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## Roles of green intellectual capital facets on environmental sustainability in Oman

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### ABSTRACT

The present study determines the impacts of different types of green intellectual capital such as green human capital, green structural capital, and green relational capital on environmental sustainability in the Sultanate of Oman. It has become a crucial aspect to analyze the effect of green intellectual capital on ecological sustainability. A simple random sample technique is used to assemble data using a structured questionnaire from 205 respondents working at Raysut Cement Company and Salalah Methanol Company in Oman. The covariance-based equation in the structural modeling perspective is used to examine data. The study's results reveal that green structure-based capital is the only dimension of green Intellectual capital that significantly affects environmental sustainability. In contrast, green human capital and relation-based capital do not substantially affect ecological sustainability. Conclusively, this study also provides ecological strategies that can be useful to enrich organizations to accomplish sustainability.

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## 1. Introduction

Since industries have predominantly considered the world a boundless place, this assumption has led to individuals and corporations believing that they have an insignificant effect on the environment. The consequence of this condition is contamination and resource exploitation (Shaw, 2016). Thus, industries need to obey their natural and environmental protection accountabilities with cumulative environmental problems stated. This phenomenon has presented the sustainable performance

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concept. This not only regards the economic performance of the business only to achieve the goal but also emphasizes achieving environmental and social objectives, as well (Bombiak & Marciniuk-Kluska, 2018). Current studies have shown that justifiable performance has heightened awareness of clean production practices; these studies have initiated a specific focus on sustainable manufacturing methods and green human resource management (Abdul-Rashid et al., 2017; Zaid et al., 2018). Furthermore, Severo et al. (2015) state that corporations might reduce environmental impacts by employing clean production practices. They found that green intellectual capital promoted corporate sustainability in small manufacturing enterprises and these organizational practices (Yusoff et al., 2019). Moreover, Cavicchi and Vagnoni (2017) conducted a previous study demonstrating that intellectual capital promotes long-term growth. Practitioners have also seen a link between intellectual capital and long-term viability (Dal Mas, 2019).

The industrial environment is an emergent concern because they contribute more to environmental problems. Firms create pollution and generate waste; moreover, they menace the presence of life on the globe (Sadorsky, 2014). Therefore, endorsing sustainability in organizational performance requires a response to global compliance with environmental regulations and codes of conduct. This is of extreme significance in industries serving humanity. On the other hand, reducing the environmental adversities concerning industrialization has also been widely discussed in the United Nations Sustainable Development Goals declarations (Abbasi et al., 2021; Sarkodie & Ozturk, 2020). For instance, while SDG9 emphasizes amplifying industrialization sustainability through innovation (Guang-Wen et al., 2022; Manigandan et al., 2022), SDG emphasizes building climate resilience by improving environmental quality (Ahmed et al., 2022; Anwar et al., 2022; Shahbaz et al., 2021). Hence, these two goals collectively endorse the relevance of greening the industrialization process.

Accordingly, the above discussion on clean organizational performances is not restricted to the promising impact of reducing circumstantial degradation. Instead, it relieves the growth in organizations' performance as well. Thus, a sustainable version requires the reformation of business or organization practices and working models for developing sound organizations with new capabilities and innovation (Cavicchi & Vagnoni, 2017). Hence, green intellectual capital contributing to sustainable environmental performance is less focused on and often overlooked by present academicians (Yong et al., 2019). Although, scholars on green intellectual capital have determined significant impacts on a company's performance (Chen, 2008a, 2008b; Delgado-Verde et al., 2014). Past scholars have also tested the association interlinked with green intellectual capital and chances of survival.

As a result, the current research offers a novel perspective on the impact of GIC, which includes aspects of GHC, green structural money, and green associative wealth on environmental durability. The relevant reasoning is as follows (a) Studies have not yet discovered the associations herein considered in the hypotheses; (b) GIC has been linked to green human capital, company sustainability, corporate social responsibility, environmental consciousness, and corporate surrounding ethics, competitive perks and environmental material innovation, and green social capital in empirical investigations (Chen, 2008a, 2008b; Delgado-Verde et al., 2014).

## 2. Literature review

### 2.1. Environmental sustainability

The sustainable development concept was initially published in a growth limits report (Gunilla, 2014). Later, it was then published in Brundtland Report, then issued in *World Commission Environment and Development* (Borim-de-Souza et al., 2015). It established the long-term viability of contemporary growth while also considering the needs of future generations. The term ‘sustainability’ refers to the poor’s necessities and the environment’s ability to satisfy future demands. Elkington (1994) contributed and introduced the *Triple Bottom Line* perspective, which refers to a framework regarding sustainability (Montabon et al., 2016). It is based on three components: profit, planet, and people, also recognized as the three Ps (Alhaddi, 2015). This concept introduces the formatting of the business report of accounting. It entails assessing the industry while making accountable judgments. It entails assessing the industry while making accountable judgments., risks, and every other feature of financial opportunities, either ecological or social. *Triple Bottom Line* and ecological sustainability are interchangeable (Galpin & Hebard, 2015).

Sustainability does not have any specific definition (Lozano, 2008). Several scholars provide various explanations (Khan et al., 2022; Murshed, 2021; Rahim et al., 2021; Rehman et al., 2021; Zhao et al., 2022). Besides, Savitz and Weber (2014) discuss environmental sustainability as a tool to generate benefits for all shareholders; it also progresses the standard of living of each, and the people surrounding them and safeguards the environment. Authors further proposed that these three dimensions of durability are diligently connected, and alteration in one component would alter the other (Bansal & DesJardine, 2014). Montabon et al. (2016), in contrast, pressured the chances of survival greatly as they rely on decreasing circumstantial enigmas, but to claim that sustainability upsurges wealth and social health simultaneously is false to an extent.

Sustainable environmental growth is the pre-emptive strategy employed by an organization to accomplish the goals of its responders while keeping because of the requirements of the coming generations (Sartori et al., 2014). In contrast, survival intends to simultaneously attain three performance goals: economic, environmental, and social (Kopnina, 2017). In addition, sustainability emphasizes the above-stated aspect and is also connected to the responsibilities towards moral issues and corporate and social activities (John & Narayanamurthy, 2015; Stancu et al., 2015). Nevertheless, corporate social responsibility and moral problems were seen as less essential than revenue (Maletic et al., 2015). Scholars have previously stated that if companies want to make money, they must increase their efforts to reduce waste while increasing revenues, they must also reuse and recycle limited resources to boost economic performance, a top goal for environmental sustainability (Jordão & de Almeida, 2017). Environmental sustainability balances multi-dimensional performances, referring to inconsistency (Jabareen, 2008). Subsequently, misconceptions abound, with various abstract and theoretical concepts (Agostini et al., 2017). Thus, the above discussion regarding environmental sustainability in the following study denotes the industry’s aim to improve social development.

## 2.2. Green intellectual capital

Currently, the world focuses on achieving better performance (Eisenhardt & Schoonhoven, 1996; Obeng et al., 2014). It is supposed that arrangement will safeguard an industry's survival (Berezinets et al., 2016), boost value creation (Edvinsson & Sullivan, 1997; Roos & Roos, 1997; Sullivan, 1999), and progress in attaining competitive advantage (Ahmad & Ahmed, 2016). Industries with higher intellectual capital will value more than those with poor intellectual capital (Berzkalne & Zelgalve, 2014). Presently, Verbano and Crema (2016) recommend intellectual capital as a tool for overcoming the weakness of small-size businesses.

