
13. Bu proje için altyapı gereksinimleri nelerdir? (Yasal/düzenleyici; Finansal; Fiziksel)
14. Önümüzdeki 10 yıllık süreç içerisinde (sürdürülebilir liman işletmeciliği açısından, karşılaşılabilecek engeller, ARGE merkezi faaliyetleri, ihtiyaç duyulacak yetkinlikler ve bilgi düzeyleri gibi vb.) , işletmeniz açısından bu projenin beraberinde neler getireceğini düşünüyorsunuz? Bunlarla ilgili planlarınız nelerdir?
15. Proje yürütme kurullarınız var mı?
16. Projeyi gerçekleştirecek/yürütecek ekibi nasıl belirlediniz?
17. Projedeki ekip ve paydaşların yönetimini nasıl sağladınız?

Appendix 16: Semi-Structured Interview Questions For Evaluating Borusan Port's Sustainability-Oriented Innovation Practices - Safe Card system (2/2)

18. Projeye ilişkin inovasyon süreçlerinizde çatışma unsurları oluştu mu? Bu çatışma unsurlarının çözümünü nasıl sağladınız? (örneğin paydaşlar arasındaki çatışma, kullanıcılar ve sistem arasındaki çatışmanın çözümü gibi).



Appendix 17: Open Codes Created in the SOI AssessmentStudy (1/3)

<i>Open Codes</i>
Development orientation (exist)
Idea Evaluation (exist)
Non-commercial ideas (exist)
Sympathy for science (exist)
Looking forward to opinions genially (exist)
Ideas that will lead the way (exist)
Unproven ideas (exist)
Even if that day wasn't enough, it's still precious (yes)
Existence of Recommendation systems (exist)
to reconsidering ideas (yes)
Triggering ideas (yes)
Innovation is part of the business (yes)
Sustainability is part of the business (yes)
To aim the requirements completely (exist)
Innovation isn't out of business (yes)
Sustainability isn't out of business (yes)
to aiming (yes)
Innovation is part of the routine (yes)
Sustainability is part of the routine (yes)
Sustainability and Innovation department (none)
Innovation and core business exist together (yes)
Sustainability and core business exist together (yes)
Adoption by everyone (yes)
Company sustainability leader (exist)
Holding sustainability leader (exist)
Company committee sponsor (exist)
Holding committee leader (exist)
Product and process design (exist)
Contribution to customer needs (exist)
Market adaptation request (exist)
Market penetration desire (exist)
Innovations based on industry expectations (exist)
Innovations regarding employee characteristics (exist)
Carrying out activities in line with industry expectations (exist)
Carrying out activities with employee features (exist)
Project-based teams make improvements (yes)
Project-based teams innovate (yes)
Following trends (exist)

Appendix 17: Open Codes Created in the SOI Assessment Study (2/3)

<i>Open Codes</i>
In-house and industry-savvy IT team (exist)
Fairly distributed project process functions (exist)
Project processes with committee structure (exist)
Holding sustainability working group (exist)
Group companies' sustainability working groups (exist)
Group companies' sustainability committees (exist)
Group intercompany sustainability committee sponsors (exist)
Departments follow each other's requirements (exist)
Sharing in department requirements (exist)
Regular holding sustainability meetings (exist)
Continuation of trials with backup business partners in existing projects (exist)
Regular sustainability meetings within the group companies (exist)
A clear innovation policy (exist)
A playground for innovations and improvements (exist)
Startup tracking in techno parks (exist)
Idea adaptation area (exist)
A joint venture capital company for tracking startup and trends (exist)
Autonomy area (exist)
Corporate culture (exist)
Core jobs and auxiliary jobs together (yes)
Innovation department (none)
Tracking startups in Turkey (yes)
A joint venture capital company abroad (exist)
Pursuing original ideas (yes)
Localization and adaptation of original ideas (exist)
Identification of innovative ideas (exist)
Use of recommendation systems (exist)
6 Sigma Culture (exist)
Operational ideas from blue collar (exist)
Ideas that guide the way to the solution (exist)
Innovative Product and process design (exist)
Experimental and incremental innovations (exist)
Giving importance to merit (yes)
Long-term business partnerships (exists)
Performance measurement of project partners (yes)
Performance feedback (exist)
Reconsidering negative feedback (yes)

