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Determining Green Transformation Strategies in Businesses Using the SWARA Method

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Abstract

Green economy, which lies at the heart of sustainable development goals, is defined as a low-carbon, resource-efficient economic system that enhances social welfare, highlighting the importance of energy, water, waste management, and biodiversity-based practices. The increasing climate crisis in recent years, fluctuations in fossil fuel prices, carbon regulation mechanisms, and policy frameworks such as the European Union (EU) Green Deal have made it inevitable for businesses to turn to sustainable practices. In this context, organizations need a multidimensional assessment process to identify the most suitable option among various green practices with different environmental and economic impacts. Accordingly, this study utilizes the literature to identify six criteria (green innovation and dynamic capabilities, energy efficiency and resource management, green supply chain and logistics management, legal compliance and corporate governance, social responsibility and stakeholder participation, economic sustainability and operational efficiency) were selected from the literature, and the step-wise weight assessment ratio analysis (SWARA) method, which evaluates the relative importance difference between the criteria based on expert opinions, was preferred as a multi-criteria decision-making method. The results obtained from the analysis showed economic sustainability and operational efficiency as the most important criteria, while social responsibility and stakeholder participation were criteria with relatively lower importance compared to the others.

Keywords: Green economy, Sustainability, Multi-criteria decision-making method, SWARA

1. INTRODUCTION

Increasing environmental issues, climate change, resource scarcity, and societal expectations on a global scale have made it imperative for businesses to adopt sustainability-based strategies. Businesses are evaluated not only on their economic performance but also on their environmental and social impacts. This transformation has reshaped the factors that determine the competitiveness of businesses and made sustainability-focused decision-making processes multidimensional. Therefore, the evaluation of practices developed within the scope of the green economy requires a holistic approach that considers not only environmental impacts but also a broader framework, including innovation capacity, corporate competencies, social responsibility, and economic sustainability. In this context, the six criteria evaluated in this study stand out as factors determining business performance in modern sustainability literature.

Green innovation and dynamic capabilities (K1), one of the key determinants of green transformation, represent businesses' capacity to adapt to environmental changes and their ability to develop innovative sustainability solutions. Teece (2018) states that dynamic capabilities strengthen a company's capacity to produce technological innovations and its strategic adaptability to environmental uncertainties. Green innovation encompasses many areas, such as low-carbon technologies, eco-friendly product designs, and sustainable process improvements, and directly affects companies' long-term competitiveness [1]. Recent studies show that green innovation capacity significantly improves both environmental and financial performance [2].

The second fundamental component of a sustainable business model, energy efficiency and resource management (K2), encompasses the efficient use of natural resources, energy-saving practices, and circular economy principles. Energy efficiency and resource management are fundamental elements in ensuring sustainability within an organization. Businesses can significantly enhance their sustainability efforts by optimizing energy consumption and managing resources effectively. Implementing energy-efficient technologies and renewable energy sources, optimizing resource use, and adopting circular economy principles are critical to reducing environmental impact and achieving sustainability goals [3]. Furthermore, increased efficiency in resource use plays a key role in reducing greenhouse gas emissions and lowering operating costs.

Another key criterion in sustainability-based decision-making is green supply chain and logistics management (K3), which aims to minimize the environmental impact of all processes from raw material procurement to distribution. It is stated that green supply chain practices both reduce the carbon footprint and improve environmental risk management in business processes. Carbon-neutral logistics, environmentally friendly purchasing, the use of recyclable packaging, and sustainable modes of transport are important components of this area. Green logistics is becoming increasingly critical in terms of international competitiveness and is decisive in companies' environmental certification processes [4].

The corporate suitability of sustainability practices, legal compliance and corporate governance (K4) criteria play a significant role in terms of third-party expectations and international regulations. Today, businesses' compliance with environmental regulations and corporate governance standards is seen as an integral part of sustainable strategies. Environmental legislation, carbon reporting requirements, waste management regulations, and international policy frameworks such as the European Union (EU) Green Deal encourage businesses to act more responsibly from an environmental perspective. It is noted that environmental governance practices directly affect corporate reputation, investor confidence, and long-term sustainability performance. Corporate governance requires businesses to implement their environmental policies in a transparent, accountable, and regulation-compliant manner [5].