John Kenneth Galbraith 1969 gave the concept of the term conceptual capital (Bontis, 1998; Serenko & Bontis, 2004). The intellectual capital discusses various literature on several subjects and manners to culminate (Stewart, 1991). Intellectual capital is defined as things that everyone in the business knows, ensuring a competitive advantage in the business, or collecting information about technologies, experience, rational property rights, industrial education and expertise, team communicative devices, client services, & multiple trademarks that, in the end, generate profit for the industry.

Another explanation of intellectual capital proposed by Edvinsson and Sullivan (1997) is the knowledge that encompasses ideas, patents, innovations, computer programs, designs, and trademarks eventually translated into industrial value. According to Roos and Roos (1997), intellectual capital is referred to as any non-quantifiable and non-physical beneficial sources that are usually partially or entirely owned by an enterprise and aid in its value generation. Brooking (1996) also contributed to this sector, describing intellectual capital as a vital intangible asset that allows the business to run smoothly. Underlined that intellectual capital is a record of data that has been and continues to be shaped by factors and the desire to get a competitive advantage or other perks that would yield a great amount of revenue (Bontis, 2001; Bontis et al., 2000).

Although there is literature debating the notion of intellectual capital, the descriptions of intellectual capital that have been put out are nearly exactly similar. According to the definitions above, intellectual capital deals with an industry's intangible resources that enable it to produce value and gain a competitive advantage. Furthermore, recent literature displays intellectual capital notions in a variety of ways. Academics and practitioners are unfamiliar with the notion of green intellectual capital, which combines theoretical capital with environmental sustainability. Furthermore, it has received insufficient attention.

Chen (2008b) initially introduced the perspective of green intellectual capital. This is followed by Yong et al. (2019). As a result of its insignificance in the management literature, it has few definitions. According to Chen (2008a), Green intellectual capital is a collection of ethereal resources, competencies, information, and relationships committed to environmental innovation or green conservation. To gain competitive privileges, green intellectual capital is defined as industrial competence and green study and information (Liu, 2010).

The concept of a sustainable environment has become widespread (Chen, 2011). Its goal is to prevent ecological damage and legitimate global warming so that

industry may generate more green innovation. Nevertheless, as consumer awareness of risk issues grows, businesses are being driven to establish robust systems for identifying environmental drifts and merging environmental management to improve their green image and strategic edge (Chen et al., 2014; Murga-Menoyo, 2014). green intellectual capital aids industries to meet strict global environmental procedures (Chang, 2011; Huang & Kung, 2011), produces value, and responds to consumer needs in terms of environmental issues. Chen (2008a) also asserted that to implement a sustainable ecological strategy effectively, the industry has to have environmental knowledge in order better to identify the relevant opportunities for process and product improvement. As a result, green intellectual capital has a lower environmental impact and provides a one-upmanship to the sector by the economical breakdown. (Aboelmaged & Hashem, 2019).

This study adopts three components to explain green intellectual capital: green human capital, green structural capital, and green relational capital. Studies on green intellectual capital are scarce. Green structural and relational capital was found to have a favorable impact on green human resource management in big industrial companies. Green innovation adoption was unaffected by sustainable human capital (Aboelmaged & Hashem, 2019). Industrial learning competency was also revealed to have a progressive link with company sustainability. Evidence demonstrates the link between green intellectual capital and financial performance (Erinos & Rahmawati, 2017). Two types of green intellectual capital, green structural capital and green relational capital, on the other hand, were linked to a green competitive advantage (Firmansyah, 2017).

Delgado-Verde et al. (2014) also noted the green intellectual capital component, finding that green-social capital is linked to environmental product innovation, although green organizational money is not. According to Huang and Kung (2011), Green intellectual capital mediated the link between ecological impact and economic benefit. Lastly, according to Chen (2008b), green intellectual capital aided an organization's competitiveness. As a result of the foregoing reasoning, this study's advantage opposes empirical testing of the hypotheses listed below.

### ***2.3. Green human capital and competitive environment sustainability***

Competitiveness may be maintained if human capital is viewed as one of the most significant strategic resources for an organization's success (Wright et al., 1994) because workers' knowledge and skills are critical to surviving operations in today's fast-changing world. Furthermore, the Human Capital Theory states that the greater an individual's knowledge and competence, the more productively they will work (Davidsson & Honig, 2003). In today's experience and understanding of culture, agents, administrators, and convergent thinkers who solve your problems must be educated. Human capital is thought to benefit employees by assisting them in gaining new knowledge, skills, and experience. Hence, the role of developing human capital for ensuring environmental sustainability has been widely recognized in the literature (Hamid et al., 2022; Jahanger et al., 2022; Jin et al., 2022; Sadiq et al., 2022; Sheraz

et al., 2022; Ullah et al., 2020). These studies have implicitly highlighted that greening human capital is an essential means of improving environmental quality.

H1. Green human capital has a significant direct impact on environmental sustainability.

#### **2.4. Green structural capital and environmental sustainability**

Poor organization systems and procedures would not perform well (Widener, 2006). Similarly, an institution's strong contextual performance will foster a safe and friendly environment that encourages employees to develop new skills (Florin et al., 2003). The value of structural capital in boosting organizational performance has been recognized by previous researchers (Hsu & Wang, 2012; Mention & Bontis, 2013; Sharabati et al., 2010). In order to combat climate issues, companies must also build a robust environmental framework. Internal policies (Lee et al., 2015) established research and development (Kuo et al., 2015), and low-carbon management practices are all part of this framework (Raar, 2015; Singh, 2015). These qualities will allow the company to achieve great environmental effects, happy workers, and profit. Furthermore, a greener culture boosts sales and lowers expenses (Mehta & Chugan, 2015).

H2. Green structural capital has a significant direct impact on environmental sustainability.

#### **2.5. Green relational capital and environmental sustainability**

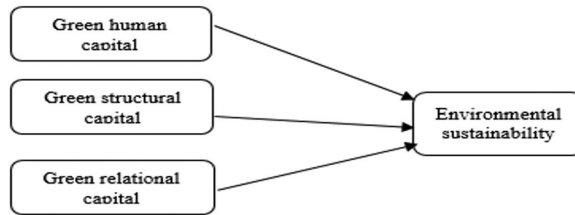
Individuals can trade information thanks to relational capital. An organization may enhance the amount of valuable feedback it receives from its stakeholders. Organizational procedures would be improved by more individual engagement (Nelson & Winter, 1982). The Social Exchange Theory (Macneil, 1980), which links the growth of complex personal and corporate structures amongst organizations, proposes a link between relational capital and transaction. In social exchange, trust is the most important connection quality (Morgan & Hunt, 1994). Collaboration between trustworthy persons improves the quality of the link between expectations and encourages learning (Doz, 1990). An organization's performance can improve due to close affiliation (Edvinsson & Malone, 1997).

H3. Green relational capital has a significant direct impact on environmental sustainability.

The study conceptual framework is built as seen in [Figure 1](#).