Appendix 17: Open Codes Created in the SOI Assessment Study (3/3)

<i>Open Codes</i>
ROI is at the forefront in economic projects (yes)
In matters that concern people, ROI is in the background (yes)
Holding Ankara office (exist)
Keeping track of the constantly changing business environment (yes)
Sectoral association membership (exist)
Public cooperation for social projects (exist)
Top management decision maker in case of lack of information (yes)
When sufficient information is yes, common sense comes to the fore (yes)
Staff are involved in operational projects (yes)
Acceptance of critical mind (yes)
Definitely offering innovative solutions (exist)
Designing equipment for operational efficiency (exist)
Possibility of Continuous Improvement (yes)
Sustainable business models for sales and goal setting (exist)
Matching revenue model and operations model to business models (yes)
Creativity (exist)
Matching customer expectations with operational efficiency (exist)
Taking initiatives that will provide economic benefit to the company (exist)
Providing holistic service (exist)
Producing process and product solutions for WES customers (exist)
Producing process and product solutions for iron and steel customers (exist)
Adaptation of new tasks and practices to the nature of the sector (exist)
Preventing new tasks and applications from making doing business difficult (exist)
Giving importance to internal customer experience (exist)
Support from top management in processes (exist)
Pivoting inefficient projects (exist)
Being prone to change and transformation (yes)
Blue collar employees are involved in operational projects (yes)
Different units introduce practices, products and processes that will benefit each other (exist)
Integration of superstructure, infrastructure and process capabilities as technologies and hardware (exist)
Turning products, applications and processes into a system according to the dynamics of the sector (exist)
Project partners think that Borusan port will develop them (yes)
Project partners see Borusan port as a reference source (yes)
Economic value of Borusan port's reputation for project partners (exist)
Borusan Port provides price advantage in project partnerships due to its reputation (exist)

Appendix 18: Emission Factors for Propulsion Engines Using HFO With 2.7% Sulphur Content.

<i>Main Engine Category (g/kWh)</i>	<i>Model Year Range</i>	<i>NO_x</i>	<i>PM10</i>	<i>PM2.5</i>	<i>SO₂</i>	<i>HC</i>	<i>CO</i>	<i>CO₂</i>	<i>N₂O</i>	<i>CH₄</i>
<i>Slow Speed Main</i>										
<i>(Tier 0)</i>	<i>1999 and older</i>	18,1	1,42	1,34	10,29	0,6	1,4	620	0,03	0,01
<i>(Tier I)</i>	<i>2000 to 2010</i>	17	1,42	1,34	10,29	0,6	1,4	620	0,03	0,01
<i>(Tier II)</i>	<i>2011 to 2016</i>	15,3	1,42	1,34	10,29	0,6	1,4	620	0,03	0,01
<i>(Tier III)</i>	<i>2016 +</i>	3,6	1,42	1,34	10,29	0,6	1,4	620	0,03	0,01
<i>Medium Speed Main</i>										
<i>(Tier 0)</i>	<i>1999 and older</i>	14	1,43	1,34	11,35	0,5	1,1	683	0,03	0,01
<i>(Tier I)</i>	<i>2000 to 2010</i>	13	1,43	1,34	11,35	0,5	1,1	683	0,03	0,01
<i>(Tier II)</i>	<i>2011 to 2016</i>	11,2	1,43	1,34	11,35	0,5	1,1	683	0,03	0,01
<i>(Tier III)</i>	<i>2016 +</i>	2,8	1,43	1,34	11,35	0,5	1,1	683	0,03	0,01

Source: Port Emission toolkit (2018) based on Third IMO GHG Study (2014)

Appendix 19: Emission Factors for Auxiliary Engines Using HFO With 2.7% Sulphur Content

