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Article

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Environmental Responsibility, Strategy, and Competitive Advantage: Mediating Effect of Environmental Innovation

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ABSTRACT

This study recognizes that corporate environmental responsibility (CER) can be put into practice in both tactical and strategic ways. Companies often embrace environmental responsibility (ER) as a commitment to the environment as they deal with constraints on their resources while seeking competitive advantages (CAs). Companies are under tremendous pressure to fulfill their social and environmental responsibilities because of accelerating environmental issues. This study uses environmental innovation (EI) as a mediating variable to study the relationship between ER, environmental strategy (ES), and CAs. The study also attempts to understand how EI affects companies' ability to compete. This paper fills the gap in the relevant literature where there is insufficient evidence regarding the practices of ER, ES, eco-innovation (EN), and competitive advantage (CA). This is due to the growing trend of EN and the resulting increase in research interest. A questionnaire was conducted on 45 of the largest local and foreign companies operating in the Republic of Yemen to achieve the objectives of the study. 250 survey questionnaires were distributed. Descriptive and inductive statistics, including structural equation modeling using Smart Plus 4 software, were used to analyze the data. The results of the study showed that the studied companies used EI strategies to a reasonable extent. We discovered a positive effect and relationship between ER and ES, as independent variables, and EI. We also discovered a direct positive effect and relationship between EN and CA. In addition, we concluded that there is a positive influence relationship and a mediating relationship between CA using EI as a mediating variable and ER and ES as independent variables.

Keywords: Environmental Responsibility, Environmental Strategy, Environmental Innovation, Competitive Advantage, Industrial Companies, Smart Plus
JEL Classifications: O30, M10, M19

1. INTRODUCTION

CER, the way companies adopt programs to support environmental protection, has been conceptualized as a strategic business response to the social demands of stakeholders (Phiri et al., 2019; Reyes-Rodríguez et al., 2016). According to this theory, environmental outcomes can only be adopted to meet regulatory requirements, rather than to address environmental issues affecting the company (Berrone et al., 2017). Sustainable development goals often prevent aberrant behaviors that have additional social costs, including ER (Berrone et al., 2017; Ramus and Montiel, 2005). This is due to the fact that these abnormal behaviors are often caused by environmental compatibility. In this article, we argue that EI is a catalytic effect. Indeed, technological developments are increasingly expected to address the climate dilemma because environmental pollution is the main source of these environmental issues (Mitchell, 1989; Mikhaylov et al., 2020; Herndon and Whiteside, 2019; Nwankwo and Ukhurebor, 2019). Environmental regulations were created as a result of promoting industry involvement to effectively solve environmental problems (Heal, 2005; Carrión-Flores and Innes, 2010; Berrone et al., 2013). In other words, encouraging companies to use environmentally friendly industrial measures can enhance

the implementation of CER in the basic sense of EN. (any). So, when can companies consider achieving ER through technology? In fact, academics have mainly studied external institutional pressures such as environmental policies (Berrone et al., 2013), pollution legislation (Wagner et al., 2002), or international environmental standards such as ISO 14000 (Giménez Leal et al., 2003; Wahba, 2008), as well as stakeholder engagement (Wu et al., 2020; Kawai et al., 2018). These studies show how external stakeholders' interest in ER can motivate companies to be interested in developing modern technologies, which may lead to corporate EI (Wu et al., 2020; Kawai et al., 2018). This is because ongoing interactions between a company and external stakeholders influence how well it carries out its ER (Wu et al., 2020; Buysse and Verbeke, 2003). This suggests that EN and CER may be related. Companies seeking a sense of ER tend to choose technical solutions to environmental issues. However, the reality is more nuanced (Lee and Kim, 2017). According to (Lee and Kim, 2017), corporate innovation does not always lead to environmental sustainability because resources are not evenly distributed between CER and EN processes. Combining the two activities improves our ability to address environmental concerns, but companies cannot invest all their resources in both activities simultaneously (Lee and Kim, 2017). Environmental problems are becoming increasingly global in scope. Therefore, CER has gained increasing importance on national and international agendas. Companies in all sectors are under increasing pressure to meet their environmental obligations and implement reforms that improve the environment (Olson, 2008). Moreover, a variety of stakeholders, including governments, NGOs, the local community, and others, are putting pressure on these companies to reduce their harmful environmental impacts (Katsikeas et al., 2016; De Marchi and Grandinetti, 2013; Gupta and Barua, 2018). Managers are under increasing pressure to refocus their approach in a more environmentally friendly way. However, debate about whether and/or when environmental awareness is beneficial remains within the very narrow field of research examining those consequences.

Some studies (Blanco et al., 2009; Clarkson et al., 2011; King and Lenox, 2001; Orsato, 2006; Stefan and Paul, 2008) showed that adopting an ES had a positive impact on company performance and CA, while other studies revealed negative effects. Some studies even fail to show any significant differences in ES and CA. It should be noted that previous empirical research that examined the CA obtained by different companies by adopting environmental strategies focused primarily on companies using general environmental strategies (De Marchi and Grandinetti, 2013; Bıçakcıoğlu, 2018; Fousteris, et al., 2018; Leonidou et al., 2013). It must be emphasized that the degrees of proactiveness of environmental plans vary significantly depending on each company's commitment to environmental activities (Lee and Rhee, 2007; Murillo-Luna et al., 2011). Also, the relationship between levels of ES and companies' CA is still unclear (Bae, 2017; Delmas et al., 2011; Do, et al., 2019; Ge et al., 2018). Understanding the relationship between ES and the CA it produces is crucial for companies to decide whether to pursue this type of ES. Because there are very few studies examining environmental strategies between different sectors and firms of varied sizes, more research that considers industry types and firm sizes as mediating factors is urgently needed. In addition, most previous studies have focused on businesses in developed Western countries, which have distinct managerial perspectives and cultural and organizational foundations from developing Eastern countries (Wright et al., 2005). Despite numerous similar attempts to measure the benefits of environmental initiatives (Leonidou et al., 2015; Wright et al., 2005), there is insufficient empirical evidence from developing markets. Despite numerous similar attempts to measure the benefits of environmental initiatives (Leonidou et al., 2015) this work fills the above gaps by developing and testing a model for understanding environmental strategies and their outcomes, including CA and a firm's environmental performance in an evolving market environment. Taking into account, in particular, the benefits of competition as suggested by (Nadkarni and Narayanan, 2007). The present study also examines the influence of firm size and industry type on ES adoption, as well as ER and EN. The Republic of Yemen is also a major topic in this article because it has become A leader in low-cost manufacturing and supply and a major entry point for exports to other Southeast Asian countries (AlQershi et al., 2021). Recent environmental problems that the Republic of Yemen has had to confront include excessive emissions, poor resource efficiency, and elevated levels of environmental degradation. However, the country As a whole they have a low level of environmental awareness, and companies generally do not have the incentive to adopt an ES (Do et al., 2019). If empirical data on the benefits of environmental measures, such as increasing competitiveness and improving the environmental performance of companies, are provided, it is possible to persuade these companies You adopt her. Concerns about climate change and the impacts of rapid economic growth on environmental degradation have increased over the past few decades (Weng et al., 2015; Papageorgiou et al., 2015). As a result, there is constant pressure on companies to improve their relationships with the environment and implement safety measures. These pressures come from government organizations through public rules and policies, from NGOs through their efforts, and from consumers through their desires because there is convincing evidence that new consumer generations are sensitive to the environment (Ntanos et al., 2018; Ntanos et al., 2020; Skordoulis, 2020). EN is essential for the long-term viability of companies and countries (Weng et al., 2015; Ar, 2012).