### **3. Results and analysis**

The present research looks at how green intellectual capital affects environmental sustainability. SPSS software was used to provide descriptive statistics based on reliability and correlation. AMOS software was also used to do exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM).



**Figure 1.** Conceptual framework.

Source: Authors Computation.

**Table 1.** Frequencies of demographic variables.

Variables	Categories	Frequency	Percent
1. Gender	Male	157	77
	Female	48	23
2. Company	Raysut cement	122	60
	Salalah methanol	83	40
3. Position	Employee	123	60
	Supervisor	41	20
	Head of dept	27	13
	Manager	14	7
	Total	205	100.0

Source: Authors' computation.

### 3.1. Population and sampling

The survey was distributed to employees working in Raysut cement co and Salalah methanol co in Salalah in the Sultanate of Oman to test the hypotheses presented above collected through an electronic questionnaire survey using a random sample technique. Table 1 shows the demographic characteristics of respondents. The table presents that most respondents (77 percent) were male. Sixty percent of respondents worked in Raysut cement, and 40 percent worked in Salalah methanol. Sixty percent of respondents were employees.

### 3.2. Measures

An eighteen scale measured green intellectual capital based on Chen (2008a) and Huang and Kung (2011): five factors for green human capital, eight items for green structure-based money, and five for green relational capital. The scale of environmental sustainability consists of ten things. Likert scale based on five points (1= 'heavily disagree', 5 = 'heavily agree') has been used in establishing the survey queries.

#### 3.2.1. Descriptive statistical approach

The averages, standard deviations, correlations, and dependability of research constant are shown in Table 2. The records show that the means of green intellectual capital measurements are available at a high level, except green structural capital, which is available at a moderate level; the mean of GHC was  $M = 4.315$  ( $SD = 0.52539$ ), the value of GSC was  $M = 3.82$  ( $SD = 0.5872$ ), and the standard of GRC was  $M = 4.1833$  ( $SD = 0.5089$ ), and the standard of GRC was  $M = 4.1833$  ( $SD = 0.5089$ ).  $M = 4.19$  ( $SD = 0.46963$ ) in terms of environmental sustainability.



**Table 2.** Descriptive statistics, correlations, and dependability.

Variables	No. of items	Mean	SD	GHC	GSC	GRC	ES
GHC	5	4.3150	0.52539	(0.617)			
GSC	8	3.8200	0.58720	0.296**	(0.691)		
GRC	5	4.1833	0.50890	0.046	0.131	(0.663)	
ES	10	4.1900	0.46963	-.040	0.241*	0.196	(0.686)

Source: Authors' computation.

**Table 3.** The study model's EFA.

Factors	Items	Loading	Variance explained	Eigenvalue	Other scales
Green human capital	GHC.P1	0.807	19.347	2.765	Cumulative variance= 61.199
	GHC.P2	0.718			
Green structural capital	GSC.P3	0.690	15.253	1.828	Bartlett's test= 225.284 Sig.= 0.000
	GSC.P4	0.761			
	GSC.P5	0.706			
	GSC.P6	0.656			
Green relational capital	GRC.P7	0.663	14.050	1.585	KMO= 0.659
	GRC.P8	0.773			
	GRC.P9	0.667			
Environmental sustainability	ES.P10	0.745	12.550	1.166	
	ES.P11	0.682			
	ES.P12	0.685			

Source: Authors' computation.

The findings of the Pearson correlation analysis show that there is no link between (green human capital and green relational capital) and environmental sustainability. Furthermore, the findings reveal a strong link between green structural wealth and environmental sustainability at an important level (0.05). Cronbach's alpha values also show that they were used in the current scale study. Is reliable, where green human capital has  $\alpha = 0.617$ , green structural capital has  $\alpha = 0.691$ , green relational capital has  $\alpha = 0.663$ , and environmental sustainability has  $\alpha = 0.686$ .

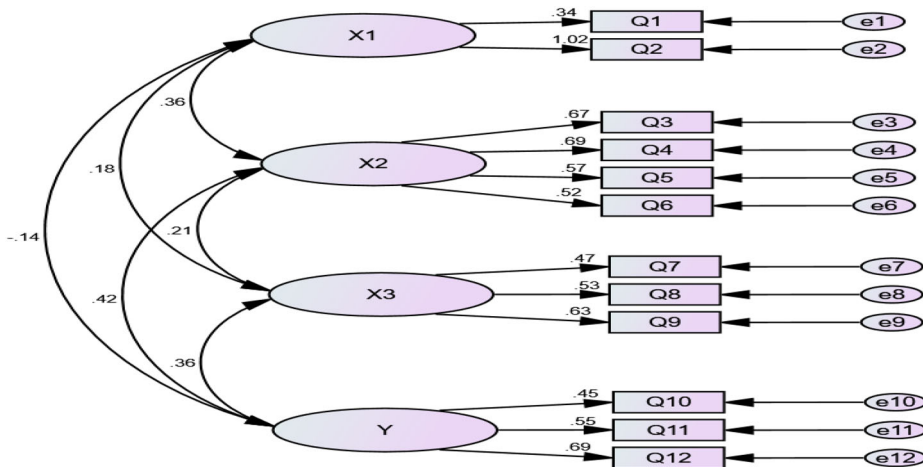
### 3.3. Exploratory factor analysis

Exploratory factor analysis (EFA) was used to determine the measures of green intellectual capital and environmental sustainability to assess construct validity. As stated in Table 3, the approach utilized was principal component inquiry using the varimax rotation manner. Furthermore, the validation threshold for the item's weight should be greater than 0.40. Through the model's entry items, EFA looked for the presence of four variables, three of which are linked to green intellectual capital (green human capital, two items; green structural capital, four items; and green relational capital, three items), and one of which is linked to environmental sustainability, three items. All EFA criteria have been satisfied, as shown in Table 3.

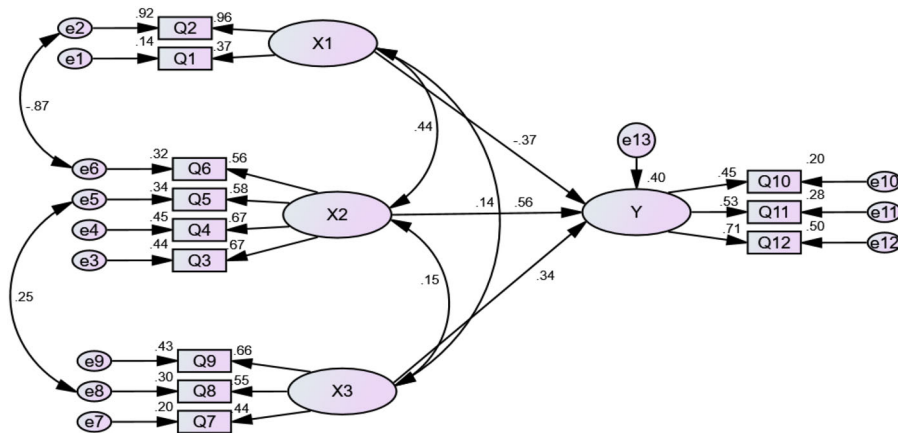
(Cumulative variance= 61.199 > 60; Bartlett's test= 225.284, with significance level measured up to 0.000 < 0.05; Kaiser-Meyer-Olkin (KMO)= 0.659 > 0.60; and eigenvalues for each factor was recorded more than 1).