<i>Main Engine Category (g/kWh)</i>	<i>Model Year Range</i>	<i>NO₂</i>	<i>PM₁₀</i>	<i>PM_{2.5}</i>	<i>SO₂</i>	<i>HC</i>	<i>CO</i>	<i>CO₂</i>	<i>N₂O</i>	<i>CH₄</i>
<i>Slow Speed Main</i>										
<i>(Tier 0)</i>	<i>1999 and older</i>	14,7	1,44	1,35	11,98	0,4	1,1	722	0,03	0,01
<i>(Tier I)</i>	<i>2000 to 2010</i>	13	1,44	1,35	11,98	0,4	1,1	722	0,03	0,01
<i>(Tier II)</i>	<i>2011 to 2016</i>	11,2	1,44	1,35	11,98	0,4	1,1	722	0,03	0,01
<i>(Tier III)</i>	<i>2016 +</i>	2,8	1,44	1,35	11,98	0,4	1,1	722	0,03	0,01
<i>Medium Speed Main</i>										
<i>(Tier 0)</i>	<i>1999 and older</i>	11,6	1,44	1,35	11,98	0,4	0,9	690	0,03	0,01
<i>(Tier I)</i>	<i>2000 to 2010</i>	10,4	1,44	1,35	11,98	0,4	0,9	690	0,03	0,01
<i>(Tier II)</i>	<i>2011 to 2016</i>	8,2	1,44	1,35	11,98	0,4	0,9	690	0,03	0,01
<i>(Tier III)</i>	<i>2016 +</i>	2,1	1,44	1,35	11,98	0,4	0,9	690	0,03	0,01

Source: Port Emission toolkit (2018) based on Third IMO GHG Study (2014)

Appendix 20: Load Factors for Different Operation Modes Based on Main and Auxiliary Engine

<i>Engine Type Load Factors Based on Operation Types</i>	<i>Container Vessel</i>	<i>General Cargo And Dry Bulk Vessel</i>	<i>Ro-Ro Vessel</i>
<i>Auxiliary Engine Load Factors</i>			
<i>Hotelling</i>	0,17	0,22	0,24
<i>Slow Cruise/Maneuvering</i>	0,25	0,27	0,3
<i>Anchor</i>	0,17	0,22	0,24
<i>Main Engine Load Factors</i>			
<i>Slow Cruise/Maneuvering</i>	0,2	0,2	0,2

Source: Browning and Bailey, (2005); USEPA (2009); Wang et al. (2020); EPA (2022).

Appendix 21: Propulsion and Auxiliary Powers of Vessels Considering in Ship Calling to Borusan Port

<i>Vessel Type</i>	<i>Propulsion MCR (kW)</i>	<i>Auxiliary Ratio to Main Power</i>	<i>Auxiliary (kW)</i>
<i>Container</i>			
<i>1000-1999 teu (handy)</i>	14.800	0,100	1480
<i>3000-4999 teu (panamax)</i>	35.450	0,080	2836
<i>5000-7999 teu (post panamax 1)</i>	56.350	0,070	3944,5
<i>8000-11999 teu (post panamax 2)</i>	76.350	0,070	5344,5
<i>12000-14499 teu (VLCS)</i>	85.000	0,053	4505
<i>14500 and more teu</i>	94.350	0,053	5000,55
<i>General cargo</i>			
<i>4999 and less dwt</i>	1.800	0,200	360
<i>5000-9999 dwt</i>	2.550	0,200	510
<i>10000 and more dwt</i>	7.761	0,200	1552,2
<i>Vehicle Carrier</i>			
<i>4000 and more vehicle</i>	13.990	0,266	3000

Source: IMO GHG Study Report (2020); MAN (2020a); MAN (2020b)

Appendix 22: Port Equipment Emission Amount per Liter Diesel Fuel and Emission Factors

MOBILE EQUIPMENT	CO₂kg/lt	CH₄gr/lt	N₂O gr/lt	CO₂ton/lt	CH₄ton/lt	N₂O ton/lt	tCO_{2-e}
Diesel	2,6972	0,10038	0,021134	0,0026971967	0,0000001004	0,0000000211	0,0027060042

Source: IPCC (2006a); IPCC (2006b); EPA (2023).

