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Evaluating the effective factors of sustainable management on company performance

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Abstract

This study aimed to evaluate the factors affecting sustainable management on the performance of 17 industry experts. The data were collected by a questionnaire, and the variables were tested using the DEMATEL and ISM methods. The results showed that business strategies (C01), size of the board of directors (C02), personal motivation and safety (C03), timely delivery (C04), and organizational culture (C09) have strong influence and low influence, which are placed in the area of independent variables. The variables of customer service quality (C05), customer satisfaction (C06), greater brand reputation (C08), and technological capabilities (C11) also had high dependence and little influence, which were dependent variables. The competitiveness variable (C07) has a similar influence and degree of dependence and is a linked variable. Construction quality (C12), external and institutional ownership (C13), skills and attitudes of employees (C14), and operating costs (C15) are also placed in the first quadrant, i.e., the autonomous region.

Keywords: sustainable management, environmental, social, and governance activities, organizational environment, non-financial performance, financial performance
2020 MSC: 68V30

1 Introduction

Environmental pollution is a critical issue in sustainable economic development because of threatening consequences for economic growth and human well-being. Pollution is the leading cause of various negative effects on health, resources, natural disasters, and risks associated with climate change. Environmental pollution can cause damage to nature in multiple ways, such as air and water pollution, noise, and soil pollution. The sources of these pollutions can be due to burning fossil fuels for heating and electricity generation in domestic and industrial sectors. In addition, the amount of greenhouse gases and the emission of waste, dust, and heat increases due to the use of cars and diesel cars, which causes gasoline and oil. Thus, the chemicals create key air pollutants, such as nitrogen dioxide, suspended matter, and sulfur dioxide [5]. The high carbon dioxide emission can be caused mainly by fuel consumption, including coal, oil, and gas. Another source of carbon dioxide emissions is income level, energy consumption, population, and foreign trade [36].

An organization's ability to gain and maintain competitive advantage has become a real challenge Due to the technological, social, political, and environmental changes during the last few decades [12], which lead to more options for customers and change their preferences and demands [39]. Further, increasing consumer awareness of dwindling

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natural resources, pollution of water, air, and soil, and changes in natural climate are forcing companies to adopt environmentally friendly methods and minimize their dependence on fossil fuels, leading to environmental vulnerabilities [26, 40]. Today, dynamic organizations prefer to follow several strategies simultaneously and support the primary strategy with subsequent strategies to achieve the goal of sustainable development (SD) efficiently [1, 41].

Therefore, carrying out responsibilities related to the environment and society in a company has become an essential criterion to determine its sustainability, and studies on sustainability have steadily increased. Although previous studies have contributed to the theoretical development of sustainable management, experimental findings on the relationships between sustainable management activities and financial performance seem relatively limited. For example, Velte [37], Huang [23], and Salem et al. [33] have shown the positive effect of environmental, social, and governance activities on company performance, while [26] have not demonstrated any significant impact of environmental, social, and governance activities on companies' return on capital employed (ROCE). The negative effect of environmental, social, and governance activities on company performance has shown in some studies. Such contradictions in previous studies point to the need to identify critical mediating and moderating variables that affect the relationships between environmental, social, governance, and performance activities. However, little experimental research has been conducted on the specific pathways that positively impact financial performance or the conditions through which firms' sustainable management activities under which the influence of sustainable management activities is enhanced. Companies' sustainable management activities are carried out in various fields, such as environmental, social, and governance. However, previous studies have mainly focused on the impact of the comprehensive implementation level of sustainable management activities by relying on secondary data, such as sustainability reports, which may be due to the inconsistencies in previous studies. Previous studies have been neglected in the context of advanced and emerging economies, although most of the previous studies have been based on samples of companies from advanced countries. Developing countries' political, economic, social, cultural, and institutional systems differ from developed ones. Therefore, applying the results of previous studies to companies in emerging countries can cause problems in practice. Therefore, more studies are required regarding companies in developing countries [27].

Based on the Stakeholder or Legitimacy Theory, Sustainable management activities increase stakeholders' perception of corporate social responsibility, corporate image, and brand value, which increases corporate financial performance. This study examines the role of non-financial performance as a mediator of the relationship between environmental, social, and governance (ESG) activities and financial performance as measured by employee satisfaction level, stakeholder satisfaction level, external image, social reputation, and brand value. Liu et al. [27] investigated the moderating effect of organizational environments on the relationship between ESG activities-non-financial performance-financial performance to assess the effect of companies' ESG activities on financial performance through non-financial performance depending on different institutional pressures. The moderated mediation model is based on institutional theory, which discusses the effects of various institutional environments on the relationship between corporate decision-making or activities and their performance [27]. Some studies have claimed that the reports of sustainability performance indicators are approaching a tipping point and the abundance of frameworks allows disclosure of industry-specific sustainability performance indicators, while there is little experimental evidence to support such claims. The degree of convergence between codes, standards, and frameworks for guiding sustainable organizations needs to be more experimentally evident. The evolution of sustainability performance indicators should be examined over a long period to study convergence and comparison [14]. This study evaluated the trend of sustainability performance indicators on financial and non-financial performance. Many industries are searching for ways to identify, understand, diagnose, improve, and better present their environmental performance. Therefore, environmental factors should be managed efficiently and effectively by optimally working on those activities, products, and services with significant environmental consequences.