### 3.4. Confirmatory factor analysis

By measuring the quality of fit between exemplary data and the predicted model, CFA was used to focus on the exploratory factor model. Figure 2 shows the CFA



**Figure 2.** CFA measurement model.  
Source: Authors Computation.



**Figure 3.** Results of SEM.  
Source: Authors Computation.

findings, which show that the dimensional model elaborated strong fit indices since all of the numerals are above the allowed level (Schermelleh-Engel et al., 2003).

### 3.5. Structural equation modeling (SEM)

SEM is an evaluation method for calculating, expressing, and evaluating multiple associations between variables. To test the research model, SEM was used. As a result, AMOS software used SEM to illustrate the influence of green human capital, green structural capital, and green relational capital as independent factors on environmental sustainability as a dependent variable in the current study (Figure 3).

All of the indices are over the fit threshold level, as shown in Table 4. Because the CMIN/DF = chi-square/degree of liberal ratio was less than 5, the RMR = root mean square (RMR 0.08), the RMSEA = root mean square of approximation (RMSEA 0.08), the CFI = comparative fit index, the GFI = goodness-of-fit index, and the

**Table 4.** Fit indices of the model.

CMIN/DF	RMR	RMSEA	CFI	IF	IFI	PGFI	PNFI
1.399	0.042	0.064	0.912	0.911	0.904	0.551	0.508

Source: Author's computation.

**Table 5.** Hypothesis trial.

H	Structural Path	Estimate	SE	CR	P	Records
H1	GHC → ES	-0.402	0.237	-1.699	0.089	Rejected
H2	GSC → ES	0.326	0.142	2.288	0.022	Accepted
H3	GRC → ES	0.321	0.247	1.300	0.193	Rejected

Source: Author's computation.

IFI = incremental fit indexes were all more than 0.9. Furthermore, PGFI = parsimony goodness-of-fit index and PNFI = parsimony normed fit index is all  $> 0.5$ , according to Schermelleh-Engel et al. (2003).

SEM presents no impact of green human capital, and green relational capital on environmental sustainability (estimate =  $-0.402$ ; CR =  $-1.699$ ;  $p > 0.05$ , estimate =  $0.321$ ; CR =  $1.300$ ;  $p > 0.05$  respectively). Hence, the first and the third hypothesis (H1) and (H2) are rejected. The analysis also made it obvious that the green structural capital positively affected environmental sustainability (estimate =  $0.326$ ; CR =  $2.288$ ;  $p < 0.05$ ). Therefore, the second hypothesis (H2) is accepted (Table 5).

#### 4. Discussion and contribution of the study

The study's goal was to see if there was a link between green intellectual capital and environmental sustainability. This study is the initial and only empirical investigation of the theoretical framework in the Sultanate of Oman. Adopting greenways to tackle environmental challenges, such as green intellectual capital, has become critical. Previous scientists, such as Huang and Kung (2011) and Chen et al. (2014), have recognized the advantages of using this method. There has not been any research into green intellectual capital and environmental sustainability. As a result, this study fills a gap by investigating the impact of green intellectual capital elements on environmental sustainability, including green human capital, green structural capital, and green relational capital. Data were obtained from 205 employees at Raysut cement company and Salalah methanol company in Salalah, Sultanate of Oman, for the suggested linkages. The outcomes of the study led to three important conclusions.

According to the study, it is exposed that there is no association between environmental sustainability and green human capital. Previous research by Chen and Chang (2013), Chen (2008b), and Huang and Kung (2011) dispute this finding. They discovered that green human capital has a considerable influence on various organizational outcomes. For various reasons, there is a negligible link between green human capital and environmental sustainability. Scholars pointed out that businesses are strapped for cash and have little interest in environmental management (Bicknell & McManus, 2006).

Furthermore, most businesses overlook the emerging notion of green human capital. They do not include environmental stewardship in their human capital. Because

human capital is a vital resource that greatly helps long-term sustainability (Yacob & Moorthy, 2012). Green human capital is also considered an analytical ability for economic development and sustainability (Karchegani et al., 2013). Because fewer adequate persons with high climate awareness and expertise are uncommon in these sectors, the study's findings show that a large investment is required to develop successfully by obtaining qualified and expert staff. They lack the necessary training to improve their skills and talents in this demanding setting. In order to capitalize on market opportunities and satisfy client needs, in the company's human resources, these discipline sessions are useful for developing an attentive climate.

Secondly, green structural capital had a significant relationship with environmental stability. This outcome aligned with the results of Chen (2008a;b), who expressed that green structural capital correlated significantly with a competitive edge in the market. Previously, authors have contributed towards structural capital on the sustainability of an organization (Massaro et al., 2018). Thus, the significant result of this study exhibited that industries in Oman acknowledge the importance of green structural capital on environmental sustainability. It is assumed that sustainability requires drives to address the creative challenges of the market. Thus, structural money plays a crucial role in supporting this process. Improvement in structural capital, new environmental sections within organizations, and innovative technology are essential for an industry to attain sustainability (Akhtar et al., 2015). After viewing the results of the two companies in the Omani industry, Raysut cement and Salalah methanol were determined to be more adaptable, making it simpler for them to change and accept new environmental processes and systems than other firms.

Thirdly, the results of this study presented that green relational capital indicates an insignificant impact on environmental sustainability. According to the findings, the connection is founded on information exchange and relationships. It is thought that a collaborative approach should aid the development of green relational capital. This opportunity encourages industries to adopt sound and sustainable environmental practices, especially if it regards green relational capital that involves the willingness to share ideas of sustainable experiments and the benefits extracted from those practices. Thus, this study helped fill the gap in larger organizations because less attention is given to new ventures in Oman. Since teamwork and collaboration are assets that motivate associates to grab opportunities that they cannot go for alone. In exchange, all collaborating cohorts can gain considerable advantages. To accelerate and improve sustainability, rich network linkages are thought to be necessary. Given the significance of large organizations to well-being, it is thus vital to fill the research gap.

## 5. Conclusion

Resources increased technological advances, growing marketplaces, environmental deterioration, and creative business models displacing traditional ones have contributed to organizations becoming more different in this complex world. Many organizations are actively seeking new, innovative green solutions that can be implemented to achieve environmental sustainability. As a result, the negative environmental impact of human activities and structural capital must be mitigated. At the same

time, this will improve society's health while gradually creating wealth. Green intellectual capital is a viable option for addressing environmental issues and ensuring ecological sustainability. However, just a little research has been done on this subject. As a result, the relationship between green intellectual capital and environmental sustainability in major enterprises in Oman is better understood. Finally, a high level of sensitivity to environmental issues may encourage businesses to adopt green techniques in their operations. To achieve environmental sustainability, businesses must invest in green intellectual capital. This research is the first step in establishing significant ecological sustainability in the Omani environment, which can then be applied to future industrial models.

As far as the limitation of the study is concerned, only two organizations focused on this investigation, which was done entirely in Oman. As a result, the results' validity and generality are minimal. Furthermore, the study's sample size was too tiny. To corroborate the definitions, substantial sample sizes are required. Nonetheless, despite its limitations, the findings of this study revealed new insights into green intellectual capital and environmental sustainability in the Omani sector. This research may stimulate future researchers to look into the part of green intellectual capital as a bridge for environmental survival.

