From resources to sustainability: a practice-based view of net zero economy implementation in small and medium business-to-business firms

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Abstract

Purpose – This study examines the effect of resources (e.g. tangible resources, human skills and intangible resources) that are utilized as a bundle of standard practices on sustainable net zero economy implementation and their further impact on financial, environmental and social performance among small- and medium-level enterprises in business markets. The moderating effect of big data analytical intelligence is also examined.

Design/methodology/approach – The samples were selected from the paper and chemical manufacturing industries of South Africa. The data analysis was performed using variance-based structural equation modeling.

Findings – The results show that tangible resources, human skills and intangible resources positively influence sustainable net zero economy adoption. However, intangible resources have a more substantial influence on sustainable net zero economy implementation. This shows that adopting a sustainable net zero economy depends more on a bundle of common practices, including sustainability culture, employee training and knowledge management, and managers must create the necessary action plans accordingly. In addition, sustainable net zero economy adoption positively influences financial performance, environmental performance and social performance. However, sustainable net zero economy adoption has a more substantial influence on social performance. Therefore, implementing a net zero economy will be more advantageous to society and to local communities.

Practical implications – To achieve a sustainable net zero economy, managers should recognize the significance of resource management. While managing tangible resources and human skills is crucial, intangible resources, such as culture and organizational learning, require more attention. Additionally, the ability of small- and medium-sized enterprises to explore, store, share and apply knowledge is crucial to achieving net zero. Therefore, managers should make use of Industry 4.0-based digital technologies for effective knowledge management. Moreover, net zero economy adoption can significantly enhance societal performance. Hence, while making budgeting decisions, managers must consider the potential of the firm's resources to improve social performance.

Originality/value – This study is the first to investigate the impact of human skills and tangible and intangible resources on the adoption of a sustainable net zero economy by companies, using empirical evidence. The research expands on the concept of the practice-based view (PBV) in the implementation of sustainable net zero economies by small- and medium-sized business-to-business enterprises.

Keywords Resources, Carbon neutrality, Net zero economy, Decarbonization, Sustainability, Business-to-Business firms

Paper type Research paper

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1. Introduction

Extreme weather events are increasing due to climatic changes triggered by unsustainable production and consumption (Bag *et al.*, 2022b). The emission of greenhouse gases (GHGs) is dangerous since it interacts with the ozone layer and gradually depletes it, resulting in climate change. The United Nations (UN) climate champions recently launched the “Race to Zero Breakthroughs” campaign. To reach net zero carbon emissions and decrease the rate of climate change, this campaign has established a roadmap with targets for more than twenty critical economic sectors, from steel manufacturing to aviation [1]. This is a fantastic illustration of the effectiveness of group efforts in combating climate change. Agents from various regions and industries can increase the impact of their actions by working together to develop fresh, cooperative solutions [1]. Nine system-level needs, including structural components and sociological and economic changes as well as governance, institutions and commitment, must be fulfilled for global decarbonization to be successful [2]. There would be significant shifts in demand for various goods and services due to changes in regulations, technologies and customer and investor preferences. Oil and gas production quantities would be 55% and 70% lower, respectively, in 2050 than they are now. By 2050, the production of coal would almost entirely cease [2]. However, the demand for alternate energy would be ten times higher in 2050 than it is today. The report further pointed out that some sectors may have operating cost savings in the long term as a result of the initial capital investments required for a net zero transformation [2].

Ambitions for a net zero economy are growing, but decarbonization has slowed somewhat during the past year [3]. Although 137 nations have committed to cutting GHG emissions by up to 25%, none of these nations is among the top five polluters. Moreover, companies are not disclosing their carbon emission data, and public awareness of climate change is limited (Mishra *et al.*, 2022a, b). There are also various challenges to achieving decarbonization in the supply chain (SC), including operational, policy and regulatory, technological, economic and market-related challenges (Mishra *et al.*, 2022a, b).

Furthermore, Nyangchak (2022) has observed that the literature on the net zero economies is fragmented and requires a holistic framework. A more comprehensive understanding of the primary forces influencing the green industry is necessary to transition to a net zero economy (Nyangchak, 2022).

Although companies like Amazon, Nestle, Unilever and Tata Motors have already taken a step towards a net zero economy, all firms and industries need to take similar steps. The sooner small and medium enterprises (SMEs) take action, the better. No previous studies have examined the effect of resources on the net zero economies. The resource-based view (RBV) assumes that resources need to be valuable, rare, inimitable and non-substitutable and, further, that the way resources are configured will determine their competitive advantage. An interesting question to pose in the context of net zero economies is whether the 120 countries who have pledged to achieve net zero by 2050 have done so for commercial gains. While businesses operate for commercial gains, the purpose of net zero is to create a sustainable ecosystem where future generations can survive and meet their needs.