2 Research literature

Although industrialization and globalization provide significant achievements for companies and countries, the negative impact of these concepts on the environment has attracted the attention of various interest groups, governments, and international institutions, among others. Thus, environmental sustainability in recent times is no longer optional but mandatory for companies. Baah et al. [6] mentioned an in-depth view of environmental manufacturing as green manufacturing, a vital weapon needed to gain competitive positions and superior performance in current business environments.

According to Govindan et al. [21], green production practices reflect processes that produce ecological goods and services using less energy while conserving natural resources and less pollution, in addition to worker safety and ensuring communities' sustainability. The introduction and implementation of ISO 14001 in 1996 made green manufacturing

practices mandatory. In 1996, this standard was introduced in response to stakeholder demands for environmental protection. Mittal and Sangwan [32] stated that the introduction of environmental production standards had provided benefits in addition to stakeholder pressures, especially from institutional and regulatory stakeholders, to adopt green production practices in developing and developed countries.

Therefore, the massive wave of adoption and implementation of green practices is achieved in various businesses. Eesley and Lenox [18] found that organizational and regulatory stakeholders play a significant role in adopting green practices due to their high impact on organizational survival. Sarkis et al. [35] and Easley and Lennox [18] discussed organizational stakeholder pressures, which significantly drive companies to adopt and implement proactive green manufacturing practices from customers, suppliers, employees, and shareholders. On the other hand, regulatory stakeholder pressures, which force or intimidate companies to adopt reactive green production practices, come from governments, trade associations, other regulatory agents, and the media [35].

According to previous studies, responding to stakeholder pressures provides critical benefits that enhance overall firm performance [18, 32, 35]. Several researchers examined the benefits of adopting quality and environmental practices on overall firm performance from an internal and external perspective using measures that reflect internal and external achievements [28, 34]. In addition, research on the broader range of benefits firms have through greening production practices needs to be more conclusive and mostly related to large firms [6, 7].

Gligor et al. [20] and Centobelli et al. [13] showed that participation in green practices significantly improves competitive positions and performance. Green manufacturing operations depend on various stakeholder groups, including suppliers, customers, shareholders, and government officials. In addition, studies have shown that firm compliance with stakeholder norms and demands leads to more excellent stakeholder support, trust, loyalty, and higher sales, among other financial benefits. Baah et al. [6, 7] claimed that shareholder satisfaction, improved goodwill, and deeper competitive positions had attracted several companies to adopt environmental practices and policies. There is a global demand for green production practices, especially in the manufacturing industry, as this sector significantly contributes to greenhouse gas emissions. However, due to the significant factors of waste generation and high energy consumption, many manufacturing companies operating in developing need to be more concerned about environmental sustainability [4, 6, 7, 13]. However, some companies struggle with the limited capacity of their resources to integrate sustainable practices into business operations, as indifferent as some companies are to environmental needs. On the other hand, developed countries have seen an extraordinary orientation towards environmental implementation due to the early adoption of green production processes and sustainable technologies, which were unavailable in developing countries [15]. Many efforts should be made to maintain environmental sustainability at the global level since wrong actions in one country or continent can negatively impact others [6, 7].

A growing concern has been shown by society in recent years about sustainable development. Many companies publish sustainability information in their annual financial reports, stand-alone corporate responsibility reports, or websites. A KPMG study found that 93% of G250 companies published this type of information and noted that nearly three-quarters of the 4,900 surveyed companies worldwide provide sustainability reports [30]. Previous studies have explained organizations' voluntary commitment to sustainability reporting based on three theoretical approaches. Economics-based theories of disclosure, stemming mainly from the work of Grossman [22], Milgrom [31], Dye [17], and Verrecchia [38] have focused on information asymmetry between managers and investors. Studies by Grossman cite46 and Milgrom [31] have shown that, theoretically, companies should voluntarily disclose all their information. In these studies, investors are urged to interpret non-disclosure as negative information that managers intentionally withhold and evaluate firms. Therefore, managers should be encouraged to voluntarily disclose all relevant information in the value attributed to the firm. However, contrary to Grossman [22] and Milgrom [31], firms and their managers do not always disclose all available information. As a result, various explanations have been offered to justify this non-compliance with the disclosure principle. According to Dye [17], investors must determine the necessary information to ensure a complete disclosure equilibrium can exist. Therefore, in this situation, the managers may not disclose all the information they possess, and the company's value is not affected.

Verrecchia [38] provides another explanation that examines the potential cost of information disclosure and suggests that firms may intentionally withhold information when its disclosure would reduce their future cash flows. As investors cannot determine whether the data is being withheld for good or bad reasons, companies can withhold negative information without facing penalties from investors. Information that is sufficiently positive to justify its publication should be published. Bewley and Li [9] found that firms tend to disclose less when there is significant uncertainty about the information withheld by managers. Moreover, uncertainty arises from external knowledge of environmental exposure and propensity for contamination [14].