Appendix 23: Grid Based Electric Consumption Emission Factor

Grid Based Electric Consumption Emission Factor	tCO_{2-e}
Electric consumption based GHG emission (t/kw)	0,000484

Source: MENR (2022)

Appendix 24: Emission Factors of Truck Calling to Borusan Port

Average GHG Emission Factor	(gr/km)
CO (gr/ton - km)	0,003
CO (gr/km)	0,045
CO₂ (gr/ton - km)	69,57
CO₂ (gr/km)	897,46
N₂O (gr/km)	0,005
CH₄ (gr/km)	0,05
CO_{2-e} (gr/km)	900,2

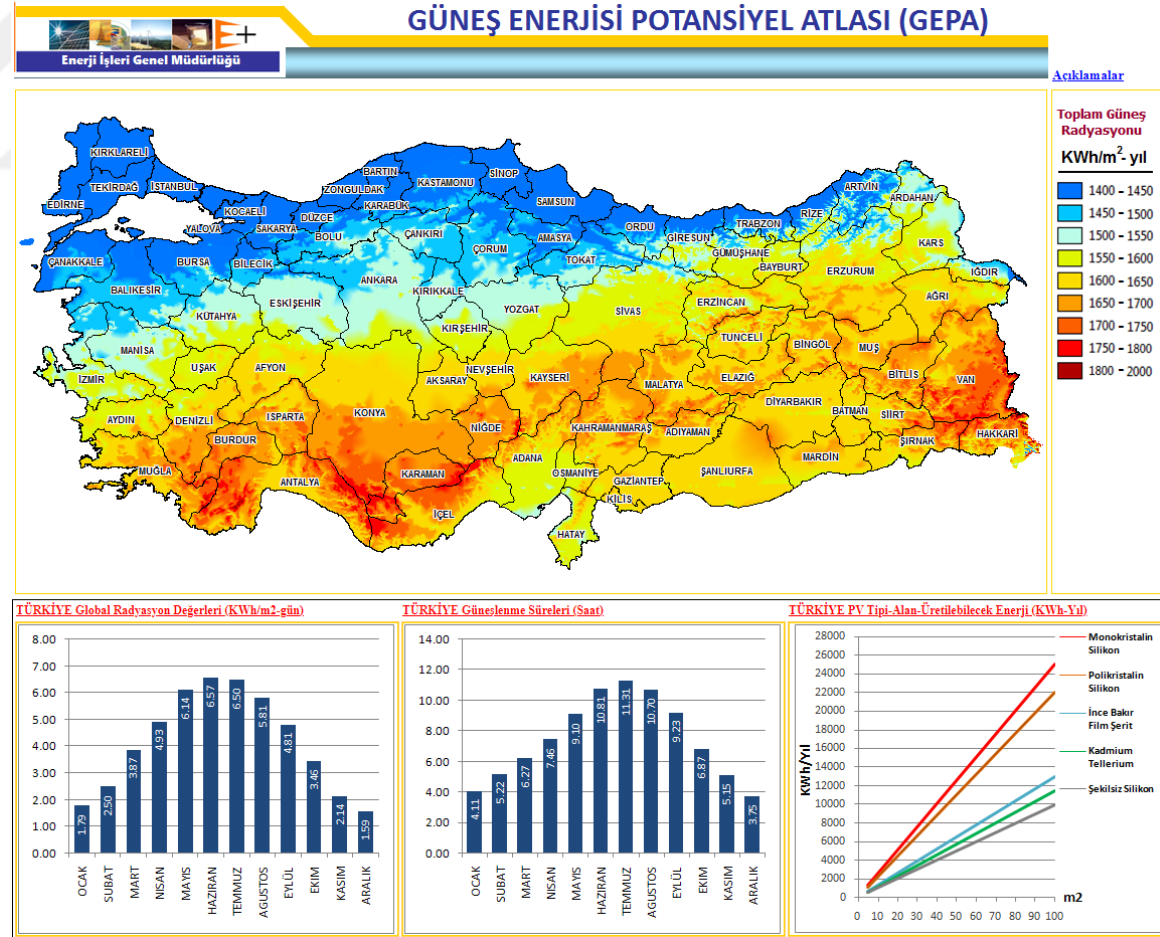
Source: Xing et al. (2016); ICCT (2018); Ragon and Rodriguez (2021)

Appendix 25: Passenger Car Emission Factor based on Euro Norms

<i>Years</i>	<i>Fuel type</i>	<i>Emission Factor (g/CO₂-e/km)</i>
<i>2019 Euro 6 (2016-2024)</i>		
	<i>Petrol</i>	148,88
	<i>Diesel</i>	158,84
<i>2020 Euro 6 (2016-2024)</i>		
	<i>Petrol</i>	139,88
	<i>Diesel</i>	153,84
<i>2021 Euro 6 (2016-2024)</i>		
	<i>Petrol</i>	132,88
	<i>Diesel</i>	148,84
<i>2022 Euro 6 (2016-2024)</i>		
	<i>Petrol</i>	112,88
	<i>Diesel</i>	126,84