Another dimension that is increasingly coming to the fore in sustainability efforts is social responsibility and stakeholder engagement (K5). Social impact, employee welfare, local community contribution, and stakeholder communication constitute the social dimension of sustainable development. Parmar et al. (2010) emphasize that stakeholder theory has become an integral part of decision-making processes in current sustainability practices and that businesses' environmental performance is closely monitored by social stakeholders [6]. Recent research shows that social responsibility performance plays a decisive role in businesses' long-term competitiveness and brand value [7].

Finally, the economic sustainability and operational efficiency (K6) criterion, which forms the economic pillar of sustainability approaches, encompasses the objectives of creating cost advantages, optimizing resource use, increasing competitiveness, and ensuring long-term financial stability. Hart and Dowell (2019) demonstrate that environmental sustainability practices do not negatively affect economic performance; on the contrary, they provide long-term efficiency gains [8]. Therefore, economic sustainability is a critical assessment dimension in terms of the applicability of green strategies and the competitive advantage of businesses.

Each of these six criteria represents a different dimension of business sustainability performance and provides a perspective for determining strategic priorities. Therefore, determining the relative importance of the criteria based on expert opinions makes the multi-criteria decision-making (MCDM) process more reliable. The step-wise weight assessment ratio analysis (SWARA) method offers an effective approach to prioritizing green economy applications by enabling step-by-step assessment of the differences in importance between criteria. This study aims to develop a decision support model for sustainability performance assessments by weighting the six criteria using the SWARA method.

2. MATERIAL AND METHOD

The purpose of the SWARA (Step-wise Weight Assessment Ratio Analysis) method is to rank the criteria from the most to the least important. It has been applied in various research contexts across many studies. The following steps describe the SWARA methodological procedure [9–12].

Step 1: s_j represents the scores assigned to the criteria. Decision-makers assign a value of 1.00 to the most important criterion and evaluate the remaining criteria in relation to it. They determine the relative importance of criterion j compared to the preceding criterion $(j-1)$. Scores are assigned in increments of five between 0 and 1.

Step 2: In this stage, the criteria are ordered from the most important to the least important.

Step 3: k_j represents the coefficient values and is calculated as follows:

$$k_j = \begin{cases} 1 & j = 1 \\ s_j + 1 & j > 1 \end{cases} \tag{1}$$

Step 4: The adjusted weights q_j are determined, and q_j is calculated as follows:

$$q_j = \frac{k_{j-1}}{k_j} \tag{2}$$

Step 5: Calculation of the final weights.

$$w_j = \frac{q_i}{\sum_{j=1}^{n} q_j} \tag{3}$$

3. RESULTS

The criteria considered in solving the problem and the expert evaluation table are presented in Table 1 below.

Table 1. Criteria and expert opinions

Criteria	Expert 1	Criteria	Expert 2	Criteria	Expert 3
Green Innovation and Dynamic Capabilities (K1)	–	K4	-	K6	-
Economic Sustainability and Operational Efficiency (K6)	0.10	K2	0.05	K3	0.10
Energy Efficiency and Resource Management (K2)	0.15	K6	0.15	K1	0.20
Green Supply Chain and Logistics (K3)	0.20	K1	0.20	K2	0.25
Legal Compliance and Corporate Governance (K4)	0.25	K3	0.30	K4	0.30
Social Responsibility and Stakeholder Engagement (K5)	0.30	K5	0.40	K5	0.40

Table 2 presents the calculations based on the data obtained from Expert 1. The same procedure was repeated for the other two experts.

Table 2. Criteria and expert evaluations

Criteria	s_j (Relative Importance)	k_j	q_j	w_j (Normalized Weight)
K1	–	1	1	0.2331
K6	0.1	1.1	0.9091	0.2119
K2	0.15	1.15	0.7905	0.1842
K3	0.2	1.2	0.6588	0.1535
K4	0.25	1.25	0.527	0.1228
K5	0.3	1.3	0.4054	0.0945

In Table 3, the average criterion weights were determined based on the score assignments of all experts. The final criterion weights are presented in order of priority.

Table 3. Final criterion weights in order of priority

Rank	Criterion	Expert 1	Expert 2	Expert 3	Average Weight (Arithmetic Mean)
1	K6	0.2119	0.189	0.2456	0.2155
2	K1	0.2331	0.1575	0.1861	0.1922
3	K2	0.1842	0.2174	0.1488	0.1835
4	K3	0.1535	0.1212	0.2233	0.166
5	K4	0.1228	0.2283	0.1145	0.1552
6	K5	0.0945	0.0866	0.0818	0.0876

4. CONCLUSION

This study analyzed the strategic priorities for businesses undergoing green transformation by evaluating six key criteria selected from the literature using the SWARA method. As environmental regulations and global climate crises necessitate a shift towards sustainable business models, determining the relative importance of these strategies becomes crucial for effective resource allocation and decision-making.

