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Esra YÜKSEL ACI
Funda H. SEZGİN
Gamze SART

YEŞİL VE DİJİTAL DÖNÜŞÜM

GÜNCEL YAKLAŞIMLAR



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İÇİNDEKİLER

BİRİNCİ BÖLÜM
Bir İş Sağlıklı ve Güvenli Değilse "Yeşil" Olabilir mi?: İşçi Sağlığı ve İş Güvenliğinde Yeşil Geçiş 1
Burcu YERLİKAYA-YARAN

İKİNCİ BÖLÜM
Covid-19 Pandemisinin Otomotiv Sektörüne Etkileri ve KFG İle İş Stratejilerinin Geliştirilmesi..... 19
Özlem KOCER BERBER, Yusuf Sait TÜRKAN, Ersin NAMLI

ÜÇÜNCÜ BÖLÜM
Dijital Ekonomide Küresel Değer Zincirlerinin Yeniden Yapılandırılmasında Asya ve Avrupa Arasında Bir Köprü: Türkiye..... 33
Halit Gökhan YÜKSEL

DÖRDÜNCÜ BÖLÜM
Finansal Sürdürülebilirlik ile Çevresel, Sosyal ve Kurumsal Yönetim (ESG) Performansı İlişkisi: BIST Sürdürülebilirlik 25 Endeksinde Araştırma..... 45
Begüm ÖKTEM

BEŞİNCİ BÖLÜM
İşletmelerde Yeşil Yönetim Yaklaşımı ve İşletme Fonksiyonlarındaki Uygulamaları..... 55
Ali KUZU

ALTINCI BÖLÜM
Organik ve Konvansiyonel Tarım İşletme Modellerinin Karşılaştırmalı Analizi Üzerine Bir Çalışma..... 65
Cengizhan GÜLLÜZ, Melek YURDAKUL

YEDİNCİ BÖLÜM
Pandemi Dönemi Yaşanan Küresel Enflasyon, Enflasyon Muhasebesi Uygulamaları ve Finansal Performans Üzerindeki Etkileri 79
Hasan YALÇIN, Ali KABLAN

SEKİZİNCİ BÖLÜM
Sürdürülebilir Kalkınma, Eko-Endüstriyel Parklar ve Türkiye'de Yeşil OSB'ler..... 101
Hilal KUVVETLİ YAVAŞ

DOKUZUNCU BÖLÜM
Üniversitelerde Sürdürülebilirlik Faaliyetlerinin Önemi..... 117
Gamze SART

ONUNCU BÖLÜM
E-Devlet Uygulaması Öncülüğünde Dijital Dönüşümün Makro Ekonomik Parametrelerle İlişkisi Üzerine Değerlendirmeler..... 125
Yahya Can DURA

ON BİRİNCİ BÖLÜM
Yeşil Finansman Araçları: Ülke Uygulamaları ve Türkiye..... 135
Jale YALINPALA ÇOKGEZEN

ON İKİNCİ BÖLÜM
Analysis of Financial Performance of Telecommunication Enterprises Operating on BIST during and After the Pandemic Period with TOPSIS Method..... 147
Ali KABLAN

ON ÜÇÜNCÜ BÖLÜM
International Circular Economy in Tourism and Social Impact of Green Economic Transition..... 153
Mehmet Tevfik İZGİ, Seyit Ali EREN

ON DÖRDÜNCÜ BÖLÜM
Recession: An Evaluation of the Vulnerabilities That Raise Concerns in The World Economy 163
Merve ARSLAN, Serdar KUZU

ON BEŞİNCİ BÖLÜM
Crypto Currencies and Market Efficiency 173
Serdar KUZU, Merve ARSLAN, Ismail Erkan CELIK

ON ALTINCI BÖLÜM
Sustainability and Importance of Technologies in Digital Transformation 179
Hatice ÖZKURT ÇOKGÜNGÖR

ON YEDİNCİ BÖLÜM
Innovative Circular Economy Practices of Manufacturing Firms in Turkey as an Emerging Market Perspective 191
Zehra Binnur AVUNDUK

ON SEKİZİNCİ BÖLÜM
Investigation of Academicians' Ecological Citizenship Levels 201
Gamze SART

ON YEDİNCİ BÖLÜM

Innovative Circular Economy Practices of Manufacturing Firms in Turkey as an Emerging Market Perspective

Zehra Binnur AVUNDUK[1]

1. INTRODUCTION

Global warming, which has occurred due to the rapid increase in the accumulation of greenhouse gases in the atmosphere since the industrial revolution, has caused climate change. In addition, the unconscious and wasted use of resources cause significant harm to nature and the economy. Climate change and rapid consumption of resources by damaging nature are global issues, and many steps have been taken all around the world to fight against them.