This research has a wide range of consequences and theoretical contributions. Organizations may use this study's approach to measure the impact of green intellectual capital components on environmental sustainability. Environmental sustainability methods provide companies with additional avenues for achieving long-term viability. Organizations can improve their ability to achieve clean practices in today's tough market by using the recommended methodology. According to Massaro et al. (2018), improved performance is accomplished through alternative thinking and motivation. As a result, businesses must invest in their human resources by teaching employees about sustainability challenges. Second, the businesses have green structural wealth (GSC), which will not be lost when staff departs (Liao et al., 2021). Green structural capital is important for environmental sustainability, according to this study. As a result, managers of firms must put in place suitable information systems to safeguard their green intellectual capital.

Environmental data collected from employees and other stakeholders must be stored correctly. The authors also stressed the need for green structural capital. It will not be long before the organization organizes and stores the green information in the minds of its employees. As a result, managers must store all information in appropriate information systems. Work is currently reliant on technology. Technology has displaced old working methods while also influencing the development of new services. As a result, businesses should think about investing in environmental processes and systems. In addition, as part of the corporate compensation system, managers should develop environmental sustainability targets. Employees would profit from this, and they would be more likely to engage in environmental preservation and sustainability thinking if they were rewarded for it. In addition, employees' degree of competence in environmental protection must be assessed for organizational task effectiveness. This technique may be included in the organization's processes and procedures to promote sustainability.

Finally, there was a link between green relational capital and environmental sustainability in this study. Previous researchers have argued that collaborating with other groups can help accomplish environmental aims (Dickel et al., 2018; Matinaro et al., 2019; Niesten et al., 2017). Close networking is required for organizations to prosper since it allows them to obtain more information quickly and directly (Cohen & Kaimenakis, 2007; Desouza & Awazu, 2006; Wong & Aspinwall, 2004). Collaboration is a valuable tool that encourages people to seize chances that they could not explore independently. In exchange for their efforts, all collaborations can reap significant rewards. To accelerate and improve sustainability, you will need a large network of contacts. As a result, the company would adopt environmental steps to boost profit margins, cut waste manufacturing costs, and boost labor efficiency through information sharing. Another action that may be made is to join industry links concerned with environmental conservation actively.

Despite its limitations, this research may be taken in many different areas. Other industries, such as information technology and banking, must be addressed when examining the impact of green intellectual capital on environmental sustainability. Further research might be carried out in developed and emerging nations to close loopholes in certain economies. This type of research would add to the information about the worldwide impact of green intellectual capital. Aside from that, doing longitudinal research to analyse the change in the factors investigated over time would be interesting. It is thought to aid researchers with diverse perspectives in recognizing any advancements in green intellectual capital elements that contribute to environmental sustainability. Furthermore, including other variables would provide a broader view of the factors that have the greatest impact on the dependent variable.

### **Disclosure statement**

No potential conflict of interest was reported by the authors.

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### **Data availability statement**

Data will be made available upon request.

## References

- Abbasi, K. R., Hussain, K., Radulescu, M., & Ozturk, I. (2021). Does natural resources depletion and economic growth achieve the carbon neutrality target of the UK? A way forward towards sustainable development. *Resources Policy*, 74, 102341. <https://doi.org/10.1016/j.resourpol.2021.102341>
- Abdul-Rashid, S. H., Sakundarini, N., Ghazilla, R. A. R., & Thurasamy, R. (2017). The impact of sustainable manufacturing practices on sustainability performance: Malaysia's empirical evidence. *International Journal of Operations & Production Management*, 37(2), 182–204. <https://doi.org/10.1108/IJOPM-04-2015-0223>
- Aboelmaged, M., & Hashem, G. (2019). Absorptive capacity and green innovation adoption in SMEs : The mediating effects of sustainable organizational capabilities. *Journal of Cleaner Production*, 220, 853–863. <https://doi.org/10.1016/j.jclepro.2019.02.150>
- Agostini, L., Nosella, A., & Filippini, R. (2017). Does intellectual capital allow improving innovation performance? Quantitative analysis in the SME context. *Journal of Intellectual Capital*, 18(2), 400–418. <https://doi.org/10.1108/JIC-05-2016-0056>
- Ahmad, M., & Ahmed, N. (2016). Testing the relationship between intellectual capital and a firm's performance: An empirical investigation regarding financial industries of Pakistan. *International Journal of Learning and Intellectual Capital*, 13(2–3), 250–272. <https://doi.org/10.1504/IJLIC.2016.075691>
- Ahmed, Z., Murshed, M., Ahmad, M., Shah, M. I., Mahmood, H., & Abbas, S. (2022). How do green energy technology investments, technological innovation, and trade globalization enhance green energy supply and stimulate environmental sustainability in the G7 countries? *Gondwana Research*, 112, 105–115. <https://doi.org/10.1016/j.gr.2022.09.014>
- Akhtar, C. S., Ismail, K., Ndaliman, M. A., Hussain, J., & Haider, M. (2015). Can intellectual capital of SMEs help in their sustainability efforts. *Journal of Management Research*, 7(2), 82. <https://doi.org/10.5296/jmr.v7i2.6930>
- Alhaddi, H. (2015). Triple bottom line and sustainability: A literature review. *Business and Management Studies*, 1(2), 6–10. <https://doi.org/10.11114/bms.v1i2.752>
- Anwar, A., Sinha, A., Sharif, A., Siddique, M., Irshad, S., Anwar, W., & Malik, S. (2022). The nexus between urbanization, renewable energy consumption, financial development, and CO2 emissions: Evidence from selected Asian countries. *Environment, Development and Sustainability*, 24(5), 6556–6576. <https://doi.org/10.1007/s10668-021-01716-2>
- Bansal, P., & DesJardine, M. R. (2014). Business sustainability: It is about time. *Strategic Organization*, 12(1), 70–78. <https://doi.org/10.1177/1476127013520265>
- Berezinets, I., Garanina, T., & Ilina, Y. (2016). Intellectual capital of a board of directors and its elements: Introduction to the concepts. *Journal of Intellectual Capital*, 17(4), 632–653. <https://doi.org/10.1108/JIC-01-2016-0003>
- Berzkalne, I., & Zelgalve, E. (2014). Intellectual capital and company value. *Procedia - Social and Behavioral Sciences*, 110, 887–896. <https://doi.org/10.1016/j.sbspro.2013.12.934>
- Bicknell, S., & McManus, P. (2006). The canary in the coalmine: Australian ski resorts and their response to climate change. *Geographical Research*, 44(4), 386–400. <https://doi.org/10.1111/j.1745-5871.2006.00409.x>
- Bombiak, E., & Marciniuk-Kluska, A. (2018). Green human resource management as a tool for the sustainable development of enterprises: Polish young company experience. *Sustainability*, 10(6), 1739. <https://doi.org/10.3390/su10061739>
- Bontis, N. (1998). Intellectual capital: An exploratory study that develops measures and models. *Management Decision*, 36(2), 63–76. <https://doi.org/10.1108/00251749810204142>
- Bontis, N. (2001). Assessing knowledge assets: A review of the models used to measure intellectual capital. *International Journal of Management Reviews*, 3(1), 41–60. <https://doi.org/10.1111/1468-2370.00053>
- Bontis, N., Chua, W., Keow, C., & Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital*, 1(1), 85–100. <https://doi.org/10.1108/14691930010324188>