In the context of net zero, is it necessary for resources to be valuable, rare, inimitable and non-substitutable? Therefore, it is essential to examine the relationships using the practice-based view (PBV). Moreover, (Mishra *et al.*, 2022a, b) note that previous studies have not discussed the social dimensions of sustainability in the context of net zero.

In the digital era, big data analytics, involving descriptive, prescriptive and predictive analytics, is playing a crucial role in decision-making and enhancing firms’ performance (Wamba *et al.*, 2017). Big data analytical intelligence involves utilizing advanced analytics techniques and algorithms to analyze large and complex datasets in order to extract valuable insights and knowledge (Bag *et al.*, 2022a). When applied in the context of a net zero economy, it can provide several benefits for SMEs. One of the primary advantages of big data analytics is its ability to improve resource management by optimizing resource utilization and reducing waste. By analyzing data, such as information about energy consumption, SMEs can identify areas of high consumption and implement measures to reduce them, resulting in improved efficiency and cost savings. Another benefit of big data analytics is its ability to accurately measure and track a company's carbon footprint. By analyzing data from various sources, such as suppliers and customers, SMEs can identify areas of high emissions and implement measures to reduce them, thereby lowering their environmental impact. In addition, big data analytics can assist SMEs in identifying and mitigating risks associated with their operations. By analyzing data on weather patterns, for instance, SMEs can anticipate and prepare for extreme weather events that could potentially impact their operations. Furthermore, big data analytics can be leveraged to foster innovation by identifying new opportunities for sustainable products and services that meet the needs of environmentally conscious consumers. By analyzing market data and consumer preferences, SMEs can develop new offerings that align with the principles of a net zero economy. Thus, the application of big data analytical intelligence can help SMEs in net zero economy implementation by enhancing resource management, reducing their carbon footprint, managing risks and driving innovation.

The quality of high/low level of big data analytical intelligence can change the effect of resources on performance outcomes, as shown in a study by Bag *et al.* (2022a). However, previous studies have not examined the impact of big data analytical intelligence on net zero performance. Hence, building on a unique application of the PBV, this study aims to develop a theoretical model and to use empirical research methods to test it. The two research questions that drive this study are.

RQ1. What resources influence net zero implementation under the moderating effect of big data analytical intelligence?

RQ2. What is the influence of net zero implementation on financial, environmental and social performance?

Conducting research on sustainable net zero economy implementation by SMEs is imperative for several reasons. Firstly, SMEs play a significant role in the economy and have a notable impact on the environment. Hence, their involvement is crucial for the successful implementation of a sustainable net zero economy. Secondly, SMEs often encounter numerous challenges in adopting sustainable practices due to their limited resources and capabilities. Thus, research can help identify the hindrances and facilitators of sustainable net zero economy adoption by SMEs, which can inform policies and strategies to assist SMEs in this transition. Thirdly, SMEs have unique characteristics and operate differently from large corporations. Consequently, research can help create customized solutions for SMEs that are efficient and practicable in their specific settings. Comprehending sustainable net zero economy adoption by SMEs is vital for achieving a more sustainable and resilient economy.

The current study bridges the gap in the existing literature and its findings are critical for three reasons: (a) it examines the effect of various resources on a sustainable net zero economy under the moderating effect of big data analytical intelligence; (b) it examines the effect of a sustainable net zero economy on financial, environmental and social performance; and (c) it considers SMEs as the basis for the empirical study.

The study is organized into five sections. Section 2 details the literature review including theoretical model building and hypotheses; section 3 presents the research methods; section 4 provides the data analysis; section 5 presents a discussion of the result; and section 6 is the conclusion.

2. Literature review

2.1 Net zero economy

Humans' use of fossil fuels has led to significant carbon dioxide emissions, which are warming the world. The level of GHG emissions into the atmosphere must be reduced to stop the warming (Mishra *et al.*, 2022a, b). However, for industries like manufacturing, controlling emissions is hard (Bonsu, 2020).

At the 2009 United Nations Climate Change Conference, scientists made a discovery. To truly reduce emissions quickly and thoroughly enough to achieve the desired temperature goals was not simple. What was actively needed was to remove GHG from the atmosphere too. Hence, the concept of net zero emerged. The countries that signed the Paris Agreement pledged to turn this idea into reality by balancing the levels of GHG emitted into and removed from the atmosphere by the second half of this century.