The linear economy that has dominated until today is a "take-make-consume-and-throw away" approach involving excessive exploitation of natural resources and accumulation of polluting waste products: increasingly scarce raw materials are being extracted from the environment and returned to them as harmful waste as they are put through the "linear" process of consumption and production. On the contrary, the circular economy (CE), a newly developing phenomenon, seeks to minimize raw materials per unit of output and recycle waste products as much as possible to reuse them as inputs in manufacturing. To achieve the goal of the CE approach, which aims to reintroduce waste into the economy by recycling it in a way that creates added value, firms need to make radical changes in their manufacturing processes. Transforming the manufacturing processes into a circular form necessitates research, development, and implementation of innovative practices.

Particularly in emerging markets, there is a strong need to enhance manufacturing performance, so there is less wastage, material, energy consumption, industrial pollution, etc. The appropriate framework for this structure is for enterprises adopting green manufacturing methods. Green manufacturing describes the renewal of manufacturing processes to achieve sustainable and cleaner production and establish environmentally friendly operations in the production area.

The term "emerging market" was coined by World Bank economist Antoine W. van Agtmael in 1981 about nations undergoing industrialization and rapid economic growth (Sun et al., 2022). The emerging market term is used interchangeably with "developing economies," which the IMF uses to categorize 150 countries based on criteria such as the composition of countries' export earnings and other income from abroad. Emerging markets' growing economies and technological significance are among the most significant forces shaping the global economy (Economy Watch, 2021). The Morgan Stanley Capital International (MSCI) Emerging Markets Index has been a selection of stocks designed to trace the financial performance of key enterprises in fast-growing countries since 1988. The index currently captures 24 countries across the globe. It comprises "Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Kuwait, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey, and United Arab Emirates" (MSCI, 2022, p. 1.). In the report published by the IMF, it is stated that according to the economic grouping of the countries, Turkey is among the "emerging market and middle income" and "emerging G20 countries" (International Monetary Fund - IMF, 2020, p. 64). The US Government also designated Turkey as one of the large emerging countries, characterized by an exponentially growing population and high economic growth (Tatoglu & Demirbag, 2008). As an emerging strategic country, Turkey has been a leading economic center crossroads between East Europe and Central Asia for many years, providing unique business opportunities (Tatoğlu & Demirbag, 2008). Presently, Turkey is in a transformation phase from an emerging to an industrialized country (Kleiner-Schäfer & Liefner, 2021).

Greenhouse gas emissions have increased by 130% in the last 30 years in Turkey, which may experience severe losses in its exports to European Union (EU) countries if it does not reduce its emission intensity (World Wide Fund for Nature) because "in December 2019, the EU announced the European Green Deal to create a climate-neutral continent by 2050 (Acar et al., 2022, p. 8162)". "A national circular economy roadmap has not been devised yet in Turkey to date; however, the *Green Deal Action Plan* announced in July 2021 by the Ministry of Industry and Trade has considered the implementation of circularity principles in Turkey. Furthermore, as part of Turkey's efforts to integrate into the EU, legal har-

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monization has been undertaken to match the EU's current legislative frame on waste and circularity issues" (KPMG & SKD Türkiye, 2022, p. 6). According to the EU Commission's "Fit for 55" legislative package, a carbon emission limit value will be set for each product imported by the EU, and an additional customs duty of 55-60 Euros on average will be applied for each ton of excess carbon emission for products exceeding these limit values, environmentally friendly (Yılmaz, 2022). This situation may reshape the concept of competitive advantage and closely affect countries exporting to the EU, such as Turkey. This situation may reshape the idea of competitive advantage and closely affect countries exporting to the EU, such as Turkey. This is because low-emission countries can trade with the EU tax-free or with low taxes; additional carbon costs will arise for countries with high emission values, such as China and Turkey.