- Borim-de-Souza, R., Balbinot, Z., Travis, E. F., Munck, L., & Takahashi, A. R. W. (2015). Sustainable development and sustainability as study objects for comparative management theory: Proposing styles of reasoning for an unknown metropole. *Cross Cultural Management*, 22(2), 201–235. <https://doi.org/10.1108/CCM-02-2013-0027>
- Brooking, A. (1996). *Intellectual capital – core-asset for the third millennium enterprise*. International Thomson Business Press.
- Cavicchi, C., & Vagnoni, E. (2017). Does intellectual capital promote the shift of healthcare organizations towards sustainable development ? Evidence from Italy. *Journal of Cleaner Production*, 153, 275–286. <https://doi.org/10.1016/j.jclepro.2017.03.175>
- Chang, C. H. (2011). The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. *Journal of Business Ethics*, 104(3), 361–370. <https://doi.org/10.1007/s10551-011-0914-x>
- Chen, Y. S. (2011). Green organizational identity: Sources and consequence. *Management Decision*, 49(3), 384–404. Chow, W. S., <https://doi.org/10.1108/00251741111120761>
- Chen, Y.-S. (2008a). The driver of green innovation and green image – green core competence. *Journal of Business Ethics*, 81(3), 531–543. <https://doi.org/10.1007/s10551-007-9522-1>
- Chen, Y.-S. (2008b). The positive effect of green intellectual capital on the competitive advantages of firms. *Journal of Business Ethics*, 77(3), 271–286. <https://doi.org/10.1007/s10551-006-9349-1>
- Chen, Y. S., & Chang, C. H. (2013). Enhance environmental commitments and green intangible assets toward green competitive advantages: Structural equation modeling (SEM) analysis. *Quality & Quantity*, 47(1), 529–543. <https://doi.org/10.1007/s11135-011-9535-9>
- Chen, F. C., Liu, Z. J., & Kweh, Q. L. (2014). Intellectual capital and productivity of Malaysian general insurers. *Economic Modelling*, 36, 413–420. <https://doi.org/10.1016/j.econmod.2013.10.008>
- Cohen, S., & Kaimenakis, N. (2007). Intellectual capital and corporate performance in knowledge-intensive SMEs. *The Learning Organization*, 14(3), 241–262. <https://doi.org/10.1108/09696470710739417>
- Dal Mas, F. (2019). The relationship between intellectual capital and sustainability: An analysis of practitioner's thought. In F. Matos, V. Vairinhos, P. Selig, & L. Edvinsson (eds.), *Intellectual capital management as a driver of sustainability* (pp. 11–24). Springer.
- Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18(3), 301–331. [https://doi.org/10.1016/S0883-9026\(02\)00097-6](https://doi.org/10.1016/S0883-9026(02)00097-6)
- Delgado-Verde, M., Amores-Salvadó, J., Martín-de Castro, G., & Emilio Navas-López, J. (2014). Green intellectual capital and environmental product innovation: The mediating role of green social capital. *Knowledge Management Research & Practice*, 12(3), 350–350. <https://doi.org/10.1057/kmrp.2014.8>
- Desouza, K. C., & Awazu, Y. (2006). Knowledge management at SMEs: Five peculiarities. *Journal of Knowledge Management*, 10(1), 32–43. <https://doi.org/10.1108/13673270610650085>
- Dickel, P., Hörisch, J., & Ritter, T. (2018). Networking for the environment: The impact of environmental orientation on start-ups' networking frequency and network size. *Journal of Cleaner Production*, 179, 308–316. <https://doi.org/10.1016/j.jclepro.2018.01.058>
- Doz, Y. (1990). Managing technological innovation in large complex firms: The contribution of human resource management. In P. Evans, Y. Doz, & A. Laurent (eds.), *Human resource management in international firms* (pp. 200–215). Palgrave Macmillan.
- Edvinsson, L., & Malone, M. S. (1997). *Intellectual capital: Realizing your company's actual value by finding its hidden brainpower*. Harper Business.
- Edvinsson, L., & Sullivan, P. (1997). Developing intellectual capital at Skandia. *Long Range Planning*, 30(3), 366–373. [https://doi.org/10.1016/S0024-6301\(97\)90248-X](https://doi.org/10.1016/S0024-6301(97)90248-X)
- Eisenhardt, K. M., & Schoonhoven, C. B. (1996). The resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science*, 7(2), 136–150. <https://doi.org/10.1287/orsc.7.2.136>



- Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California Management Review*, 36(2), 90–100. <https://doi.org/10.2307/41165746>
- Erinos, N Rahmawati. (2017). Green intellectual capital and financial performance of corporate manufacturer in Indonesia. *International Journal of Business and Management Invention*, 6(2), 75–81.
- Firmansyah, A. (2017). Pengaruh green intellectual capital dan manajemen lingkungan organisasi terhadap green organizational identity dan dampaknya terhadap green competitive advantage. *Substansi: Sumber Artikel Akuntansi Auditing Dan Keuangan Vokasi*, 1(1), 183–219.
- Florin, J., Lubatkin, M., & Schulze, W. (2003). A social capital model of high-growth ventures. *Academy of Management Journal*, 46(3), 374–384. <https://doi.org/10.2307/30040630>
- Galpin, T., & Hebard, J. (2015). Sustainability in start-up ventures: What founders say versus what they do. *World Journal of Entrepreneurship, Management and Sustainable Development*, 11(4), 246–255. <https://doi.org/10.1108/WJEMSD-05-2015-0025>
- Guang-Wen, Z., Murshed, M., Siddik, A. B., Alam, M. S., Balsalobre-Lorente, D., & Mahmood, H. (2022). Achieving the objectives of the 2030 sustainable development goals agenda: Causalities between economic growth, environmental sustainability, financial development, and renewable energy consumption. *Sustainable Development*, C. Weidinger, F. Fischler, & R. Schmidpeter (eds.), <https://doi.org/10.1002/sd.2411>
- Gunilla, A. (2014). Sustainability and SMEs: The next steps. In *Sustainable entrepreneurship* (pp. 265–268). Springer.
- Hamid, I., Alam, M. S., Murshed, M., Jena, P. K., Sha, N., & Alam, M. N. (2022). The roles of foreign direct investments, economic growth, and capital investments in decarbonizing the economy of Oman. *Environmental Science and Pollution Research International*, 29(15), 22122–22138. <https://doi.org/10.1007/s11356-021-17246-3>
- Hsu, L. C., & Wang, C. H. (2012). Clarifying the Effect of Intellectual Capital on Performance: The Mediating Role of Dynamic Capability. *British Journal of Management*, 23(2), 179–205. <https://doi.org/10.1111/j.1467-8551.2010.00718.x>
- Huang, C. L., & Kung, F. H. (2011). Environmental consciousness and intellectual capital management: Evidence from Taiwan's manufacturing industry. *Management Decision*, 49(9), 1405–1425. <https://doi.org/10.1108/00251741111173916>
- Jabareen, Y. (2008). A new conceptual framework for sustainable development. *Environment, Development and Sustainability*, 10(2), 179–192. <https://doi.org/10.1007/s10668-006-9058-z>
- Jahanger, A., Yang, B., Huang, W.-C., Murshed, M., Usman, M., & Radulescu, M. (2022). Dynamic linkages between globalization, human capital, and carbon dioxide emissions: Empirical evidence from developing economies. *Environmental Development and Sustainability*, <https://doi.org/10.1007/s10668-022-02437-w>
- Jin, C., Razzaq, A., Saleem, F., & Sinha, A. (2022). Asymmetric effects of eco-innovation and human capital development in realizing environmental sustainability in China: Evidence from quantile ARDL framework. *Economic Research-Ekonomska Istraživanja*, 35(1), 4947–4970. <https://doi.org/10.1080/1331677X.2021.2019598>
- John, L., & Narayanamurthy, G. (2015). Converging sustainability definitions: Industry independent dimensions. *World Journal of Science, Technology and Sustainable Development*, 12(3), 206–232. <https://doi.org/10.1108/WJSTSD-04-2015-0017>
- Jordão, R. V. D., & de Almeida, V. R. (2017). Performance measurement, intellectual capital, and financial sustainability. *Journal of Intellectual Capital*, 18(3), 643–666. <https://doi.org/10.1108/JIC-11-2016-0115>
- Karchegani, M. R., Sofian, S., & Amin, S. M. (2013). The Relationship Between Intellectual Capital and Innovation: A Review. *International Journal of Business and Management Studies*, 2(1), 561–581.
- Khan, S., Murshed, M., Ozturk, I., & Khudoykulov, K. (2022). The roles of energy efficiency improvement, renewable electricity production, and financial inclusion in stimulating