There is much discussion about "net zero" goals to fight against changes in climatic conditions. Companies such as British Airways and Facebook and pop artists such as Billie Eilish have promised to bring GHG emissions closer to net zero.

Net zero involves balancing the removal of GHG from the atmosphere with GHG emissions into the atmosphere so that the total becomes zero. However, achieving these net zero goals is complicated in reality (Virmani *et al.*, 2022).

In order to achieve net zero, two actions must be taken: the first is more evident and involves reducing GHG output; the second consists of removing emissions from the atmosphere. The latter action is more challenging. To attain net zero, the world must transition from a global economy that emits around 40 billion tons of carbon dioxide annually to one that removes billions of tons. Some techniques for removing GHGs are already applied on a large scale, such as expanding the tree population and enhancing soil properties to increase carbon dioxide storage. New technologies, including those that capture carbon dioxide, store it underground or burn it to produce power and then capture the gas once again as it burns, are still in the early stages of research. While much work has been done on negative emission technologies, none of these projects have achieved scale. More innovations are required to make net zero a reality. As yet, there is no universal policy for reducing emissions. However, the US and the EU are working towards the target of net zero by 2050 (Jenkins *et al.*, 2021). China has also pledged to achieve net zero before 2060 [4].

2.2 Practice-based view

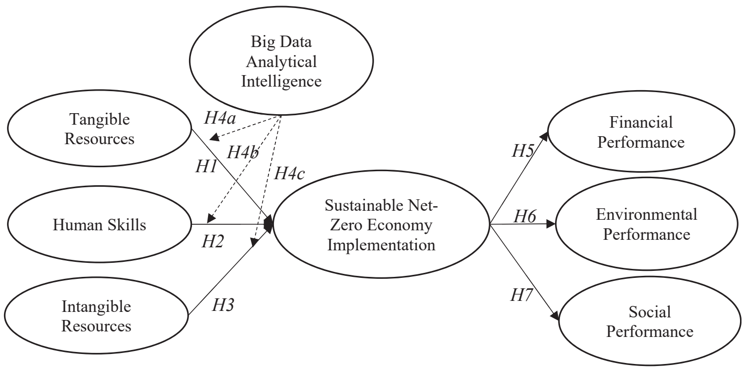
The PBV is a recent viewpoint that has been suggested as an alternative to the RBV. Bromiley and Rau (2014) contend that ordinary enterprises like SMEs, which are making minor but significant development, do not match the qualifying requirements for the application of the RBV/Dynamic Capability View (DCV) and that the theory of competitive advantage is only applicable to a few selected firms in an industry. Additionally, the RBV and DCV suggest that resources or capabilities are a source of competitive advantage (Barney, 1991). However, SMEs need to focus on standard practices to achieve net zero. It is well understood that the balance between the amount of GHG produced and the amount removed from the atmosphere is known as net zero. When the amount that is added is precisely equal to the amount subtracted, net zero will be reached [5]. There are two ways of doing this: first, by reducing the emissions that are sent into the atmosphere and second, by removing GHG from the atmosphere. The first approach can be performed by using cleaner technologies in production; alternative energy sources for meeting power demand; and alternative fuel in logistics. Cleaner technologies can minimize and reduce carbon emissions in production. Digital technologies (e.g. the internet of Things, big data analytics and blockchain technology) could be immensely beneficial in attaining a net zero economy Mishra *et al.* (2022a, b).

The second approach comprises removing carbon from the atmosphere by planting trees or by capturing the carbon before it is emitted. Therefore, different practices are essential for adopting net zero economy initiatives. Since firms are not competing with each other to achieve net zero, they are doing so to achieve a greater goal, i.e. creating a sustainable planet. However, current net zero literature rarely considers specific, practical methods that managers might utilize to develop strategies or broadly applicable managerial practices. Hence, a theoretical model is grounded in the PBV, which is proposed as an appropriate lens to examine the role of practices that are common and easy to imitate. Using a PBV as an alternative theoretical lens delivers an enhanced understanding of net zero. A similar argument was made in a study by Bag *et al.* (2021a) in the context of sustainable development and in another study by Dubey *et al.* (2022) in the context of humanitarian SC.