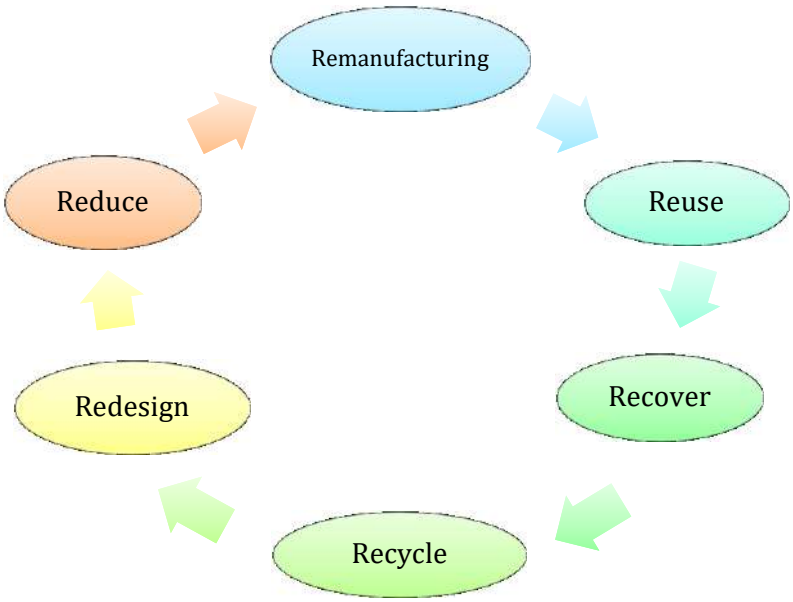
Emerging markets must contend with many challenges because increased economic activity causes a simultaneous upward movement in energy demand (especially fossil fuels such as oil, gas, coal, etc.) (Shan et al., 2021). Along with the industrial revolution, the intensive increase in manufacturing since the 19th century, the excessive and wasteful use of natural resources, the mixing of toxic chemicals and greenhouse gases due to production into the atmosphere, and the pollution/destruction of wastes have adversely affected the environment and natural resources. Moreover, despite the growing trend in sustainability certifications (i.e., ISO 14001, ISO 50001), many industrial firms are just starting to enter the circular economy, and green manufacturing is still not widely implemented, especially in emerging markets. This indicates that green manufacturing entails challenges (Mao & Wang, 2019). As a result, the earth is under threat of deterioration due to greenhouse gas emissions from the excessive use of fossil fuels (Ding et al., 2021) and the harmful methods used in the industry. Thus, firms face pressure to change manufacturing methods from linear to circular, reinforcing the need to evaluate their performance on sustainability issues (Gupta et al., 2021). The CE is an economical approach that replaces the "end-of-life" concept by recycling, reducing, recovering, and reusing materials in manufacturing processes (Kirchherr et al., 2017). Therefore, CE can be used to minimize the usage of resources, decrease waste generation (Abreu & Ceglia, 2018; Bag et al., 2020; Kalmykova et al., 2018; Schroeder et al., 2019), and reuse wastes by processing and recycling instead of being garbage, etc. can be seen as most appropriate and a holistic way of how to transform the manufacturing processes towards a sustainable manner.

Thus, this chapter aims to contribute to the literature from the perspective of an emerging market by demonstrating, understanding, and inferring the motivation behind the circular practices of manufacturing firms in Turkey. For this purpose, Zorlu Holding is chosen as the study's sample. This study aims to examine the innovative circular economy practices of Zorlu Holding, which was established in Turkey in 1953, has production enterprises operating in many sectors, and is among the top 500 in the Largest Industrial Enterprises ranking (Istanbul Chamber of Industry-ICI 500) with the companies it owns. Moreover, this study follows the Natural Resource-Based View (NRBV) theory as it offers a valuable lens for evaluating the context of the circular organization.

2. THEORETICAL BACKGROUND

The circular economy concept has its roots in industrial ecology, which predicts a type of material symbiosis between different organizations and manufacturing processes (Andersen, 2007) to promote the minimum usage of natural resources and decrease the creation of residuals, as well as adopt clean technologies (Andersen, 1999). The circular economy approach is a promising proposal for sustainable development (Sauve et al., 2016). Jawahir and Bradley (2016) have proposed 6R's model for the circular economy. 6R's model is demonstrated in Figure 1.