Thanks to EN, new goods may focus on providing environmental benefits (Ar, 2012). Eco-product innovation is also seen to improve business efficiency and CA (Ar, 2012). Firms' CA and innovation in environmental processes are linked. EI has a greater impact on CA than financial performance alone, according to quantitative analysis (Ar, 2012). In addition to reducing environmental damage, increasing the quality and cost of goods and services, and creating new jobs, EN can also do these things (Ar, 2012; Ma et al., 2017). According to (De Marchi and Grandinetti, 2013), "all new or modified processes, technologies, systems, and products to avoid or reduce environmental harm" are examples of EN and are sometimes referred to as green innovation or EN. According to studies conducted by (R et al., 2012; Ma et al., 2017), EN can also reduce environmental impact, increase the quality and cost of goods and services, and create new employment opportunities. According to relevant literature, "all new or

modified processes, technologies, systems and products to avoid or reduce environmental damage" (De Marchi and Grandinetti, 2013) is what is meant by EN, sometimes referred to as green innovation or EN. EI can also reduce environmental impact, increase the quality and cost of goods and services, and create new employment opportunities (Ar, 2012; Ma et al., 2017).

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. ER, ES, and EI

When strategizing environmental performances, two conflicting cognitive representations—technology and market—might be revealed as the pluralistic goals in resource allocation procedures (Gavetti and Rivkin, 2007). Businesses devote resources to initiatives that develop technology or new information, in accordance with the technological focus for environmental performance (Al-Swidi et al., 2023, 2024). This promotes the adoption of EI by firms. Businesses might instead focus on markets where they consider brand equity, customer relations, and market standing by responding to environmental challenges or engaging in CER (Manning, 2013). Efforts to produce eco-friendly products, address environmental issues in supply chains, and use natural resources as sparingly as possible are all included in this definition of CER (Kovács, 2008; Al-Hakimi et al., 2022). Even though CER and EI are often departmentalized inside the company and individually specialized (Li et al., 2020; Wu et al., 2020; Kawai et al., 2018), Corporations are unable to make comprehensive investments because of the limited resources available because each option requires consideration. Given that there is a trade-off between the aims, the resource restrictions allow decision-makers to cognitively choose the allocation scheme based on how they evaluate each goal for the firm's overall future worth (Heidenberger and Stummer, 1999). By improving the efficiency and sustainability of corporate operations, EI is expected to have a positive impact on competition (Sharma and Vredenburg, 1998; Chang, 2011). This expectation will encourage decision-makers to continue investing in technical development for environmental concerns when the developed technologies provide economic benefits and the commitment to EI increases. Ironically, fewer market-related activities should be carried out because this self-reinforcing process demands more financial resources (O'Riordan and Stoll-Kleemann, 2015). This demonstrates how resource constraints put a ceiling on how far EI may advance inside a business. Additionally, as CER is continuously needed by society, firms are increasingly seeking solutions to enhance environmental performance in the short term (Wu et al., 2020; Kawai et al., 2018).

Hypothesis (H1) Environmental responsibility positively affects environmental innovation.

Hypothesis (H2) Environmental strategy positively affects environmental innovation.

2.2. EI on the CA of Companies

Over the past 20 years, numerous studies have examined how EI has given companies a CA. Porter's concept suggested that EN may enhance business competitiveness, but more studies have focused on the voluntary creation of eco-labels triggered by legislation (Rexhäuser and Rammer, 2014). ENs may not always have to be unique to the market or industry in which a company competes (Rexhäuser and Rammer, 2014). According to (Rexhäuser and Rammer 2014), these environmental changes can increase resource efficiency, increase revenues, and provide firms with a CA. The positive association between EIs and business CA can benefit both law-driven innovations and personal choice-driven EIs. Since it has been proven that enterprise-led EN is more important, this type of EN will certainly change how Porter's theory influences management practices. However, the decision to pursue EN often depends on other factors, such as government funding, current or future customer needs, or GEPs. Because they stand to benefit from employment stability, technology market protection, and the resulting open EI, governments must address the challenges by enacting legislation to protect intellectual property rights (Matricano et al., 2022). In a pioneering study, Aragón-Correa and Sharma (2003) discovered a link between corporate environmental strategies, CA, and the environment. According to the author, a company's strategy may greatly benefit from incorporating EN. Banerjee et al. (2018) recommend developing environmental conservation strategies in order to gain a CA. Moreover, they argued that companies can improve their financial performance and environmental performance by implementing sophisticated environmental policies. (Lippmann, 1999) investigated the fiscal impact of EN on business success. They found that environmental management and innovation are the most essential elements of CA because they may prevent competing firms from entering emerging green industries and improve entry opportunities. EN is a proactive strategy used by companies to launch subtle changes in the market. An environmental firm's CA may be influenced by EI in environmentally friendly processes and products. Eco-product innovation is positively related to CA, according to (Olaleye, 2023). On the other hand, environmental process innovation is closely related to low-cost advantage and CA. By comparing companies that pursue an environmentally oriented strategy with companies that do not have an environmentally oriented strategy, Wagner and Schulteger (Wagner et al., 2002) were able to collect strong evidence that an environmentally oriented strategy is positively related to a number of aspects of a company's business and CA, including Market-related competition, internal competition, profitability, and risk. According to a more recent study (Fousteris et al., 2018), EN can give companies a CA even in tough times. Moreover, the authors found that even in financially tough times, medium and large companies can integrate EN into their corporate strategy, a move that is linked to their competitiveness in a favorable way (Fousteris et al., 2018). According to the audit report, some environmental interventions or proactive measures are insufficient for a limited period (Aragon-Correa and Sharma, 2003). CA can only be achieved through management's continued use of long-term environmental initiatives. In light of the above, the following theory was developed:

Hypothesis (H3) Environmental innovation positively affects competitive advantage.

2.3. ER and CA

CA, CER, and Green Product Innovation: A Relationship Today's companies have figured out how to embrace modern (i.e.,

environmentally friendly) business methods by dominating their markets in harsh situations. Companies can meet the demands of the competitive world by integrating innovative business strategies with CER activities (Almeida and Coelho, 2019), giving them a clear advantage. Given the RBV, a company views resource capability as a critical tool to maintain performance and gain a CA over competitors (Barney, 1991). Conversely, results show that CER initiatives encourage the creation of differentiated assets, giving businesses a sustainable CA (Valdiansyah and Augustine, 2021). Companies view CER as a core concept that helps them fulfill their obligations to stakeholders such as consumers, employees, and the economic research community. According to the study results (Han et al., 2019), business ER policies generate sustainable growth in the form of CA. By establishing a symbolic bond with a company's stakeholders, organizations gain a CA. (i.e., SMEs) (Nadanyiova, 2021). Sustainability is undoubtedly the core of CA that enables a company to compete in harsh industries. Companies can outperform others thanks to the differential view of RBV. By achieving a sustainable CA, corporate environmental and strategic responsibility initiatives benefit both the company and society. CER is a key differentiator for an organization. CER initiatives give companies a distinct way to stand out from the competition because they place high value on a company's ability to develop distinctive resource capabilities that produce long-term CA (Banerjee et al., 2018). As a result, according to the literature, CER provides a solid foundation for both organizational success and business competitiveness. However, in order to achieve a distinct CA, these environmental concerns have forced companies to improve product innovation by developing distinctive positions (Skordoulis et al., 2020). Research repeatedly shows that GPI enhances business performance by producing long-term CA (Demirel and Kesidou, 2019). Green product innovation encourages companies to launch environmentally friendly goods, making it easier for companies to take advantage of green opportunities and gain a CA in new markets. According to this perspective, research shows that EN enhances the competitiveness of SMEs by addressing the negative effects of environmental vulnerabilities while creating a good impact on society as a whole (Ifrim et al., 2018). As a result, according to the study (Al-Abdullah and Al-Salem, 2021), green product innovation is positively related to CA. Based on the previous results, the hypothesis that was developed is as follows:

Hypothesis (H4) Environmental responsibility positively affects competitive advantage when using EI as a mediating variable.