Afzal et al. [2] stated that organizational sustainability performance consists of three dimensions that form the basis

of organizational resources and capabilities for companies to configure and implement their strategies to improve their organizational sustainability performance. Managers combine, create, and reconfigure their resources and capabilities into diverse strategies that enable them to achieve sustainability goals. Identified resources and capabilities include organizational culture, employee skills and attitudes, supply chain capabilities, technological capabilities, and business strategies. Liu et al. [27] showed that environmental, social, and governance activities positively affect the financial performance of companies, and the effect of environmental, social, and governance activities on financial performance is entirely mediated by non-financial performance. The results of a moderated mediation analysis further show that the mediation effect varies depending on the level of institutional pressure from the government, consumers, and competitors. Kong et al. [25] showed that customer service-on-time delivery should be considered for a sustainable business. Therefore, policymakers should consider economic and environmental impacts when assigning importance weights to different objectives. Aksoy et al. [3] indicated that foreign and institutional ownership positively affects shaping corporate sustainability performance and show that corporate sustainability performance is positively related to board size and the proportion of independent board members. Studies have revealed that companies with a leading level of corporate sustainability performance have lower returns than companies with an average corporate sustainability performance based on the market-oriented measure and Q-Tobin. Fechete and Nedelcu [19] showed that indicators such as production costs, manufacturing quality, energy consumption, personal motivation, and safety should be considered in evaluating companies' environmental performance.

Duric and Potočnik Topler [16] also showed that indicators might be used and interpreted as guidelines for implementing sustainability-oriented processes from a managerial point of view. Hotel businesses that practice environmentally sustainable development protect the environment and perform better financially. The essential advantages of an environmentally sustainable hotel business are based on: the reduction of negative impacts and preservation of the environment, reduction of operating costs, and efficiency of cost control (especially energy intensive), increase of energy efficiency, greater customer satisfaction, more brand reputation and creating a better image and competitiveness. Public reporting on this business's impacts is also essential to show the public hotels' efforts and contribution to environmental protection, which helps the image and better position in a popular space. The following criteria have been extracted based on the literature review and research background.

Table 1: Identified variables

Researcher	**Variable**
[2]	Business strategies
[3]	Board size
[19]	Personal motivation and safety
[25]	Timely delivery
[16, 25]	Quality of customer service
[16, 25]	Customer satisfaction
[16]	Competitiveness
[16]	More brand reputation
[2]	Organizational culture
[2]	Supply chain capabilities
[2]	Technological capabilities
[19]	Build quality
[3, 27]	Foreign and institutional ownership
[2]	Skills and attitudes of employees
[16]	Operating expenses

3 Method

The researcher did not manipulate the variables and did not create conditions for the occurrence of events, and described the phenomena. The variables of this descriptive-survey research were investigated by selecting a sample representing the statistical population and distributing a questionnaire to examine the concepts. This study aimed to test theoretical concepts in situations of fundamental problems and to solve concrete problems with objective and specific results. In this research, the analysis of previous data (data prepared for topics other than the subject under investigation) provides practical help in defining the problem and the method of approaching the problem. The previous data should be analyzed before the research plan to collect the primary data and identify the main root of a series of behaviors and feedback. A cross-sectional survey research plan was used to collect the data because this research population comprises 17 active managers in ... without samples. For this purpose, the matrix questionnaire of the structural interpretation method was distributed among 17 experts, and then, the leveling of these factors was done using this sequencing technique. Finally, the guiding power and dependence of obstacles are checked using

MICMAC analysis. ISM technique and obtaining internal relationships and priorities of elements in a system should be a process.

3.1 Variables and research model

3.2 Validity and reliability of research model variables

3.3 Identification of criteria

Content validity ratio (CVR) was used to identify criteria, calculated by Lawshe and based on the following relationship:

$$CVR = \frac{n_e - N/2}{N/2} \tag{3.1}$$

In which, N is the total number of experts, and n_e indicates the number of experts who have chosen the necessary option. The opinion of 17 experts was used to ensure the correctness of the selected indicators, based on which the minimum acceptable CVR value was 0.45. The questions with a lower CVR value than the desired value should be excluded from the test because they do not have acceptable content validity based on the content validity index. The results of the content validity of the indicators using the Lawche formula are presented in Table 2.

Table 2: Identification of criteria

Sustainable management criteria	n_e	**CVR**	**Result**
Business strategies	15	0.65	Accepted
Board size	13	0.53	Accepted
Personal motivation and safety	17	1.00	Accepted
Timely delivery	17	1.00	Accepted
Quality of customer service	13	0.53	Accepted
Customer satisfaction	17	1.00	Accepted
Competitiveness	13	0.53	Accepted
More brand reputation	15	0.76	Accepted
Organizational culture	17	1.00	Accepted
Supply chain capabilities	14	0.65	Accepted
Technological capabilities	16	0.88	Accepted
Build quality	14	0.65	Accepted
Foreign and institutional ownership	13	0.53	Accepted
Skills and attitudes of employees	13	0.53	Accepted
Operating expenses	13	0.53	Accepted

4 Evaluating the relationships between the identified criteria

Based on the research model, the next step is to identify the internal relationships of the criteria. The DEMATEL method reflects the internal relationships between sustainable management criteria. Experts could express their opinions more fluently regarding the effects (direction and intensity of impact) between factors. The internal communication matrix shows the cause-and-effect relationship between the factors and the influence of the variables.