Figure 1. 6R's model of the circular economy



Initially, the circular economy relied on the 3Rs principles of recycling, reusing, and reducing. The aim is achieving optimum manufacturing by using minimum natural resources and decreasing pollution, wastes, and emissions by utilizing these principles (Wu et al., 2014). The 3Rs are fundamentally the foundation for green manufacturing derived in the 1990s from lean manufacturing, which is based on Reduce (1R) introduced in the 1980s. However, the present tendency demonstrates that accomplishing sustainable value in production requires transforming from lean to green to sustainable production (Jawair & Dillon, 2007).

Green manufacturing is a significant aspect of a circular economy, a growing trend among industrial manufacturing firms, and 420.433 certifications of ISO 14001:2015 and 21.907 certifications of ISO 50001:2011&2018 all over the World were authorized up to 2021 (ISO Survey 2021). "ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance" and "is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability.ISO 14001:2015 helps an organization achieve the intended outcomes of its environmental management system, which provide value for the environment, the organization itself and interested parties (ISOa)". The aim of ISO 50001: 2011&2018 document "is to enable organizations to establish the systems and processes necessary to continually improve energy performance, including energy efficiency, energy use, and energy consumption. This document specifies the energy management system requirements for an organization. Successful implementation of an energy management system supports a culture of energy performance improvement that depends upon commitment from all levels of the organization, especially top management. This often involves cultural changes within an organization (ISOb)."

Environmental awareness manufacturing, also known as green manufacturing, was presented by the American Society of Manufacturing Engineers (ASME) in 1996. According to the ASME, green manufacturing can be defined as an advanced production approach of comprehensive consideration of resource efficiency and environmental impact, whose aim is to manufacture products throughout the total life cycle from the redesign, remanufacturing, packaging, transportation, reusing of the waste disposal, minimizing the harmful effect on the nature, the highest resource efficiency, and as much as possible to make the waste recycling and harmless, thus allowing the system to accomplish optimal environmental, social, and economic benefits is a crucial manufacturing approach to realize the sustainable development of industrial enterprises. Its connotation is that the product life cycle is all green (Rong & Ling, 2012). Companies attempt to develop eco-innovative products and processes supported by increased energy, resource, and operational efficiency (Dangelico & Pujari, 2010). Green manufacturing bears a broad meaning, and it involves waste reduction, diminishing greenhouse gas emissions (Pang and Zhang, 2019), performing life-cycle assessment (Reich-Weiser et al., 2010), reduction of energy consumption (Leong et al., 2019), and diminishing the carbon footprint (Bhattacharya et al., 2015). Green manufacturing is an economi-

cally centered, system-wide, and integrated approach to reducing and eliminating all waste streams associated with the production, design, use, and disposal of materials and products (Sezen & Çankaya, 2013). It encompasses a green manufacturing plan and adopts the manufacturing technology process and program route with less energy consumption and resources and as little environmental contamination as possible (Gao et al., 2009).

Theoretically, the Resource-Based View (RBV) neglects the interaction between an institution and its natural environment while considering various potential sources and having a more compelling and complete rationale than previous endeavors to explain competitive advantage. For this reason, Hart (1995) developed the NRBV, "it is likely that strategy and competitive advantage in the coming years will be rooted in capabilities that facilitate environmentally sustainable economic activity-a natural-resource-based view of the firm (Hart, 1995, p. 991)." In the context of NRBV, Hart (1995) argues that a conceptual framework comprises "three interconnected strategic capabilities: pollution prevention, product stewardship, and sustainable development."

Table 1 summarizes the strategic elements of NRBV.

Table 1. The Natural Resource Based View: Conceptual Framework

Strategic Capability	Environmental Driving Force	Key Resource	Competitive Advantage
Pollution prevention	Minimize emissions, effluents, & waste	Continuous improvement	Lower costs
Product stewardship	Minimize the life-cycle cost of products	Stakeholder integration	Preempt competitors
Sustainable development	Minimize environmental burden of firm growth and development	Shared vision	Future position

Source: Hart (1995: p. 992).