2.4. ES and CA

Researchers who employ the RBV methodology have examined the relationships between CA and ES. CA is the ability of a business to create "greater net benefits, through superior differentiation and/or lower costs" than its marginal competitors, according to (Peteraf et al., 2003). Al-Khazaf (Porter and Kramer, 1985) stated that "Achieving cost leadership and CA are often inconsistent, because CA is typically costly. However, (Hill, 1988) stated that in order for businesses to gain a sustainable CA, they may need to pursue cost leadership and differentiation projects concurrently. Authors like Molina-Azurin et al. and Leonido and others. Businesses can gain from cheap costs and other CAs by implementing an ES, according to (Molina-Azorn et al., 2015). Hart and Dowell (Hill, 1988) asserts that business resources, particular pollution-reduction capabilities, and sustainable management all support sustainable growth. Make the argument that these environmental abilities can be viewed as unique resources for firms, allowing them to achieve different types of CA, based on the RBV (Hart and Dowell, 2011; Newbert, 2008). Many scholars contend that adopting an ES may have potential CAs in a manner similar to this (Sharma and Vredenburg, 1998; Aragón-Correa et al., 2007). In particular, a company that adopts a proactive ES can exploit its unique strengths to increase its CA, including differentiated CAs (Sharma and Vredenburg, 1998). According to (Molina-Azorn et al., 2015), a superior image/location, higher product quality, better consumer value, and innovation are all examples of differentiating CA. A larger green commitment strategy may foster distinctive corporate images when contrasted to those of rivals (Leonidou et al., 2017; Liu et al., 2015). Additionally, a company may be motivated to innovate and improve the quality of its products in order to produce more environmentally friendly alternatives as a result of substantial developments in its ability and resources for environmental strategies (Bıçakcıoğlu, 2018), giving it a clear advantage over its rivals in the marketplace (Leonidou et al., 2015; Zeriti et al., 2014). (Aragón-Correa et al., 2007 and Blomquist et al., 2015) both note that firms that pursue a proactive ES usually obtain green awards like ISO14001, environmental labels, or certifications that help them stand out in their markets. Therefore, the following was our hypothesis:

Hypothesis (H5) Environmental strategy positively affects competitive advantage when using EI as a mediating variable.

3. METHODOLOGY

ER is defined as "the degree to which a company ensures that environmental concerns that either arise from its business operations are addressed or are otherwise addressed" (Jayachandran et al., 2013). This reveals the extent of awareness and actions taken by companies to address environmental problems that affect them (DesJardins, 1998). CER is assessed in this study. The level of action a company takes to solve environmental problems over a specific period of time is referred to as its environmental strength. In addition, to measure environmental performance with respect to the environment, we collected period-specific binary codes for companies. We combined these two continuous measures of environmental strength and environmental concern in order to understand CER as a company's attitude toward environmental issues. We define environmental strategies in the manner of Li and Rhee (Li et al., 2020) as multidimensional constructs with five aspects: "product," "production process," "organizational system," "supply chain and recovery," and "relationship." In foreign affairs. • Product PR consists of three parts: life cycle analysis, green product marketing, and concurrent green engineering in the context of new goods. • The organizational system was measured by three components, organizational structure, and performance in responding to environmental issues was assessed. The production process (PP) consists of three elements related to pollution reduction practices, green production techniques, and environmental impact assessment procedures in the production process. Three components related to the company's interactions

with key stakeholders were used in developing and implementing environmental plans to operationalize the external relationship. On a five-point Likert scale, each representative who participated in the survey was asked to score their level of implementation for each decision area. Answers ranged from (1) strongly disagree to (5) strongly agree. We looked at how companies build and develop green products over time to identify EN (Cecere et al., 2020).

We particularly consider the creation of patented green products to be an example of EN. Producing environmentally friendly products, ensuring environmentally friendly production, promoting an environmentally friendly industry, adhering to international standards related to its green operations, coming up with ideas and solving difficulties, and enhancing performance are just a few examples in these areas, Cai and Liao We adopted the techniques of researchers others because only a small number of companies provided quantitative data for our study). As previously described in the research methods section, to measure EN based on participants' perceptions. Thus, we consulted a variety of relevant literature to define EN. Many researchers have classified different ENs as described by (Zhang, 2022). We ultimately chose to use the eco-product and process innovation typology in our study because it is widely used in the relevant literature for both EN (Chang, 2011) and the general aspect of innovation (Kafetzopoulos, et al., 2015). We view the former as environmentally friendly and innovative organizational processes based on the metrics, we have used to measure environmental process innovation and environmental product innovation. While the latter are new and environmentally friendly products and production techniques. Studies relevant to this discussion have already identified the components of eco-process innovation and eco-product innovation that we used in our research (Dangelico and Pontrandolfo, 2015). Each strategy ultimately aims to give the company a lasting CA. Although the idea of CA is fundamentally important, there are many approaches that differ significantly from each other, making it impossible to come up with a precise conceptual definition (Sigalas et al., 2013). However, there are primarily two trends. According to the latter, CA can be any factor or reason that motivates a company to perform better than its competitors. The first defines CA as a company's ability to impose favorable terms in trade. These patterns show that performance improvement and the concept of competitiveness are strongly intertwined. We believe that a company's CA determines its position in the market based on the study presented above. Focused his research on how ES affects companies' ability to compete in specific industry sectors, and the environmental competitiveness factors we also used in our study came from principal components analysis. Hence, the current study can adopt their definition of environmental competitiveness. From April to June 2023, we developed the questionnaire, evaluated it, distributed it, and waited for the results. Among the participants were representatives of major industrial companies in the Republic of Yemen dedicated to ER and EN. These companies use environmental methods. Because this probability sampling technique enables researchers to obtain data from a reasonably representative group of administrators, employees, and workers, systematic and stratified sampling was used (Wishart et al., 2018). In addition, it ensures that every eligible organization has an equal opportunity to be represented in the survey. Large industrial companies that participated in the CA and EI Assessment Program constitute the sampling frame, and sustainability reports were generated for these companies either as separate reports or as parts of annual reports that include data on sustainable development (Yemeni Ministry of Industry and Trade, 2010). The industrial companies under study that voluntarily registered and had the ES, ER, and EI to participate in the assessment were considered environmental companies adopting environmental strategies with the highest level of commitment to all areas of environmental decision. 45 large industrial companies agreed to this study. Please participate in completing the survey in 2023 and do so responsibly and honestly. We sent the questionnaire to business leaders or operations/marketing/HR managers with an introduction statement explaining the nature and objectives of the study and requesting their informed permission. We followed up with participants by phone or email after sending the survey to persuade them to complete it. A total of 250 questionnaires were distributed, of which 234 were returned, resulting in a response rate of 93.6 percent. Figure 2 shows information on the size of the companies included in the study and the type of industry.