4.1 Calculation of direct correlation matrix

First, the opinions of experts were collected. If the RK experts examined the relations of n criteria initial matrix of the examination of the relations of n criteria from the point of view of k experts is as follows:

$$\begin{bmatrix} 0 & X_{12}^{(k)} & \cdots & X_{1n}^{(k)} \\ X_{21}^{(k)} & 0 & \cdots & X_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1}^{(k)} & X_{n2}^{(k)} & \cdots & 0 \end{bmatrix} \tag{4.1}$$

The simple average of the opinions or the view (mode) can be used by using the opinion of several experts. The direct correlation matrix (X) based on the opinion mode of 17 experts is presented in Table 3.

Table 3: Direct correlation matrix

X	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
A1	0	2	4	4	4	1	4	3	0	3	3	0	0	2	2
A2	3	0	4	4	4	3	3	4	2	3	3	0	2	1	3
A3	3	2	0	3	2	2	4	3	0	1	1	0	0	0	0
A4	4	4	3	0	4	3	4	4	0	1	0	0	0	3	3
A5	1	1	1	3	0	3	4	3	2	0	1	0	0	0	0
A6	1	3	1	1	1	0	2	4	3	1	3	3	0	0	0
A7	3	3	4	3	4	4	0	3	4	2	3	4	3	2	2
A8	0	1	0	0	4	4	3	0	4	0	3	2	3	2	1
A9	3	1	3	1	4	4	3	3	0	0	2	2	0	0	0
A10	1	0	1	2	1	3	3	2	0	0	1	1	0	1	0
A11	1	0	1	0	3	4	4	3	0	1	0	0	2	0	0
A12	0	0	0	0	1	2	4	2	1	2	3	0	0	1	1
A13	0	0	0	0	2	4	3	3	0	0	0	0	0	1	0
A14	1	0	1	2	2	1	2	1	0	0	0	0	4	0	0
A15	0	3	0	2	3	1	3	2	0	0	0	0	0	0	0

4.2 Normalization of the fuzzy direct correlation matrix

The sum of all rows and columns is calculated first to normalize the values. The most significant number of rows and columns forms k.

Table 4: Direct correlation matrix

X	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	Total
A1	0	2	4	4	4	1	4	3	0	3	3	0	0	2	2	32
A2	3	0	4	4	4	3	3	4	2	3	3	0	2	1	3	39
A3	3	2	0	3	2	2	4	3	0	1	1	0	0	0	0	21
A4	4	4	3	0	4	3	4	4	0	1	0	0	0	3	3	33
A5	1	1	1	3	0	3	4	3	2	0	1	0	0	0	0	19
A6	1	3	1	1	1	0	2	4	3	1	3	3	0	0	0	23
A7	3	3	4	3	4	4	0	3	4	2	3	4	3	2	2	44
A8	0	1	0	0	4	4	3	0	4	0	3	2	3	2	1	27
A9	3	1	3	1	4	4	3	3	0	0	2	2	0	0	0	26
A10	1	0	1	2	1	3	3	2	0	0	1	1	0	1	0	16
A11	1	0	1	0	3	4	4	3	0	1	0	0	2	0	0	19
A12	0	0	0	0	1	2	4	2	1	2	3	0	0	1	1	17
A13	0	0	0	0	2	4	3	3	0	0	0	0	0	1	0	13
A14	1	0	1	2	2	1	2	1	0	0	0	0	4	0	0	14
A15	0	3	0	2	3	1	3	2	0	0	0	0	0	0	0	14
Total	21	20	23	25	39	39	46	40	16	14	23	12	14	13	12	46

According to Table 4, the largest number is 46, and all values of the direct correlation matrix are multiplied by the inverse of this number to make the matrix normal.

$$K = \max\left\{\max\sum_{j=1}^{n} x_{ij}, \sum_{i=1}^{n} x_{ij}\right\} = 46, \quad N = \frac{1}{46} * X.$$

4.3 Calculation of the complete correlation matrix

First, the same matrix (I) is formed to calculate the complete correlation matrix. Then the identity matrix minus the normal matrix was normalized, and the resulting matrix was inverted. Finally, the normal matrix was multiplied