The analysis results revealed that economic sustainability and operational efficiency (K6) is the most significant criterion. This finding indicates that for businesses, the transition to a green economy is not merely an environmental obligation but is fundamentally driven by the need to maintain competitiveness, optimize resource usage, and ensure long-term financial stability. It suggests that successful green transformation strategies must be built upon a solid economic foundation that harmonizes profitability with environmental goals.

Green innovation and dynamic capabilities (K1) emerged as the second most important factor. This highlights the critical role of adaptive capacity and technological advancement in responding to environmental uncertainties. Businesses that prioritize low-carbon technologies and sustainable design improvements are better positioned to achieve both environmental and financial performance.

Conversely, social responsibility and stakeholder engagement (K5) was identified as the criterion with the relatively lowest weight. While the social dimension remains an integral part of sustainable development, this result suggests that in the strategic hierarchy of green transformation, experts and decision-makers currently prioritize structural, operational, and economic capabilities over social drivers.

In conclusion, this study provides a decision support model suggesting that managers should primarily focus on investments that enhance operational efficiency and innovation capacity to facilitate a successful green transition. Future research could expand on these findings by applying this model to specific industries or by comparing the results using fuzzy-based MCDM methods to address the uncertainties in expert evaluations.

References

[1] D. J. Teece, “Business models and dynamic capabilities,” *Long Range Planning*, vol. 51, no.1, pp. 40–49, Feb. 2018.

[2] Y. S. Chen, Y. H. Lin, C. Y. Lin, and C. W. Chang, “Enhancing green absorptive capacity, green dynamic capacities and green service innovation to improve firm performance: an analysis of structural equation modeling (SEM),” *Sustainability*, vol. 7, no. 11, pp. 15674–15692, Nov. 2015.

[3] R. S. Pawar and S. Dawkhar, “Strategies for integrating sustainability into business operations,” *International Journal for Multidisciplinary Research*, vol. 5, no. 1, pp. 1–7, Jan. 2023.

[4] H. Buhari, M. S. Basingab, A. Rizvan, M. Sanchez-Chero, C. Pavlatos, and G. Fotis, “Sustainable green supply chain and logistics management using adaptive fuzzy-based particle swarm optimization,” *Sustainable Computing: Informatics and Systems*, vol. 46, art. no. 101119, Mar. 2025.

[5] G. Aras, G. and D. Crother, “Governance and sustainability: an investigation into the relationship between corporate governance and corporate sustainability,” *Management Decision*, vol. 46, no. 3, pp. 433–448, Jan. 2008.

[6] B. L. Parmar, R. E. Freeman, J. E. Harrison, A. J. Wicks, S. Colle, and L. Purnell, “Stakeholder theory: The state of the art,” *Cambridge University Press*, 2010.

[7] M. A. Engin, and Z. Parlak, “Labour standards and corporate social responsibility: The case of Turkish apparel industry,” *Labor History*, vol. 66, no. 2, pp. 243–260, Jun. 2024.

[8] S. L. Hart, and G. Dowell, “A natural-resource-based view of the firm: Fifteen years later,” *Journal of Management*, vol. 45, no. 5, pp. 1469–1495, Sep. 2019.

[9] H. Yurdoglu and N. Kundakci, “SWARA ve WASPAS yontemleri ile sunucu secimi,” *Balikesir Universitesi Sosyal Bilimler Enstitusu Dergisi*, vol. 20, no. 38, pp. 253–270, Dec. 2017.

[10] O. Derse, and E. Yontar, “SWARA-TOPSIS yontemi ile en uygun yenilenebilir enerji kaynaginin belirlenmesi,” *Endustri Muhendisligi*, vol. 31, no. 3, pp. 389–419, Nov. 2020.

[11] T. Sivageerthi, S. Bathrinath, M. Uthayakumar and R. K. A. Bhalaji, “A SWARA method to analyze the risks in coal supply chain management,” *Materials Today: Proceedings*, vol. 50, pp. 935–940, Jun. 2021.

[12] O. Eroglu and C. Gencer, “Classification on SWARA method and an application with SMAA-2,” *Journal* of *Polytechnic Dergisi*, vol. 24, no.4, pp. 1707–1718, Dec. 2021.