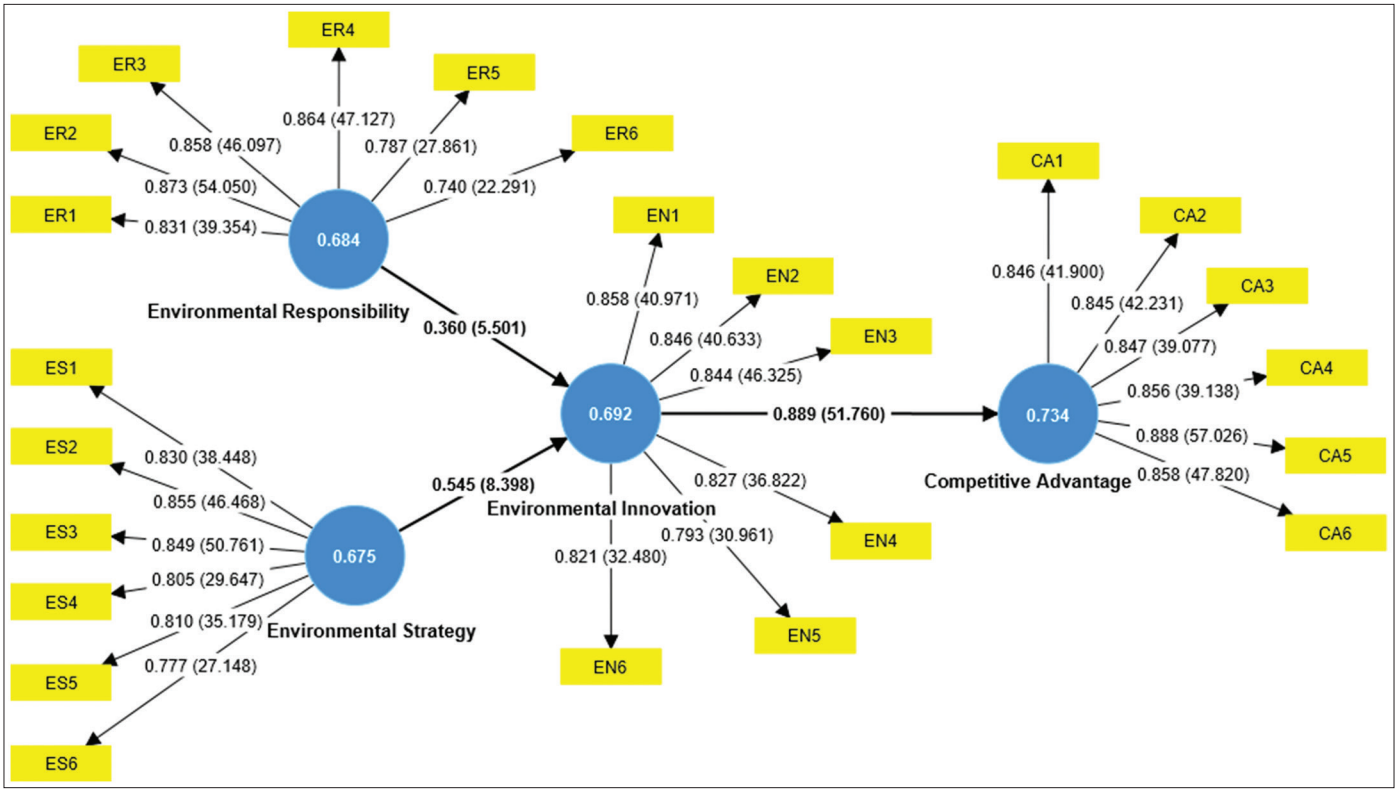
Using structural equation modeling (SEM) methodology, the model depicted in Figure 2 was empirically validated in this study (Bou-Llusar et al., 2009). In order to confirm that the four combinations of variables that made up the observed model were one-dimensional, factor analysis (PCA) was first performed to statistically test the validity of the aforementioned model (Kingir and Mesci, 2010). Table 1 displays the results for B-factor loading and variance ratio values explained by a one-dimensional factor. Confirmatory factor analysis (CFA) was conducted on the control or measurement model to establish the validity and reliability of the test model. The findings, which are also included in Table 1 , reveal that most variables have significant levels >0.05, demonstrating the statistical validity of the test model values. Additionally, the t-test outcomes, which were used to test the null hypothesis that the sample and population are identical, regularly provide values higher than 2 (He, 2006). In research models, Cronbach's alpha is used to evaluate the consistency of variables within particular latent groupings (Cronbach, 1951). The resulting Cronbach's alpha values, which are more than 0.7 (Table 1), show that several variables within four specific latent groupings of the model under test coexist well. All four groupings of variables' Cronbach's alpha values are more than 0.9, so, it is possible to assess the suggested model using the data (Bou-Llusar et al., 2009). Equation modeling (SEM) was used to compare pairs of latent question sets that were included in the measurement model in order to evaluate the discriminatory validity of various question sets. The Table 4 displays the findings for discriminating validity and correlations among the four sets of questions. SEM correlations and Pearson coefficients show a correlation score of 0.873 for the independent

Figure 1: The variables and dimensions of the study

Table 1: Factor analysis (EFA) and the confirmatory factor analysis (CFA)

Construct	Element	Factor analysis (EFA)		Confirmatory factor analysis (CFA)		
		PCA		Reliability	Convergent validity	
		Factor loadings	% of variance explained by a factor of unidimensionality	Cronbach's alpha	Factor loading b	T values
ER	ER1	0.831	74.842	0.907	0.830	39.354
	ER2	0.873			0.872	54.050
	ER3	0.858			0.858	46.097
	ER4	0.864			0.864	47.127
	ER5	0.787			0.786	27.861
	ER6	0.740			0.738	22.291
ES	ES1	0.830	76.267	0.903	0.829	38.448
	ES2	0.855			0.854	46.468
	ES3	0.849			0.848	50.761
	ES4	0.805			0.804	29.647
	ES5	0.810			0.809	35.179
	ES6	0.777			0.776	27.148
EI	EN1	0.810	76.518	0.911	0.857	40.971
	EN2	0.852			0.844	40.633
	EN3	0.875			0.843	46.325
	EN4	0.865			0.825	36.822
	EN5	0.861			0.791	30.961
	EN6	0.847			0.820	32.480
CA	CA1	0.846	76.745	0.927	0.845	41.900
	CA2	0.845			0.843	42.231
	CA3	0.847			0.845	39.077
	CA4	0.856			0.854	39.138
	CA5	0.888			0.887	57.026
	CA6	0.858			0.857	47.820

Figure 2: The PLS algorithm of the measurement model. Factor analysis (EFA) and the confirmatory factor analysis (CFA)



variable indicating ER. With the lowest score or value on this axis being 0.740, the remaining values or scores are situated between these two numbers. The ES, the second independent variable, had a maximum value of 0.855 and a minimum value of 0.777. The greatest score or value for the mean variable that assesses EI is 0.875, the lowest score is 0.810, and the rest scores fall between these two values, according to the results of SEM correlations and Pearson coefficients. The dependent variable, which measures

Figure 3: The PLS algorithm of the measurement model. % of variance explained by a factor of unidimensionality. The second model for analyzing is Smart Plus