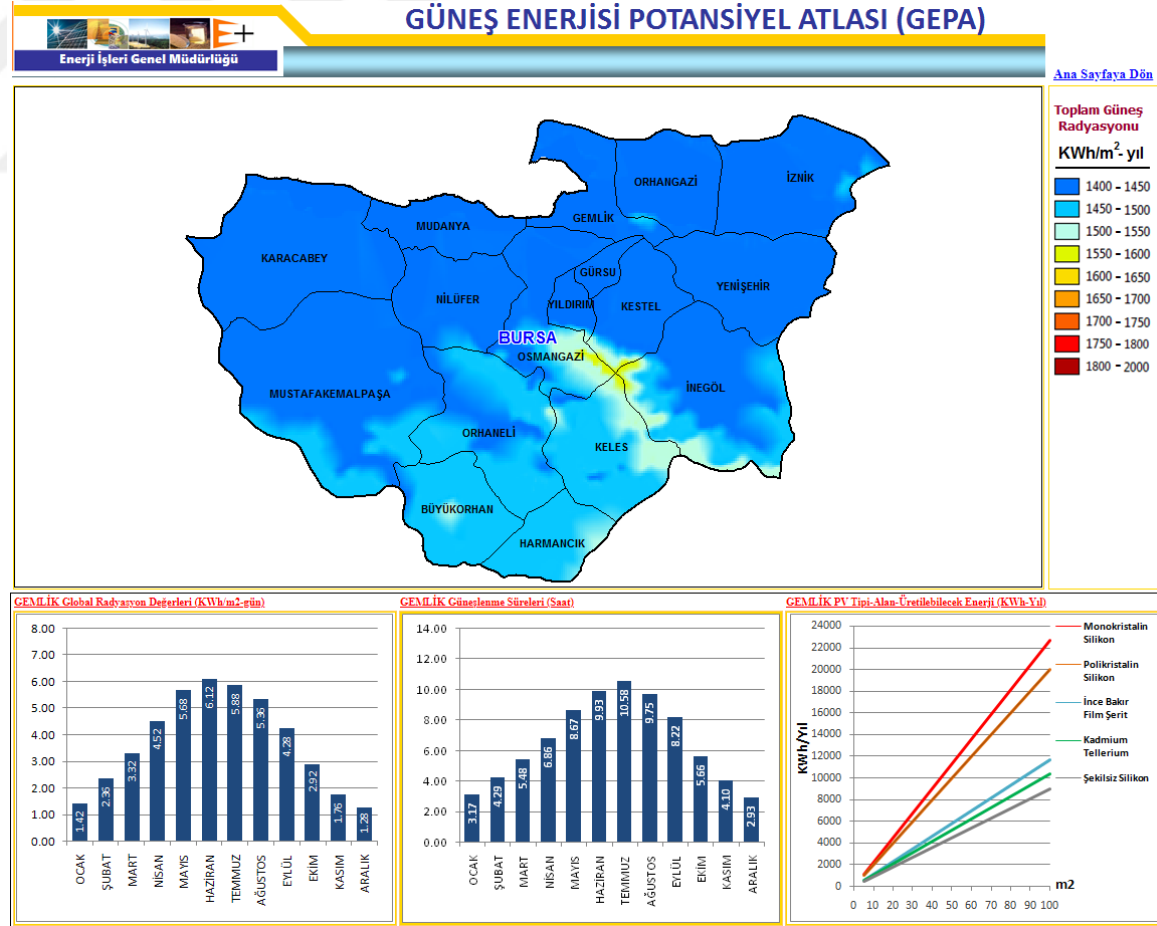
Source: EEA (2023)

Appendix 26: Türkiye Solar Energy Potential Atlas



Source: Solar Energy Potential Atlas (Güneş Enerjisi Potansiyel Atlası-GEPA, 2023)

Appendix 27: Gemlik-Bursa Solar Energy Potential Atlas



Source: Solar Energy Potential Atlas (Güneş Enerjisi Potansiyel Atlası-GEPA, 2023)