Three strategic capabilities of NRBV are driven by various forces and lead to crucial competitive advantages. First, the "pollution prevention" strategy deals with the waste control and its minimization by storing, retreating, and re-using it (Ellen MacArthur Foundation, 2015). Within pollution prevention strategy, resource efficiency deals with implementing effective and feasible measures to deal with water, energy and other resources & material, to deal with resource scarcity (Miemczyk et al., 2016). Second, the "product stewardship" strategy goes even further than pollution prevention by expanding its scope to include stakeholder integration in the enterprise's production processes (Hart & Dowell, 2011; Amores Salvado, 2013). Finally, the third strategy, "sustainable development", focuses and deals with its tools beyond "greening," which implies a long-term commitment to market investment and development (Hart, 1995; Hart & Dowell, 2011; Latan et al., 2018; Lucianetti et al., 2018).

A firm can accomplish outstanding performance if it can exploit as well as protect natural resources in its operating environment (Wong et al., 2012). Therefore, to cope with several operating restraints resulting from raising awareness of environmental degradation, proponents of the NRBV suggest that firms consider environmental issues in their strategic planning process (Chan, 2005; Hart, 1995). They further maintain that such incorporation will enhance the skill of companies to deal with uncertainties at the interface between environmental issues and firm operations and help to create competitively valuable organizational capabilities (Banerjee, 2001; Chan, 2005; Hart, 1995).

3. METHODOLOGY

This study adopted the case study analysis method and aims to contribute to the literature from an emerging market perspective by demonstrating, understanding, and inferring the motivation behind the circular practices of manufacturing firms in Turkey. For this purpose, Zorlu Holding is chosen as the sample of the study. This research aims to examine the innovative circular economy practices of Zorlu Holding. Secondary data sources were used in the research. The sustainability reports of the Holding and the publicly available information on the website were used as the secondary data source.

Zorlu Holding was established in Turkey in 1953 and has manufacturing enterprises operating in the energy, textiles, white goods and telecommunications, consumer electronics, property, mining and metallurgy, and other sectors such as air transportation to hotel management in the services field. Zorlu Holding is among the top 500 in the Largest Industrial Enterprises ranking (Istanbul Chamber of Industry-ICI 500) with its own companies. Moreover, Zorlu Holding, which imple-

ments innovative practices for the circular economy, adapts its processes to advanced technologies, develops manufacturing methods with industry 4.0 tools, and adopts digitalization and continuous improvement as a philosophy, has been selected as the appropriate examination unit for the sample of the study.

5. FINDINGS OF THE RESEARCH

Zorlu Holding operates in various sectors and has a structure that includes different group companies. For this reason, selected practices of Zorlu Holding in the circular economy, innovation, and green manufacturing in different sectors are given as examples within the scope of NRBV theory.

Operating in consumer electronics, white goods, and information technologies with more than 16.000 personnel, Vestel, the flagship of Zorlu Group, comprises 29 companies, 13 of which are abroad. Vestel is one the largest white goods and consumer electronics manufacturers in Europe and Turkey. Vestel started producing the initial domestic electric bicycle battery in Turkey. The mechanical designs, software, hardware, production, and testing infrastructure of the batteries are entirely created and performed by Vestel. The batteries provide numerous advantages thanks to their reliability, long-lasting use, and online service. This operation aims to create financial value with bicycle batteries' cost, quality, delivery times, and after-sales services, which are offered to bicycle manufacturers and e-bike system manufacturers. Vestel constantly strives to minimize all adverse environmental impacts with its novel products and aims to boost its Research & Development (R&D) investments toward circular economy-based innovation. Vestel conducts its processes following "ISO 14001 Environment Management System, which is integrated with ISO 9001 Quality Management System and adopted to Total Quality Approach, since 1998, ISO 14064-1 Greenhouse Gases Management System. Vestel has also certified its Energy Management System with ISO50001 since 2012. As of Nov 2, 2015, Vestel Elektronik, one of the publicly traded companies of Zorlu Holding, was included in the Borsa Istanbul Sustainability Index, which includes listed companies with high corporate sustainability performance." Vestel is also two times finalist of the European Environmental Awards. They stated in the Climate Change Report that (Vestel Climate Change Report, 2020: 1):

> "Environmental sustainability is an integral part of our business model. We are aware that our success as Vestel is closely linked to comprehensive management of sustainability issues. With this awareness, we map global risk trends that affect or are likely to affect our activities and manage these risks through a holistic approach which starts at the Holding level. We aim to build a smarter future by putting our planet and the society besides profitability at the core of our "Smart Life 2030" sustainability vision, which we started to implement throughout the Holding in 2019. Smart Life 2030 is developed in line with the 2030 Sustainable Development Goals (the SDGs)."