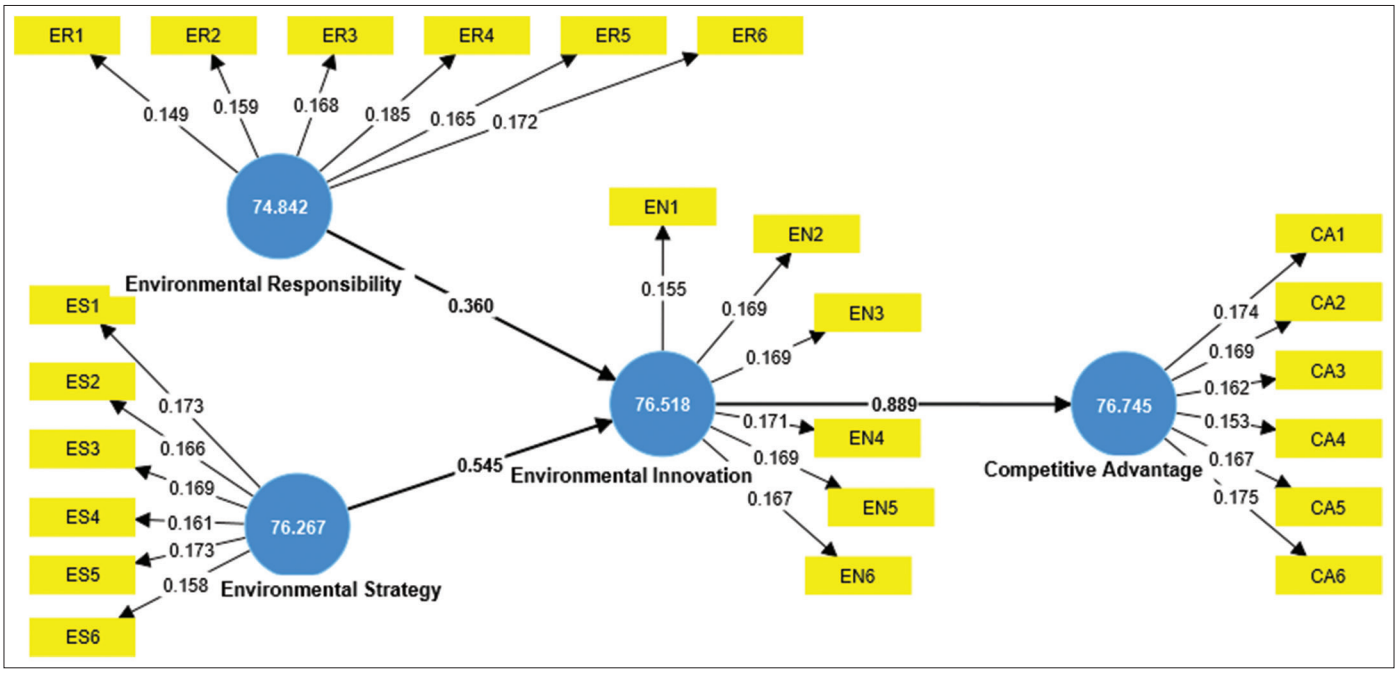


Table 2: Cross loadings

Study variables	Items	ER	ES	EI	CA
ER	ER1	0.831	0.686	0.668	0.676
	ER2	0.873	0.692	0.670	0.699
	ER3	0.858	0.725	0.708	0.745
	ER4	0.864	0.764	0.710	0.768
	ER5	0.787	0.646	0.636	0.671
	ER6	0.740	0.638	0.659	0.699
ES	ES1	0.727	0.830	0.758	0.765
	ES2	0.706	0.855	0.726	0.734
	ES3	0.703	0.849	0.699	0.697
	ES4	0.660	0.805	0.648	0.671
	ES5	0.647	0.810	0.662	0.672
	ES6	0.683	0.777	0.675	0.667
EI	EN1	0.669	0.726	0.858	0.750
	EN2	0.650	0.677	0.846	0.745
	EN3	0.703	0.681	0.844	0.724
	EN4	0.656	0.675	0.827	0.717
	EN5	0.685	0.710	0.793	0.698
	EN6	0.714	0.755	0.821	0.797
CA	CA1	0.743	0.717	0.777	0.846
	CA2	0.724	0.717	0.747	0.845
	CA3	0.702	0.721	0.736	0.847
	CA4	0.749	0.738	0.762	0.856
	CA5	0.760	0.763	0.782	0.888
	CA6	0.739	0.739	0.765	0.858

CA, has scores that lie within these two ranges and a maximum score or value of 0.888. Additionally, it was discovered that EI and responsibility for the environment had the lowest association between the study's variables, with a correlation coefficient of 3.360. EI as a mediating variable and CA as a dependent variable had the highest correlation (0.889). ES and EI also have a link and impact score of 0.545. The relationships between ER, ES, and CA as a dependent variable are all positively skewed (statistically significant), and EI mediates these relationships. Since it was established that the statistical reliability of the data was sufficient,

Table 3: Construct reliability and validity

Items	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ER	0.907	0.908	0.928	0.684
ES	0.903	0.905	0.926	0.675
EI	0.911	0.911	0.931	0.692
CA	0.927	0.928	0.943	0.734

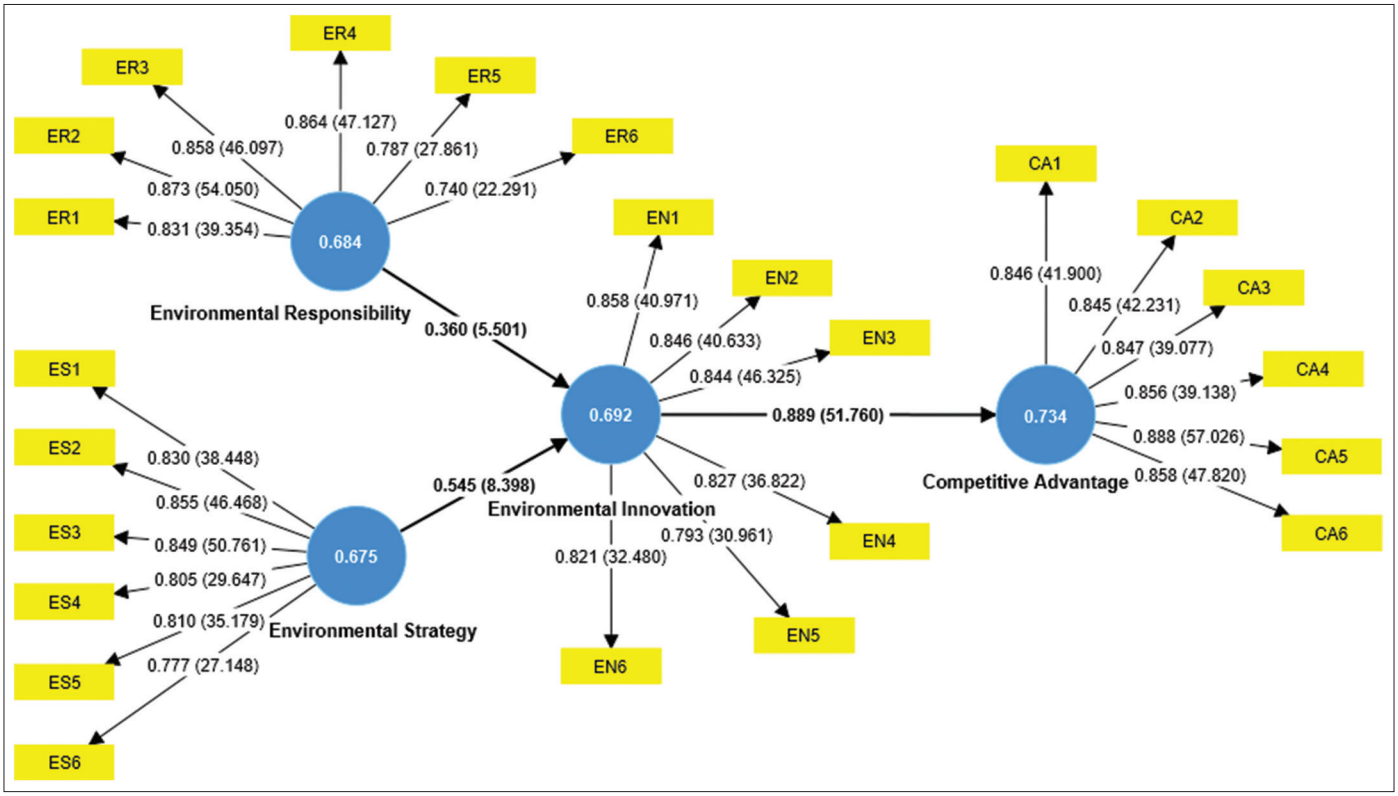
Table 4: Discriminant validity (HTMT)

Items	CA	EI	ER	ES
CA				
EI	0.966			
ER	0.937	0.899		
ES	0.932	0.931	0.924	

LISREL v.16 software was used to process the statistical data for model validation in Figures 2 and 3. The indicators' initial values, which were used to gauge how well the suggested model matched the entered model, were generated. The table displays the findings from a study of pertinent indicators. The Quality of Fit Index (GFI) evaluates how well a model fits data when compared to no model. A GFI value greater than 0.90 indicates a strong match (Molina-Azorín et al., 2009). The GFI number in this instance, 0.56, is below the minimum. A greater GFI value would most likely result from a larger statistical sample size. The misfit for each degree of freedom is determined by the root mean square error of approximation (RMSEA) index. A decent RMSA value is present in the range.