Table 5: Normalized direct correlation matrix

N	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
A1	0.000	0.043	0.087	0.087	0.087	0.022	0.087	0.065	0.000	0.065	0.065	0.000	0.000	0.043	0.043
A2	0.065	0.000	0.087	0.087	0.087	0.065	0.065	0.087	0.043	0.065	0.065	0.000	0.043	0.022	0.065
A3	0.065	0.043	0.000	0.065	0.043	0.043	0.087	0.065	0.000	0.022	0.022	0.000	0.000	0.000	0.000
A4	0.087	0.087	0.065	0.000	0.087	0.065	0.087	0.087	0.000	0.022	0.000	0.000	0.000	0.065	0.065
A5	0.022	0.022	0.022	0.065	0.000	0.065	0.087	0.065	0.043	0.000	0.022	0.000	0.000	0.000	0.000
A6	0.022	0.065	0.022	0.022	0.022	0.000	0.043	0.087	0.065	0.022	0.065	0.065	0.000	0.000	0.000
A7	0.065	0.065	0.087	0.065	0.087	0.087	0.000	0.065	0.087	0.043	0.065	0.087	0.065	0.043	0.043
A8	0.000	0.022	0.000	0.000	0.087	0.087	0.065	0.000	0.087	0.000	0.065	0.043	0.065	0.043	0.022
A9	0.065	0.022	0.065	0.022	0.087	0.087	0.065	0.065	0.000	0.000	0.043	0.043	0.000	0.000	0.000
A10	0.022	0.000	0.022	0.043	0.022	0.065	0.065	0.043	0.000	0.000	0.022	0.022	0.000	0.022	0.000
A11	0.022	0.000	0.022	0.000	0.065	0.087	0.087	0.065	0.000	0.022	0.000	0.000	0.043	0.000	0.000
A12	0.000	0.000	0.000	0.000	0.022	0.043	0.087	0.043	0.022	0.043	0.065	0.000	0.000	0.022	0.022
A13	0.000	0.000	0.000	0.000	0.043	0.087	0.065	0.065	0.000	0.000	0.000	0.000	0.000	0.022	0.000
A14	0.022	0.000	0.022	0.043	0.043	0.022	0.043	0.022	0.000	0.000	0.000	0.000	0.087	0.000	0.000
A15	0.000	0.065	0.000	0.043	0.065	0.022	0.065	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000

by the inverse matrix:

$$I_{15\times15} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T = N \times (I - N)^{-1}$$

Table 6: Complete correlation matrix

T	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
A1	0.057	0.098	0.142	0.148	0.177	0.116	0.188	0.158	0.050	0.096	0.119	0.035	0.039	0.076	0.074
A2	0.126	0.066	0.151	0.156	0.194	0.174	0.187	0.197	0.100	0.101	0.131	0.043	0.082	0.060	0.099
A3	0.105	0.085	0.048	0.111	0.114	0.111	0.158	0.134	0.042	0.050	0.069	0.030	0.028	0.029	0.028
A4	0.139	0.143	0.127	0.073	0.183	0.157	0.191	0.183	0.058	0.059	0.066	0.039	0.042	0.098	0.098
A5	0.061	0.062	0.064	0.102	0.065	0.127	0.150	0.128	0.082	0.024	0.065	0.031	0.026	0.024	0.023
A6	0.060	0.098	0.064	0.061	0.092	0.074	0.119	0.153	0.104	0.048	0.113	0.093	0.029	0.024	0.024
A7	0.130	0.129	0.155	0.138	0.201	0.204	0.138	0.187	0.146	0.086	0.141	0.129	0.105	0.082	0.079
A8	0.039	0.059	0.043	0.042	0.154	0.161	0.143	0.077	0.127	0.024	0.112	0.076	0.092	0.063	0.040
A9	0.106	0.067	0.111	0.072	0.159	0.161	0.150	0.143	0.047	0.031	0.098	0.076	0.029	0.026	0.025
A10	0.049	0.031	0.052	0.072	0.069	0.111	0.115	0.092	0.031	0.018	0.055	0.045	0.021	0.040	0.017
A11	0.050	0.033	0.054	0.035	0.116	0.143	0.143	0.121	0.039	0.041	0.040	0.030	0.066	0.020	0.016
A12	0.026	0.027	0.029	0.029	0.070	0.095	0.136	0.091	0.052	0.059	0.097	0.025	0.023	0.038	0.035
A13	0.020	0.024	0.022	0.023	0.079	0.124	0.102	0.103	0.031	0.013	0.030	0.023	0.019	0.035	0.011
A14	0.043	0.024	0.045	0.067	0.082	0.064	0.086	0.064	0.022	0.013	0.023	0.016	0.100	0.016	0.013
A15	0.030	0.093	0.033	0.076	0.112	0.070	0.113	0.091	0.032	0.018	0.032	0.020	0.020	0.018	0.020

4.4 Cartesian coordinate graph

Based on the values of the complete correlation matrix, the mutual effects of the elements can be calculated (Table 6): The sum of the elements of each row (D) indicates the influence of that factor on other factors of the system. The sum of the elements of each column (R) shows the influence of that factor on other factors of the system. The

horizontal vector (D+R) is the degree of influence and impression of the desired factor in the system. An agent with a higher D+R value interacts more often with other system agents. The vertical vector (D-R) shows the influence of each factor, and positive D – R indicates a causal variable. However, negative D – R is considered an effect. Table 7 presents the relationship pattern in the causal diagram.