> "Clothing items made from plastic-based materials shed microplastics during washing, which find their way into wastewater and ultimately to waterways and oceans, causing water pollution and damaging aquatic ecosystems. In response to this challenge, we have developed new washing machines equipped with patent-pending microfiber filtering systems to reduce water pollution. Furthermore, in 2021, we joined APPLiA's Consortium on Microplastics Release to play a more active role in global efforts in this direction" (Zorlu-Akıllı Hayat 2030).

Zorlu Enerji completed its project design to transform Alaşehir-I Geothermal Power Plant into a renewable co-generation plant within the scope of amended local legislation. The company aims to generate 6 million kWh of electricity annually by establishing a 3.58 MW solar power plant within the power plant, which has an installed geothermal capacity of 45 MW. While this generation level will meet the annual electricity consumption of approximately 1,700 households, it will also prevent 300 tons of CO_2 emissions (Zorlu Holding, 2020).

Zorluteks has developed Ecodesign, a new product range that consumes fewer resources thanks to an optimized process. The company tried to optimize its processes by analyzing the production processes used by applying a Life Cycle Analysis (gate to gate) to the products under the Ecodesign umbrella. The analysis concluded that the carbon footprint of products could be reduced by at least 50% compared to the processes used by Ecodesign. A more detailed analysis of the project achievements suggests that the carbon footprint of the process will decrease 1.6 times compared to the conventional pigment printing process and 2 times compared to the conventional reactive printing process. Furthermore, "40% less water will be consumed compared to the conventional rotary printing process. Under the Ecodesign product range produced using less water, energy, and chemicals, many products such as bed linens, tablecloths, and decorative pillowcases will be manufactured" (Zorlu Holding, 2020).

Within the scope of Zorlu Group's innovative regenerative business models developed for green manufacturing, Zorlu utilizes nanotechnology to minimize the footprint of their textile products and reduce water and energy consumption with their self-cleaning roller blinds dust-free curtains. In addition, Zorlu "brings cutting-edge technology to daily life through innovative products, such as light-blocking and thermally insulated, air-cleaning, non-iron curtains, LED curtains, QR code duvet covers, and UV-resistant polyester yarns" (Zorlu-Akıllı Hayat 2030).

Based on the circular economy approach, which is the second pillar of Zorlu Holding's regenerative business model, it is aimed to minimize the use of resources during manufacturing, "design products in a cyclical manner, and transform the economic potential of waste into benefits for the society, the environment", and their business. Therefore, all group firms "protect natural capital through a regenerative model". Furthermore, by adopting an innovation-based business model in their group firms, they implement practices that involve their stakeholders, decrease "the use of resources, bring waste back into the economy, and respond to the climate crisis." Thus, they contribute to establishing sustainable systems with innovative products and services while managing their environmental impact (Zorlu Holding, 2020).

Executed by Zorluteks and 15 partner firms from 11 different countries, the "OXIPRO project aims to develop sustainable products using environmentally-friendly enzymes in the detergent, textile, cosmetics, and food supplements industries based on an interdisciplinary and systemic innovation approach. The project will reduce resource consumption, environmental pollution, and harmful chemical consumption and boost product functionality with the enzymes to be developed equivalent to the chemicals used in the processes." Furthermore, "the immobilization feature of the enzymes to be developed enables the enzymes to be collected and reused after the process." Thus, while supporting reducing production costs, it also contributes to the circular economy (Zorlu Holding, 2020).

Zorlu Enerji "launched the first lot of the sustainability-themed Sukuk Issuance Program (with a total amount of TL 450 million) with an amount of TL 50 million", which was created by the Industrial Development Bank of Turkey (Türkiye Sınai Kalkınma Bankası) in 2020. "This issuance is also Turkey's first sustainable Sukuk issuance and is the first of its kind across the world with its sustainable Sukuk" framework. Organized in line with the 4 essential standards of the International Capital Market Association, this issuance transaction differs from others in that it also includes targets such as "sustainable infrastructure and clean transportation". Furthermore, Zorlu Enerji received a total of 4 awards, two of which are international, with Zorlu Energy Solutions (ZES), the "Electric Vehicle Charging Station Network", which is spreading throughout Turkey and the number of which is increasing day by day. Furthermore, "having been deemed worthy of the Sustainability Awards – Sustainability Product of the Year Award in the international arena, ZES won first place in the Best Sustainable Product and Process Category at the Best Business Awards given by Awards Intelligence" (Zorlu Enerji, 2021).