Figure 4 illustrates a pattern of the moderating effects of control-oriented culture and the relationship and degree of influence between ER, ES, EI, and CA. Figure 5 shows that for there to be a strong relationship between ER, ES, and EI and CA, there needs

Figure 4: The PLS algorithm of the measurement model



to be a culture within industrial organizations that is supportive of these concepts. The results also showed that an environment that values ER, ES, and EI strengthens the relationship between ER, environmental advantage, and EI and CA. The cross-loading of the structures is then examined to see whether elements are more heavily loaded on the structures with which they are associated than on other structures (Chin, 1998; Reich et al., 2003). Each element loaded its own build far more frequently than the other builds, as seen in Table of the results. The results of the investigation further highlight how fussy the measurement strategy is.

The PLS smart measurement assessment model was used in this study to carry out structured equations modeling. The measurement model's convergent and discrete validity, as well as its constructive reliability, were evaluated. Construct reliability was reached on the questionnaire, as shown by the results in Table 2 (Cronbach's alpha and composite reliability (CR) values are higher than 0.7 (Kannan and Tan, 2005) (Werts et al., 1974). In each instance, the Cronbach's alpha value was (0.907, 0.903, 0.911, 0.927), the composite reliability values (rho_a) were (0.908, 0.905, 0.911, 0.928), the composite reliability values (rho_c) are summed as follows: (0.928, 0.926, 0.931, 0.943). All reliability values are (>0.5), and the average variance extracted (AVE) is (0.684, 0.675, 0.692, 0.734). Additionally, the indicator's factor loading values are more trustworthy than the suggested value (0.5) (Figure 2). (Rigdon et al., 2010; Hair et al., 2017) Convergent validity was satisfied because the mean extracted variance (AVE) values were more than 0.5, as shown in Table 1 (Babin and James, 2010). Additionally, discriminant validity is met. The associations between the variables are greater than the AVE values in bold in Table, according to the Fornell-Larcker criteria (Fornell and Larcker, 1981).

Table 5: Fornell-Larcker criterion

Items	CA	EI	ER	ES
CA				
EI	0.857	0.832		
ER	0.889	0.818	0.827	
ES	0.860	0.848	0.838	0.822

Table 6: Path coefficients

STDEV, T values, P values				
Relationship	**Beta**	**T statistics (|O/STDEV|)**	**P-values**	**Decision**
ER -> EI	0.360	5.501	0.000	Supported
ES -> EI	0.545	8.398	0.000	Supported
EI -> CA	0.889	51.760	0.000	Supported

(Chin, 1998) and (Chin et al., 2003). Furthermore, each construct's AVE is clearly above the 0.5 cutoff point, at values exceeding 0.70. The aforementioned findings show the measurement model's strong convergent validity, claim (Pavlou and Fygenson, 2006). Discriminant validity is also evaluated to gauge how well items distinguish between constructs. We then examine the relationships between the constructs to see whether the correlation between a construct and other constructs is greater than the square root of the average variance derived from each construct (Chin, 1998; Reich et al., 2003). Table 4 shows that each construct's square root of the AVE is significantly higher than the correlation of that construct with other constructs, proving the requisite discriminant validity of the measuring model. The cross-loadings of the constructs are the next thing we examine to determine whether anything loads more heavily on its connected constructs compared to the other constructs (Chin, 1998; Reich et al., 2003). Each item loads

significantly more on its particular construct than on the other structures, as shown in Table 6. The investigation's findings further show how highly discriminating the measuring model is.

The results of the Fornell-Larcker criterion for discriminant validity are shown in Table 5, where the bolded values indicate square roots of AVEs on the diagonals that are greater than correlations between constructs (represented by the corresponding row and column values). Given that the constructs are more intricately connected with their respective indicators than other model constructs are (Fornell and Larcker, 1981; Chin, 1998), this shows that the constructs have excellent discriminant validity (Hult et al., 2017) ((Tatham et al., 2017). The correlation between exogenous components is also smaller than 0.88 (Awang, 2014). As a result, the discriminant validity of each construct is met.

Evaluation of the structural model: The t-values of the supported hypotheses of the study are more than 1.65, as shown in Table 6. As a result, all theories were confirmed and approved. The hypothesis has a clear relationship to current research. The first hypothesis, which is that ER positively affects EI, is accepted, and supported (beta value = 0.360; T = 5.501; P < 0.05), which indicates a positive effect between the two variables. The relationship between ER and EI is also positive, as (beta value = 0.360) is positive. The second hypothesis is that ES has a positive effect on EI (beta value = 0.545; T = 8.398; P < 0.05), which means that the hypothesis is accepted and supported, which indicates that there is a positive effect between ES and EI, and that the relationship is positive between ES. EI (beta value = 0.545) is positive. With reference to the third hypothesis, which states that EI positively affects CA, the study showed that EI positively affects CA, as (beta value = 0.889; T = 51.760; P < 0.05), which indicates a positive effect between EI and advantage. Competitiveness: The relationship between EI and CA is positive, as (beta value = 0.889) is positive.

Structural Model Evaluation the t-values for the supported hypotheses of the study are more than 1.65, as shown in Tables 6 and 7. As a result, all theories were confirmed and approved. Hypothesis is now intricately linked to investigation. The fourth hypothesis was accepted, which states that ER positively affects CA when using EI as a mediating variable. The hypothesis was accepted and supported as (beta value = 0.321; T = 5.422; P <