Table 7: The number of mutual effects of sustainable management criteria

Symbol	Criteria	D	R	D+R	D-R
A1	Business strategies	1.573	1.041	2.615	0.532
A2	Board size	1.867	1.039	2.906	0.829
A3	Personal motivation and safety	1.142	1.143	2.285	−0.001
A4	Timely delivery	1.656	1.205	2.861	0.451
A5	Quality of customer service	1.033	1.866	2.899	−0.833
A6	Customer satisfaction	1.156	1.892	3.048	−0.736
A7	Competitiveness	2.049	2.119	4.169	−0.070
A8	More brand reputation	1.252	1.920	3.172	−0.668
A9	Organizational culture	1.302	0.964	2.266	0.338
A10	Supply chain capabilities	0.818	0.681	1.499	0.137
A11	Technological capabilities	0.946	1.191	2.137	−0.245
A12	Build quality	0.832	0.709	1.541	0.123
A13	Foreign and institutional ownership	0.658	0.721	1.379	−0.063
A14	Skills and attitudes of employees	0.679	0.651	1.330	0.028
A15	Operating expenses	0.779	0.602	1.380	0.177

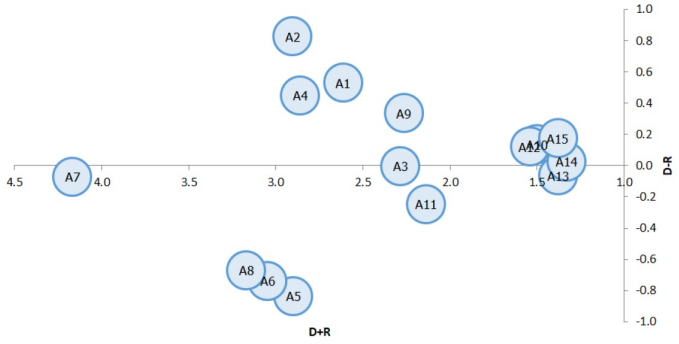

Figure 1: Cartesian coordinates of criteria

4.5 Map of network relationships

A threshold value should be calculated to determine the Network Relationship Map (NRM) to partial relationships and plot the network of significant relationships. Only relationships are displayed in NRM whose values in matrix T are more significant than the threshold value. The threshold value of relationships can be calculated by calculating the average values of matrix T. All T matrix values below the threshold are set to zero, and the causal relationship is not considered. In this study, the threshold value was 0.079.

4.6 Structural self-interaction matrix

In this study, the output of the DEMATEL method (model of significant relationships of sustainable management criteria) is used as the input of the structural-interpretive modeling. The significant relationships in the complete relation matrix are one, and the meaningless relationships are 0.

4.7 Relationships and leveling of dimensions and indicators

The set of outputs and inputs for each criterion should be extracted from the received matrix to determine the relationships and leveling of criteria. The set of outputs and outputs includes the criterion and its affected criteria. Then, the set of two-way relationships of the criteria is determined.

The commonality of the achievement set (influence) and the prerequisite set (impression) should be identified to identify first-level variables. The shared variables of two sets equal to the attainable set are the variables of the first

Table 8: The pattern of significant relationships of sustainable management criteria

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
A1	0	1	1	1	1	1	1	1	0	1	1	0	0	0	0
A2	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1
A3	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0
A4	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1
A5	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
A6	0	1	0	0	1	0	1	1	1	0	1	1	0	0	0
A7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A8	0	0	0	0	1	1	1	0	1	0	1	0	1	0	0
A9	1	0	1	0	1	1	1	1	0	0	1	0	0	0	0
A10	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
A11	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
A12	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0
A13	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
A14	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
A15	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0

Table 9: Set of inputs and outputs to determine the level

	Output: Influence	**Input: Impression**
C01	C02, C03, C04, C05, C06, C07, C08, C10, C11	C02, C03, C04, C07, C09
C02	C01, C03, C04, C05, C06, C07, C08, C09, C10, C11, C13, C15	C01, C03, C04, C06, C07, C15
C03	C01, C02, C04, C05, C06, C07, C08	C01, C02, C04, C07, C09
C04	C01, C02, C03, C05, C06, C07, C08, C14, C15	C01, C02, C03, C05, C07
C05	C04, C06, C07, C08, C09	C01, C02, C03, C04, C06, C07, C08, C09, C11, C13, C14, C15
C06	C02, C05, C07, C08, C09, C11, C12	C01, C02, C03, C04, C05, C07, C08, C09, C10, C11, C12, C13
C07	C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11, C12, C13, C14, C15	C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11, C12, C13, C14, C15
C08	C05, C06, C07, C09, C11, C13	C01, C02, C03, C04, C05, C06, C07, C09, C10, C11, C12, C13, C15
C09	C01, C03, C05, C06, C07, C08, C11	C02, C05, C06, C07, C08
C10	C06, C07, C08	C01, C02, C07
C11	C05, C06, C07, C08	C01, C02, C06, C07, C08, C09, C12
C12	C06, C07, C08, C11	C06, C07
C13	C05, C06, C07, C08	C02, C07, C08, C14
C14	C05, C07, C13	C04, C07
C15	C02, C05, C07, C08	C02, C04, C07

Table 10: Determining the first level in the ISM hierarchy

Criteria	**Commonality**	**Level**
C01	C01,C04,C16	
C02	C02,C16	
C03	C03,C04,C12,C16,C18	
C04	C01,C03,C04,C06,C08,C10,C12,C16,C17	
C05	C05,C12,C14,C15,C17,C18	1
C06	C04,C06,C08,C10,C12,C14	1
C07	C07,C11	1
C08	C04,C06,C08	1
C09	C09	1
C10	C04,C06,C10,C11,C12	
C11	C07,C10,C11,C12	
C12	C03,C04,C05,C06,C10,C11,C12,C14,C15,C17	
C13	C13	
C14	C05,C06,C12,C14,C15,C17	
C15	C05,C12,C14,C15,C17	
C16	C01,C02,C03,C04,C16	
C17	C04,C05,C12,C14,C15,C17	
C18	C03,C05,C18	

level. Then, the variables whose level is known in Table 9 are removed from the whole set and again form the set of inputs and outputs to obtain the level of the following variable.