"Zorlu Gayrimenkul and Zorlu Tekstil continue to improve their environmental, social, and governance performance by putting sustainability at the center in line with the Smart Life 2030 strategy. In line with this approach, Zorlu Center and Zorlu Tekstil documented the electrical energy they use with the International Renewable Energy Certificate (I-REC) in cooperation with Zorlu Enerji. This certificate shows that the energy needs of Zorlu Tekstil Kırklareli Campus, Zorlu Shopping Center, Zorlu PSM, and Raffles Istanbul are covered by the green energy produced by Zorlu Enerji at Alaşehir I Geothermal Power Plant. In addition, we minimize the environmental impact of electric vehicles with the clean energy supplied to ZES electric vehicle charging stations at Zorlu Center" (Zorlu Holding, 2020).

6. CONCLUSION AND DISCUSSION

When the circular economy, innovation, and green manufacturing activities of Zorlu Holding group companies are evaluated within the scope of NRBV, it can be stated that the companies have pioneered work and awards for all three strategies (pollution prevention, product stewardship, and sustainable development). In this context, it has been determined that the circular practices of companies affiliated with Zorlu Holding are essentially intertwined and related. For this reason, it is impossible to make a strategic distinction in the applied examples. It has been seen from the examples examined that each activity both prevents pollution and maximizes the lifetime value of the product by reducing the lifetime production costs of the product and encouraging sustainable development. As a result, Zorlu Holding's activities within the scope of the CE are proactive, innovative, award-winning, and sustainable.

Technological progress may support manufacturing-based industries in getting their targets in the CE context (Rosa et al., 2020). The 4th Industrial Revolution allows countries to usher in a more sustainable production future and counteract the damage done by earlier industrialization. There is a clear need for green manufacturing practices that minimize the use of natural resources and toxic materials and reduce waste and pollutant emissions not to endanger future generations' needs (World Economic Forum, 2018). Furthermore, businesses can produce more economical and creative solutions by combining their strengths in issues such as developing new products or processes or rebuilding supply chain ecosystems through open innovation.

With the CE, while saving will increase, it will be possible to reduce the harmful effects of waste on society. In the long run, employment will increase significantly. There will be positive effects on people's access to resources and less exposure to the unhealthy effects of chemical substances and air pollution. An economic gain will be possible with the increase in employment and waste recycling in the economy. More durable, long-lasting products will find more place in our lives. As a result of all these, the transition to the CE will contribute positively to the creation of new job opportunities, the expectation of a healthy and balanced environment in society, the consumer's awareness of protecting the environment,

the priority of environmental protection, and the change in habits, socio-cultural values, and consumption habits in the society.

In this study, it is recommended that all businesses in Turkey be encouraged to obtain ISO 14001 and ISO 50001 environmental and energy management certificates. Their needs will be determined and supported by the government, professional industry, and trade chambers. In particular, collecting technological wastes from consumers in cooperation with businesses and municipalities can be more effective in recycling and reuse. In addition, it is essential to increase the number and accessibility of the relevant containers for the segregation and disposal of waste. In this regard, training should be given to businesses, suppliers, and households. Besides, regulations regarding waste management should be made. Sanctions can be applied to those who violate the rules and throw waste without separating it. To develop the recycling ecosystem in Turkey, the waste collection system needs to be developed with the cooperation of all stakeholders, both within the scope of consumers, businesses, and municipalities. Therefore, waste management becomes critical to dispose and collect wastes in a clean and segregated manner, to ensure that raw materials are of higher quality and cleaner, and to integrate them into the manufacturing processes of enterprises with less cost and quality. For example, in cardboard recycling, the wet disposal of the material makes it difficult to recycle, or if the plastic is dirty, it does not work. In this regard, raising awareness among consumers and households is essential.

It is recommended for future studies to develop scales to measure the types of innovations made within the scope of the circular economy, to apply these surveys to SMEs and large-scale enterprises, and to develop solutions to establish more green manufacturing methods by examining the differences, trends, and needs by examining them in terms of business size and sector.

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