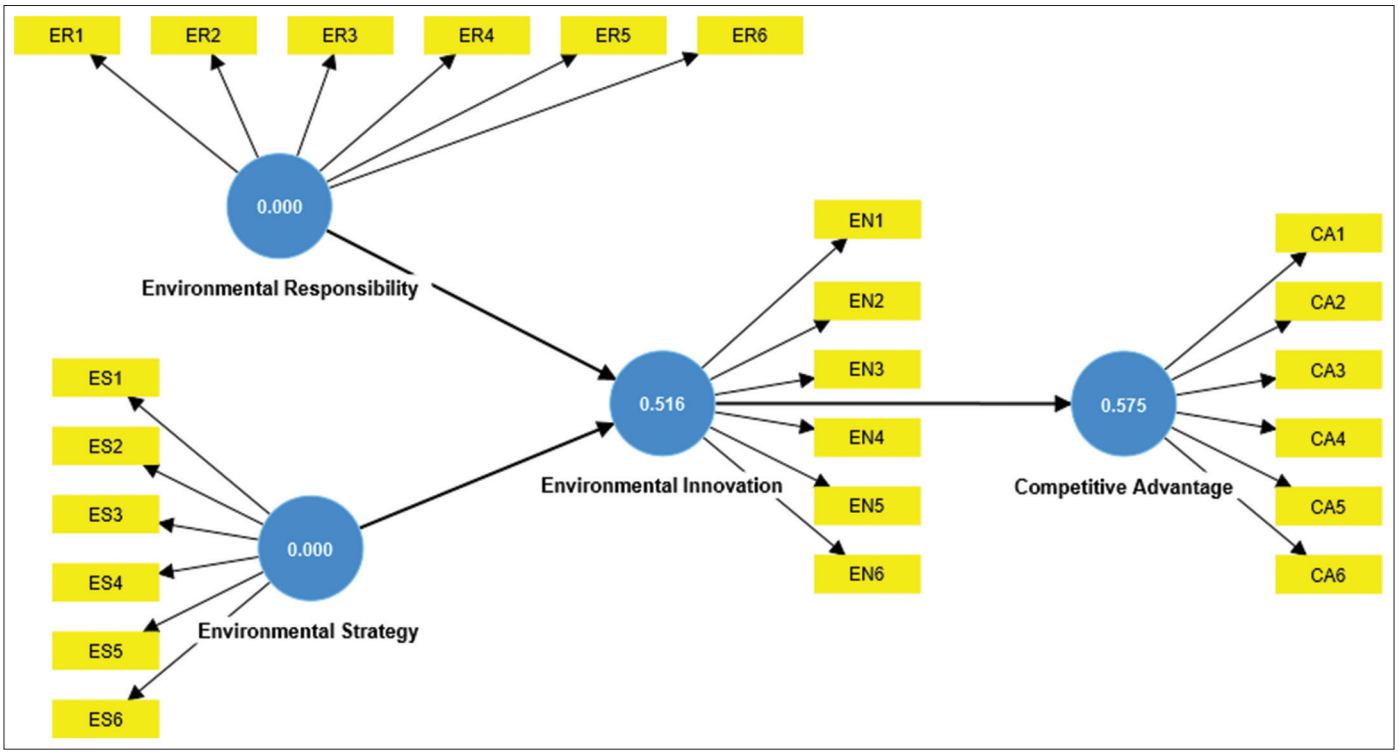
Table 7: Total indirect effects

Relationship	Beta	T statistics (|O/STDEV|)	P-values	Decision
ER -> CA	0.321	5.422	0.000	Supported
ES -> CA	0.485	8.183	0.000	Supported

Table 8: Total effects and values R^2, f^2, Q^2

Relationship	Beta	Error	2.5%	97.5%	T	P values	Decision	R^2	f^2	Q^2
ER -> EI	0.360	0.066	0.228	0.485	5.501	0.000	Supported		0.159	
ES -> EI	0.545	0.065	0.418	0.673	8.398	0.000	Supported		0.364	
EI -> CA	0.889	0.017	0.849	0.917	51.760	0.000	Supported	0.791	3.785	0.575
ER -> CA	0.321	0.059	0.201	0.435	5.422	0.000	Supported	0.757		0.516
ES -> CA	0.485	0.059	0.369	0.603	8.183	0.000	Supported			

Figure 5: The PLS algorithm of the measurement model



0.05), and the relationship is positive between ER and advantage. Competitiveness, as (beta value = 0.321) is positive. With reference to the fifth hypothesis, which states that ES positively affects CA when EI is used as an intermediary variable, the study showed that ES positively and indirectly affects CA, as (beta value = 0.485; T = 8.183; P < 0.05) That is, the hypothesis was accepted and supported, and the relationship between ER and CA is positive, as (beta value = 0.485) is positive.

Structural Model Evaluation Given that the hypotheses supported for the study have t-values >2, Table 8 clearly shows the direct and indirect effect and the direct and indirect relationships between the study variables. All theories have been verified and approved as a result; This leads to the first hypothesis of the research, which states that ER positively affects EI, which has a positive effect while (beta value = 0.360; T = 5.501; P < 0.05), and the relationship is positive between ER and EI, which indicates that the first hypothesis is accepted and supported. The results support the second hypothesis that ES positively affects EI, as the study proved that there is a positive effect between them as (beta value = 0.545; T = 8.398; P < 0.05), which indicates that the second hypothesis It is accepted and supported, and the relationship is positive between ES and EI. As for the third hypothesis, which states that EI positively affects CA the study showed that EI positively affects CA, as (beta value = 0.889; T = 51.760; P < 0.05 Which indicates that there is a positive effect between EI and CA, just as there is a positive relationship between EI and CA. The fourth hypothesis was accepted, which states that ER positively affects CA when using EI as a mediating variable. The hypothesis was accepted and supported as (beta value = 0.321; T = 5.422; P < 0.05), and the relationship is positive between ER and advantage. Competitiveness. With reference to the fifth hypothesis, which states that ES positively affects CA when using EI as an intermediary variable, the study showed that ES positively and indirectly affects CA, as (beta value = 0.485; T = 8.183; P < 0.05) That is, the hypothesis was accepted and supported, and the relationship is positive between ER and CA.

When considering evaluation (R2), effect size (f2), and predictive significance (R2), the coefficient of determination (R2) describes the amount of variance due to all exogenous causes in the endogenous variable. In addition, Reference (Hair et al., 2017) provided cut-off values for the appropriate parameter for selection values such as 0.75 strong, 0.50 moderate, and 0.25 weak. The results in the table show that the coefficient of determination had a small degree of predictive accuracy. The relationship between EI as an intermediary variable and CA is linked to the R2 coefficient, and the R2 result was 0.791, which is a positive and significant result because it is higher than 0.75. Because it is higher than 0.75, the R2 result for the association between ER and CA was 0.757, which is a significant result. Effect size measures the effect of omitted exogenous variables on latent endogenous variables. In the model under study, the difference in (R2) between the main effects appears when any specific exogenous variable is either present or absent (Hair et al., 2013). Threshold values range from 0.02, 0.15, and 0.35 for medium, high, and weak relationship sizes, respectively, to measure the relationship size for a given model. The current study revealed a significant relationship between the models under consideration. Exogenous variables have predictive significance to variables endogenous to the model if the level of acceptance of predictive significance (Q2) is more than 0 (Hair et al., 2017). Table 6 shows that as a result, Q2 = 0.575 and Q2 = 0.516 are both positive integers. The present study model has sufficient prognostic significance as a result.

4. CONCLUSIONS

Our findings show a positive relationship between ER and EN. Our research findings support the body of knowledge on corporate EN and ER from a resource-based perspective with a business focus (Gallegolvarez, et al., 2022; O'Riordan and Stoll-Kleemann, 2015). When deciding how to allocate their resources, companies favor one area over another, according to the literature. In particular, we can emphasize that it is up to the company to decide whether to invest in ER or better fit how the market perceives environmental performance (Dierickx and Cool, 1989; Teece, 1998). Because environmental standards are complex and levels of ES activity vary between countries and companies, the effects of environmental strategies must be taken into account in a variety of circumstances (Henriques and Sadorsky, 1999; Darnall et al., 2010). Research on ES and its impacts in developing markets is sparse (Yol Lee et al., 2007). Our analysis highlights the CA provided by the environmental approach. Environmental approaches can be considered dynamic skills that increase CA. According to our understanding, this study is one of the first to examine the relationship between environmental strategies and CA. The first conclusion is that implementing an ES can lead to CA. This assertion builds on previous research in this field (Junquera and Barba-Sánchez, 2018; Leonidou et al., 2015) and provides empirical evidence in favor of the assertion that corporate ES is positively related to CA (Aragón-Correa and Sharma, 2003). Given the direct relationship between environmental goals and CA, our research shows how ES can give companies a distinct market position. It is important to note that our study advances knowledge about environmental sustainability by integrating environmental strategies as multidimensional entities. Yemen is a growing country that is increasingly industrializing but its awareness of environmental issues is limited. Our first finding, related to the environment (Do et al., 2019), provides Yemeni companies with a compelling case for implementing environmental strategies to protect the environment. The second result is that there is a positive and indirect relationship between ES and the CA that companies can gain by putting the plan into practice. We have concluded that developing environmentally friendly products and innovating environmental processes is essential to achieving CA. More specifically, we see that the higher the values of environmental process and product innovation, the greater the value of CA (Weerawardena and Mavondo, 2011). The results of our study are consistent with several previous research (Wagner et al., 2002; Dangelico and Pontrandolfo, 2015; De Marchi, 2012 Aragón-Correa, 1998; Dangelico and Pontrandolfo, 2015; De Marchi, 2012). Analyzed using Smart Plus. We have observed a strong relationship between EN and the CA of large industrial companies in other countries. In this research, there is no evidence of a dual causality problem. Additionally, our data shows that creating a CA is statistically influenced by industry and business size. This conclusion can be adequately supported by the fact that our sample, similar to the examples of environmental processes and