Therefore, the following are first-level variables: (C05), (C06), (C07) and (C08). The variables of the first level are removed after identification, and the set of inputs and outputs is calculated without considering the first-level

variables. The common set of identification and the variables whose commonality is equal to the set of inputs is selected as the second-level variables. Calculations for determining the second level in the ISM hierarchy are presented in Table 11.

Table 11: Determination of the second level in the ISM hierarchy

	Output: Influence	Input: Impression	Commonality	Level
C01	C02,C03,C04,C10,C11	C02,C03,C04,C09	C02,C03,C04	
C02	C01,C03,C04,C09,C10,C11,C13,C15	C01,C03,C04,C15	C01,C03,C04,C15	
C03	C01,C02,C04	C01,C02,C04,C09	C01,C02,C04	2
C04	C01,C02,C03,C14,C15	C01,C02,C03	C01,C02,C03	
C09	C01,C03,C11	C02		
C10		C01,C02		2
C11		C01,C02,C09,C12		2
C12	C11			
C13		C02,C14		2
C14	C13	C04		
C15	C02	C02,C04	C02	2

The following variables are second-level variables according to the output of calculations for determining the second level in the ISM hierarchy: (C03), (C10), (C11), (C13) and (C15). The variables of the second level are removed to determine the elements of the third level, and once again, the set of inputs and outputs is calculated without considering the variables of the second level. According to Table 12, the common set of identification and the variables whose commonality is equal to the set of inputs is selected as the third-level variables.

Table 12: Determination of elements of the third level

	Output: Influence	Input: Impression	Commonality	Level
C01	C02,C04	C02,C04,C09	C02,C04	3
C02	C01,C04,C09	C01,C04	C01,C04	
C04	C01,C02,C14	C01,C02	C01,C02	
C09	C01	C02		
C12				3
C14		C04		3

According to the output of ISM hierarchy calculations, the third-level variables are: (C01), (C12) and (C14). These variables were removed to determine the elements of the fourth level. Calculations for the determination of level four elements are presented in Table 13.

Table 13: Determination of level four elements

	Output: Influence	Input: Impression	Commonality	Level
C02	C04,C09	C04	C04	
C04	C02	C02	C02	4
C09		C02		4

Variables C12 and C09 are selected as fourth-level elements, and variable C02 is selected as the last-level element.

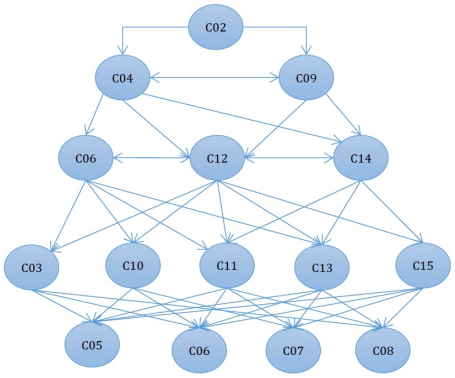

Figure 2: The final research model

4.8 Analysis of influence-dependence power (MICMAC chart)

The interrelationships and influence between the criteria at different levels are well shown in the model (ISM), which leads to a better understanding of the decision-making space by managers. Criteria are formed in the final access matrix to determine the critical criteria of influence and dependency. The power-dependence diagram for the studied variables is shown in Figure 3.

Table 14: Power of influence and degree of dependence of research variables

	Research variables	Degree of dependence	Power of influence
C01	Business strategies	5	9
C02	Board size	6	12
C03	Personal motivation and safety	5	7
C04	Timely delivery	5	9
C05	Quality of customer service	12	5
C06	Customer satisfaction	12	7
C07	Competitiveness	15	15
C08	More brand reputation	13	6
C09	Organizational culture	5	7
C10	Supply chain capabilities	3	3
C11	Technological capabilities	7	4
C12	Build quality	2	4
C13	Foreign and institutional ownership	4	4
C14	Skills and attitudes of employees	2	3
C15	Operating expenses	3	4

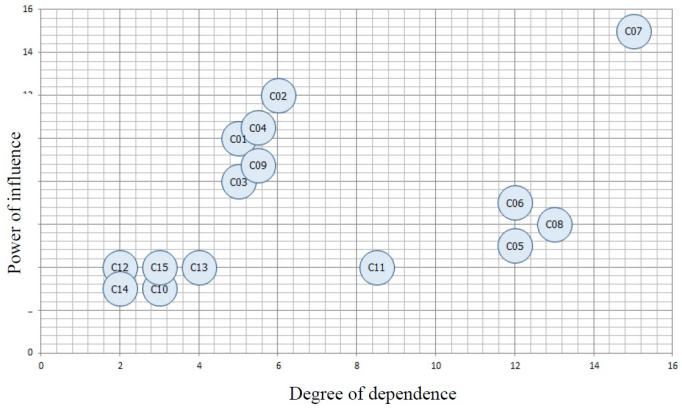

Figure 3: Power of influence and degree of dependence (Mik-Mak output)

A coordinate system can be defined based on the dependence and influence of variables and divided into four equal parts. This research included a group of variables in the motivation sub-group, with a strong influence and low dependence. In the next category, there are dependent variables, which are the product development process results and are less likely to become the basis of other variables.