- environmental sustainability in the Next Eleven countries. *Renewable Energy*, 193, 1164–1176. <https://doi.org/10.1016/j.renene.2022.05.065>
- Kopnina, H. (2017). Sustainability: New strategic thinking for business. *Environment, Development and Sustainability*, 19(1), 27–43. <https://doi.org/10.1007/s10668-015-9723-1>
- Kuo, L., Yu, H. C., & Chang, B. G. (2015). The signals of green governance on mitigation of climate change- evidence from Chinese firms. *International Journal of Climate Change Strategies and Management*, 7(2), 154–171. <https://doi.org/10.1108/IJCCSM-07-2013-0083>
- Lee, K.-H., Min, B., & Yook, K.-H. (2015). The impacts of carbon (CO<sub>2</sub>) emissions and environmental research and development (R&D) investment on firm performance. *International Journal of Production Economics*, 167, 1–11. <https://doi.org/10.1016/j.ijpe.2015.05.018>
- Liao, H. Y., Hsu, C. T., & Chiang, H. C. (2021). How does green intellectual capital influence employee pro-environmental behavior? The mediating role of corporate social responsibility. *International Journal of Management Studies*, 28(2), 27–47. <https://doi.org/10.32890/ijms2021.28.2.2>
- Liu, C. C. (2010). *Developing green intellectual capital in companies by AHP* [Paper presentation]. In IEEE 8th International Conference on Supply Chain Management and Information Systems (SCMIS) 2010, IEEE Proceedings, Hong Kong (pp. 1–5).
- Lozano, R. (2008). Envisioning sustainability three-dimensionally. *Journal of Cleaner Production*, 16(17), 1838–1846. <https://doi.org/10.1016/j.jclepro.2008.02.008>
- Macneil, I. R. (1980). *The new social contract: An inquiry into modern contractual relations*. Yale University Press.
- Maletic, M., Maletic, D., Dahlgaard, J., Dahlgaard-Park, S. M., & Gomišček, B. (2015). Do corporate sustainability practices enhance organizational, economic performance? *International Journal of Quality and Service Sciences*, 7(2–3), 184–200. <https://doi.org/10.1108/IJQSS-02-2015-0025>
- Manigandan, P., Alam, M. S., Alagirisamy, K., Pachiyappan, D., Murshed, M., & Mahmood, M. (2022). Realizing the Sustainable Development Goals through technological innovation: Juxtaposing the economic and environmental effects of financial development and energy use. *Environmental Science and Pollution Research*, <https://doi.org/10.1007/s11356-022-22692-8>
- Massaro, M., Dumay, J., Garlatti, A., & Dal Mas, F. (2018). Practitioners' views on intellectual capital and sustainability: From a performance-based to a worth-based perspective. *Journal of Intellectual Capital*, 19(2), 367–386. <https://doi.org/10.1108/JIC-02-2017-0033>
- Matinaro, V., Liu, Y., Lee, T. J., & Poesche, J. (2019). Extracting critical factors for sustainable development of enterprises: A case study of SMEs in Taiwan. *Journal of Cleaner Production*, 209, 1152–1169. <https://doi.org/10.1016/j.jclepro.2018.10.280>
- Mehta, K., & Chugan, P. K. (2015). Green HRM in pursuit of environmentally sustainable business. Pursuit of Environmentally Sustainable Business (June 1, 2015). *Universal Journal of Industrial and Business Management*, 3(3), 74–81. <https://doi.org/10.13189/ujibm.2015.030302>
- Mention, A., & Bontis, N. (2013). Intellectual capital and performance within the banking sector of Luxembourg and Belgium. *Journal of Intellectual Capital*, 14(2), 286–309. <https://doi.org/10.1108/14691931311323896>
- Montabon, F., Pagell, M., & Wu, Z. (2016). Making sustainability sustainable. *Journal of Supply Chain Management*, 52(2), 11–27. <https://doi.org/10.1111/jscm.12103>
- Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20–38. <https://doi.org/10.1177/002224299405800302>
- Murga-Menoyo, M. A. (2014). Learning for a sustainable economy: Teaching of green competencies in the university. *Sustainability*, 6(5), 2974–2992. <https://doi.org/10.3390/su6052974>
- Murshed, M. (2021). Can regional trade integration facilitate renewable energy transition to ensure energy sustainability in South Asia? *Energy Reports*, 7(C), 808–821. <https://doi.org/10.1016/j.egy.2021.01.038>
- Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Harvard University Press.