product innovation described above, consists of large-sized firms. We incorporated a mediator variable into our statistical analysis to help better understand the relationship between ER and ES on the one hand, and CA on the other. The final model included this variable because it was statistically significant for the external data set and because it was related to CA. This conclusion is not supported by the review study conducted by (Asensio-López et al., 2018).

In this review study on business and innovation, it was determined that there was sufficient information to establish the relationship between the previous study's focus on EN and CA. In contrast, larger companies often invest more in R&D and EI, although results vary between countries and within different business models (Asensio Lopez et al., 2018). Green manufacturing may be greatly influenced by EN (De Marchi and Grandinetti, 2013; De Marchi, 2012). As previously shown through literature research, its importance should not be underestimated. Companies can benefit from EN by receiving all the information they need about their internal and external environments. Supporting EN becomes crucial as new processes and technologies are needed, making it exceedingly difficult for companies to achieve environmental goals by relying solely on their own resources (Spena and Di Paola, 2020). To pursue EN in companies it is necessary to integrate business growth, co-creation, knowledge management, climate change and environmental impact mitigation, and ecosystems (Ul-Durar et al., 2023). Recent studies indicate that organizations are more likely to view gaining a CA favorably if they integrate EN into their strategy. The study results specifically showed the relationship between EN and business advantage. This finding is similar to those of other research conducted in other countries (Rexhäuser and Rammer, 2014; Porter and Kramer, 2006; Banerjee, et al., 2018; Wagner et al., 2002). It is important to remember that a large share of green production supports the CA that EI provides to companies. This is the most important finding of the study, and it should highlight how important it is for contemporary companies to integrate EI into their strategies. When analyzing EN, it is important to analyze how the sample company in question implements the company's ES. Corporate environmental strategies may be more effective in promoting EN in sectors with low levels of competition (Amore and Bennedsen, 2016; Giroud et al., 2011). Given the significant barriers to EN, EN will make it easier for companies to sustainably support and integrate green manufacturing into their strategies and gain a sustainable CA (Yang et al., 2019). Firms are largely motivated to adopt EN because they are unable to finance innovation expenditures alone (Van de Vrande et al., 2009). Another key factor is the belief shared by many managers that EI is positively related to company growth. According to research (Van de Vrande et al., 2009; Mohr and Spekman, 1994), additional essential elements that influence EN also include meeting customer needs and gathering new knowledge According to traditional models of innovation, companies must generate and support their own ideas (Van de Vrande et al., 2009).

In this competitive period, businesses have stressed the value of CER by adopting effective production techniques (Maqbool and Zamir, 2018). Due to the significance of environmental safety, organizations are drastically modifying their industrial and manufacturing processes in favor of green processes (Khan et al., 2018). Based on the findings, this study concluded that there is a positive and significant indirect association between CER and CA. The findings indicated that CER and CA had a significant and advantageous relationship. ER, the creation of green products, and CA are all strongly and favorably related. This research also found a strong and favorable link between EI and CA. The study's findings show how innovation in the environmental field strengthens the link between such innovation and CA. The study's findings demonstrated that the strength of EI is related to CA indirectly through CER. By encouraging EI that will affect the company's main operations and the values of its clients.

5. CONTRIBUTION

This study also contributes to the body of knowledge on the causes of CER. Corporate investments based on ER have the potential for EI. Our research adds to the body of knowledge by conducting a comprehensive and systematic analysis of various indicators of ER and ES, such as how ER and a company's environmental performance strategy relate to CA (Nadkarni and Narayanan, 2007). This is done by looking at the company's performance from a strategic management perspective. Our study adds to the body of knowledge by highlighting the complementary effects of CA on different indicators of ES and EN, which have only been partially examined in previous studies (Bıçakcıoğlu, 2018; Leonidou et al., 2017; Barba-Sánchez and Atienza-Sahuquillo, 2016). Industrial companies can better meet the environmental requirements of their target customers and increase their satisfaction thanks to the CA provided by environmental solutions. These environmental customers play a crucial role in helping companies improve green products in the short and long term since they are often more educated, more long-term focused, and willing to spend more on environmentally friendly products and services (Nguyen et al., 2016; Nguyen et al., 2019). A thoughtful and helpful point of view. In contrast, people who care about the environment may not notice the product being "green" due to lower prices offered by companies with a CA; However, over time, these customers can learn more about the company's environmental friendliness and develop a liking for the items. Our study also emphasizes how ER and indirect ES are related to CA in terms of business performance. According to the results, large industrial companies in Yemen are more likely than small and medium-sized companies to effectively pursue ER and ES. According to the findings on the effect of firm size, which are in line with previous studies (Leonidou et al., 2015; Brammer, 2012), firms with larger sales and assets are more likely to use an ES. Given that most previous studies have focused on a single industry or sector, our study adds to the body of knowledge by providing new insight into how different industry types influence the adoption of environmental policies. This study adds to the body of knowledge about CA. Corporate environmental strategy and ER. In an extremely competitive market. Previous research has focused on ER in creating green products, green business, and EI according to CA and market values.

6. ACKNOWLEDGMENT

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Study questionnaire	
Environmental Responsibility:	
Our company is ready to purchase environmentally friendly production materials and contribute to protecting the environment.	Suki, N. M. (2016). Lin, S.T., Niu, H.J., (2018.)
Our company changed brands for environmental reasons.	Wee C.S., et al (2014).
Our company produces products that are less harmful to the environment.	
Our company is ahead of its competitors by contributing to environmental responsibility.	
Our company plans to increase environmentally friendly products in the future.	
Environmental responsibility is an essential choice in choosing our company's products.	
Strategic Responsibility:	
Our company selects strategic, environmentally friendly products	Nicole, S.J.et al.,(2022) .
Our company determines production strategies that suit the requirements of the environment in which they compete.	Camilleri, M. A. (2022)
Our company strategically plans on environmentally friendly production.	
Our company faces current and future environmental threats that affect the safety of the environment.	
Strategic environmental analysis helps our company comply with environmental standards.	
Our company considers strategic responsibility part of its strategic plans.	
Environmental innovation:	Albort-Morant, et al. (2016) .
Our company uses materials that produce least pollution.	Zuraik, A., & Kelly, L. (2018).
Our company consumes less energy and resources.	Zuraik, A., et al (2020)
Our company plans to design environment friendly product.	
Our products in are easy to recycle, reuse.	
Our company's manufacturing effectively reduce hazardous materials.	
Our company creates environmentally friendly product additives	
Competitive advantage:	Leonidou, et al (2015).
Our create a green brand image to identify the firm in the market.	Molina-Azorín, et al (2015).
Our environmentally friendly products have better quality than our rivals.	
Our environmentally friendly products add more value for customers.	
Our environmentally friendly products are highly innovative.	
Our environmentally friendly products focus on minimizing costs.	
Our focus on improving our productivity.	

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