This analysis divides the variables into four autonomous, dependent, linked, and independent groups.

Autonomous variables: Autonomous variables have a low degree of dependence and direction power, which are generally separated from the system because of weak connections with the system.

Dependent variables: Dependent variables have strong dependence and weak direction. These variables generally have a high impression and little influence on the system.

Independent variables: independent variables have low dependence and high direction. In other words, high influence and low impression are the characteristics of these variables.

Linkage variables: link variables have high dependence and high direction power. In other words, the influence and impression of these criteria are very high, and any small change in these variables causes fundamental changes in the system.

Based on the influence-dependence diagram, the variables of business strategies (C01), board size (C02), personal motivation and safety (C03), on-time delivery (C04), and organizational culture (C09) have high influence and low

impression, which are placed in the area of independent variables. In addition, the variables of customer service quality (C05), customer satisfaction (C06), greater brand reputation (C08), and technological capabilities (C11) have high dependence and low influence and are considered dependent variables. The competitiveness variable (C07) has a similar influence and degree of dependence and is a linked variable. Construction quality (C12), foreign and institutional ownership (C13), employee skills and attitudes (C14), and operating costs (C15) are also placed in the first quadrant, i.e., the autonomous region.

5 Discussion and conclusion

Many organizations in challenging economic conditions have realized that quality improvement is essential for successful global competition [10]. Competitive advantage creates and maintains companies over time as the core of success or failure compared to competitors. Competitive advantage is a unique advantage that helps companies to achieve higher efficiency in an industry. Gaining a competitive advantage leads to the competitive dynamics of companies [24]. Industrial organizations rapidly consume natural resources to produce various products and provide customer services to maximize profits. Unlike the service industry, the manufacturing sector consumes more natural resources and causes more damage to the environment in the form of pollution, especially water and air pollution [40]. This process leads to a continuous increase in the planet's temperature and depletion of natural resources. Several people, such as environmentalists and international institutions, raised their voices to increase awareness about ecological issues and the lack of natural resources, which led to significant pressure on companies to follow sustainable development measures and be more socially responsible [11]. In addition to stakeholder pressure, highly competitive business markets force organizations to direct their operations toward sustainability, differentiation, and cost reduction [29]. In this situation, the resource-based view (RBV) highlights the company's organization, resources, and competencies as enablers of the relationship between sustainable development practices and performance [1]. This study aimed to evaluate the factors of sustainable management on the company's performance.

The results showed that business strategies (C01), board size (C02), personal motivation and safety (C03), on-time delivery (C04), and organizational culture (C09) had a high influence and low impression in the area of independent variables. The variables of customer service quality (C05), customer satisfaction (C06), greater brand reputation (C08), and technological capabilities (C11) also have high dependence but little influence, which are considered dependent variables. The competitiveness variable (C07) has a similar influence and degree of dependence and is a linked variable. Construction quality (C12), foreign and institutional ownership (C13), employee skills and attitudes (C14), and operating costs (C15) are also placed in the first quadrant, i.e., the autonomous region. Sustainability is an area of growing importance in business today and has received much attention over the past decades, affecting company reporting by this trend.

Several challenges, such as global warming, climate change, energy regulations, data protection, resource scarcity, social conflicts, and migrations, force companies to respect the requirements of sustainability management. Changes in the corporate environment result from reshaping investor (and other stakeholder groups) requirements for information. A retrospective orientation solely based on the performance of other financial indicators is not sufficient to provide and maintain long-term business success and competitive advantage and represents the systematic conditional risks and actual costs of applied corporate policies. In recent years, the number of companies reporting the environmental, ethical, and social aspects of their business activities through a specific disclosure form has increased. Sustainability reporting is an essential part of foreign company reporting today. Sufficient inclusion of sustainability issues in company reports is one of the critical issues for the further development of company communication with stakeholders. Previous research by Baker and Pollock [8] has resulted in high corporate reputation and shareholder approval levels because companies are viewed as stable and operating within accepted industry norms, gaining corporate legitimacy. In addition, meeting these stakeholder pressures leads to stronger relationships with regulatory bodies and other stakeholder groups, such as delivering higher environmental and financial performance achievements. Orientation towards green production practices also leads to lower production costs due to efficient use of raw materials, reduced waste, minimal energy use, and reduced or eliminated redundant production processes. These methods ensure minimal pollution by reducing greenhouse gas emissions, significantly decreasing the costs associated with environmental pollution. According to the results of the research, the following suggestions are presented:

Company managers are recommended to consider the factors of the organizational era, including the quantity and quality of employees, company size, company age, company market share, strategic direction, strategic goals, and organizational culture, to develop sustainable management and appropriate investment in these resources. Managers are suggested to try to attract their opinions and innovative ideas by using appropriate communication with employees and creating a supportive environment for sustainable organizational management. The company's managers should

develop sustainable management in the organization, provide appropriate fields for knowledge exchange between the cooperating organizations, obtain updated information, and implement it correctly in the organization.

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