- Nielsen, E., Jolink, A., Beatriz Lopes de Sousa Jabbour, A., Chappin, M., & Lozano, R. (2017). Sustainable collaboration: The impact of governance and institutions on sustainable performance. *Journal of Cleaner Production*, 155(2), 1–6. <https://doi.org/10.1016/j.jclepro.2016.12.085>
- Obeng, B. A., Robson, P., & Haugh, H. (2014). Strategic entrepreneurship and small firm growth in Ghana. *International Small Business Journal: Researching Entrepreneurship*, 32(5), 501–524. <https://doi.org/10.1177/0266242612463946>
- Raar, J. (2015). SMEs, environmental management and global warming: A fusion of influencing factors? *Journal of Small Business and Enterprise Development*, 22(3), 528–548. <https://doi.org/10.1108/JSBED-10-2013-0157>
- Rahim, S., Murshed, M., Umarbeyli, S., Kirikkaleli, D., Ahmad, M., Tufail, M., & Wahab, S. (2021). Do natural resources abundance and human capital development promote economic growth? A study on the resource curse hypothesis in Next Eleven countries. *Resources, Environment and Sustainability*, 4, 100018. <https://doi.org/10.1016/j.resenv.2021.100018>
- Rehman, A., Ma, H., Ozturk, I., Murshed, M., Chishti, M. Z., & Dagar, V. (2021). The dynamic impacts of CO2 emissions from different sources on Pakistan's economic progress: A roadmap to sustainable environment. *Environment, Development and Sustainability*, 23(12), 17857–17880. <https://doi.org/10.1007/s10668-021-01418-9>
- Roos, G., & Roos, J. (1997). Measuring your company's academic performance. *Long Range Planning*, 30(3), 413–426. [https://doi.org/10.1016/S0024-6301\(97\)90260-0](https://doi.org/10.1016/S0024-6301(97)90260-0)
- Sadiq, M., Shinwari, R., Usman, M., Ozturk, I., & Maghyreh, A. I. (2022). Linking nuclear energy, human development and carbon emission in BRICS region: Do external debt and financial globalization protect the environment? *Nuclear Engineering and Technology*, 54(9), 3299–3309. <https://doi.org/10.1016/j.net.2022.03.024>
- Sadorsky, P. (2014). Modeling volatility and correlations between emerging market stock prices and copper, oil, and wheat prices. *Energy Economics*, 43, 72–81. <https://doi.org/10.1016/j.eneco.2014.02.014>
- Sarkodie, S. A., & Ozturk, I. (2020). Investigating the environmental Kuznets curve hypothesis in Kenya: A multivariate analysis. *Renewable and Sustainable Energy Reviews*, 117, 109481. <https://doi.org/10.1016/j.rser.2019.109481>
- Sartori, S., Latrónico, F., & Campos, L. (2014). Sustainability and sustainable development: A taxonomy in the field of literature. *Ambiente & Sociedade*, 17(1), 01–22. <https://doi.org/10.1590/S1414-753X2014000100002>
- Savitz, A. W., & Weber, K. (2014). *The Triple Bottom Line: How today's best-run companies are achieving economic, social, and environmental success and How You can too*. John Wiley & Sons.
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, 8(2), 23–74.
- Serenko, A., & Bontis, N. (2004). Meta-review of knowledge management and intellectual capital literature: Citation impact and research productivity rankings. *Knowledge and Process Management*, 11(3), 185–198. <https://doi.org/10.1002/kpm.203>
- Severo, E. A., de Guimarães, J. C. F., Dorion, E. C. H., & Nodari, C. H. (2015). Cleaner production, environmental sustainability and organizational performance: An empirical study in the Brazilian Metal-Mechanic industry. *Journal of Cleaner Production*, 96, 118–125. <https://doi.org/10.1016/j.jclepro.2014.06.027>
- Shahbaz, M., Sharma, R., Sinha, A., & Jiao, Z. (2021). Analyzing nonlinear impact of economic growth drivers on CO2 emissions: Designing an SDG framework for India. *Energy Policy*, 148, 111965. <https://doi.org/10.1016/j.enpol.2020.111965>
- Sharabati, A. A. A., Jawad, S. N., & Bontis, N. (2010). Intellectual capital and business performance in the pharmaceutical sector of Jordan. *Management Decision*, 48(1), 105–131. <https://doi.org/10.1108/00251741011014481>
- Shaw, A. K. (2016). Drivers of animal migration and implications in changing environments. *Evolutionary Ecology*, 30(6), 991–1007. <https://doi.org/10.1007/s10682-016-9860-5>

- Sheraz, M., Deyi, X., Sinha, A., Mumtaz, M. Z., & Fatima, N. (2022). The dynamic nexus among financial development, renewable energy and carbon emissions: Moderating roles of globalization and institutional quality across BRI countries. *Journal of Cleaner Production*, 343, 130995. <https://doi.org/10.1016/j.jclepro.2022.130995>
- Singh, Y. (2015). Environmental management through Green banking: A study of commercial banks in India. *International Journal of Interdisciplinary and Multidisciplinary Studies*, 2, 17–26.
- Stancu, I., Stancu, D., Dumitrescu, D., & Tinca, A. (2015). Sales forecasting in the context of seasonal activities and company sustainable growth. *Anfiteatro Economic*, 17(40), 1054.
- Stewart, T. A. (1991). Brainpower intellectual capital is becoming corporate America's most valuable asset and its sharpest competitive weapon. The challenge is to find what you have and use it. *Fortune*, 44–60.
- Sullivan, P. H. (1999). Profiting from intellectual capital. *Journal of Knowledge Management*, 3(2), 132–143. <https://doi.org/10.1108/13673279910275585>
- Ullah, S., Ozturk, I., Usman, A., Majeed, M. T., & Akhtar, P. (2020). On the asymmetric effects of premature deindustrialization on CO2 emissions: Evidence from Pakistan. *Environmental Science and Pollution Research International*, 27(12), 13692–13702.
- Verbano, C., & Crema, M. (2016). Linking technology innovation strategy, intellectual capital, and technology innovation performance in manufacturing SMEs. *Technology Analysis & Strategic Management*, 28(5), 524–540. <https://doi.org/10.1080/09537325.2015.1117066>
- Widener, S. K. (2006). Human capital, pay structure, and performance measures in bonus compensation. *Management Accounting Research*, 17(2), 198–221. <https://doi.org/10.1016/j.mar.2005.06.001>
- Wong, K. Y., & Aspinwall, E. (2004). Characterizing knowledge management in the small business environment. *Journal of Knowledge Management*, 8(3), 44–61. <https://doi.org/10.1108/13673270410541033>
- Wright, P. M., McMahan, G. C., & McWilliams, A. (1994). Human resources and sustained competitive advantage: A resource-based perspective. *The International Journal of Human Resource Management*, 5(2), 301–326. <https://doi.org/10.1080/09585199400000020>
- Yacob, P., & Moorthy, M. (2012). Green practices: Perception of Malaysian SME owners/managers. *International Journal of Academic Research in Economics and Management Sciences*, 1(3), 103–111.
- Yong, J. Y., Yusliza, M.-Y., Ramayah, T., & Fawehinmi, O. (2019). Nexus between green intellectual capital and green human resource management. *Journal of Cleaner Production*, 215, 364–374. <https://doi.org/10.1016/j.jclepro.2018.12.306>
- Yusoff, Y. M., Omar, M. K., & Kamarudin, M. D. (2019). Does organizational learning capability allow improving business sustainability ? Quantitative analysis in the manufacturing SME context. *IOP Conference Series: Materials Science and Engineering*, 469, 012015. <https://doi.org/10.1088/1757-899X/469/1/012015>
- Zaid, A. A., Jaaron, A. A. M., & Bon, A. T. (2018). An empirical study is the impact of green human resource management and supply chain management practices on sustainable performance. *Journal of Cleaner Production*, 204, 965–979. <https://doi.org/10.1016/j.jclepro.2018.09.062>
- Zhao, J., Sinha, A., Inuwa, N., Wang, Y., Murshed, M., & Abbasi, K. R. (2022). Does structural transformation in economy impact inequality in renewable energy productivity? Implications for sustainable development. *Renewable Energy*, 189, 853–864. <https://doi.org/10.1016/j.renene.2022.03.050>