2.3 Theoretical model

Drawing on PBV, the theoretical model is presented in Figure 1. Resources, including tangible resources, human skills and intangible resources, directly affect sustainable net zero economy implementation, whereas big data analytical intelligence plays a moderating role. Further sustainable net zero economy implementation is linked with financial, environmental and social performance.

2.3.1 Tangible resources and sustainable net zero economy implementation. Technology plays a significant role in nurturing the green industry (Liu *et al.*, 2020). Nyangchak (2022) has argued that the green industry could help to achieve net zero. However, there are practical challenges involved in capturing carbon before its escapes into the atmosphere. Accurate demand forecasting, followed by proper capacity planning, inventory management and the implementation of vehicle routing models, is vital for sustainable operations management (OM). In this volatile business environment, it is hard to predict the right number, but digital technologies, such as big data analytics, can be immensely useful for descriptive, prescriptive and predictive analytics (Bag *et al.*, 2021b). Gupta and George (2016) have indicated that tangible resources are crucial for the development of big data analytics capability. Similarly, tangible resources, such as data driven technologies, are essential for implementing a sustainable net zero economy. Bag *et al.* (2021a) have empirically proven that Industry 4.0-based digital technology implementation positively and significantly influences 10R advanced manufacturing capabilities. 10R advanced manufacturing capabilities will enhance resource circularity. Again, technology emerges as a vital component in the implementation of net zero economies at firm level. This is validated by Gupta and Garg (2020), who have observed that poor technological infrastructure will create a barrier to implementing a net zero system in the SC. Technology readiness for low-carbon operations is necessary. SMEs need to enhance the



Source(s): Author's own work

Figure 1. Theoretical model

adaptability of natural renewable resources. This will help to minimize waste generation volume and reduce carbon emissions and environmental costs (Mishra *et al*., 2022a, b). In the near future, there will be increased demand for renewables, batteries and energy storage, circular economy, green buildings, manufacturing process innovation, hydrogen energy, sustainable fuels, carbon removal and capture and storage technologies [6]. On the other side, nature-based solutions, such as planting more trees, will absorb the carbon dioxide from the atmosphere and help to achieve net zero goals. Hence.

H1. Tangible resources would have a positive relationship with sustainable net zero economy implementation.

2.3.2 Human skills and sustainable net zero economy implementation. According to Nyangchak (2022), human capital is a primary enabler of the green industry. Also, human capital will aid in the generation of green occupation, environmental awareness, green innovation and enhance sustainability performance.

Managerial skills are crucial for the implementation of a sustainable net zero economy. Management of cleaner technology-based operations and analytics acumen are necessary (Mishra *et al*., 2022a, b). Additionally, lean management practices are also essential to reduce wastage in the SC.

Managing the systems, workforce and creating a digital system to monitor the performance will bring a change to the traditional systems. Managing the change must be handled cautiously to avoid employee and stakeholder dissatisfaction. Cabral and Dhar (2019) emphasized the importance of green human resource management systems to shape green attitudes and behaviors.

Technical skills are equally important since the smooth running and maintenance of advanced manufacturing technology-based equipment and machinery is the core of net zero systems. Mishra *et al.* (2022a,b) pointed out that a lack of technical skills challenges implementing a sustainable net zero economy. Frequent breakdowns and the non-availability of technicians can impact productivity and delivery commitments. Periodic inspection, maintenance, calibration is vital for required to run smooth plant operations. Hence, both managerial and technical skills are necessary to implement a sustainable net zero economy (Bag *et al*., 2021b).

H2. Human skills would have a positive relationship with sustainable net zero economy implementation.

2.3.3 Intangible resources and sustainable net zero economy implementation. Presently, all SMEs follow a set of practices that will entirely or partly change the moment the firm will implement the net zero policy. There will be resistance in the path of net zero implementation from internal and external stakeholders. Employees will become unhappy because the new set of net zero practices will require the acquisition of new skills and knowledge. The intensity of training programs will be heavy since continuous education will be necessary. Changes in roles, organizational structure and intercompany transfer will make junior-level employees uncomfortable. Too much discomfort will lead to more employees leaving the firm. Many vendors will stop supply due to high uncertainty and fear of what net zero technologies will mean for them.

In some cases, top management leaders will also oppose the implementation of net zero and try to delay the projects intentionally. In order to overcome these challenges, top management must align their business objectives with net zero economy targets first and then focus on developing a sustainability-driven culture to make everyone aware of and comfortable with the sustainable development aims. Multiple rounds of meetings with key stakeholders and detailed discussions of the net zero project will help to ensure smooth implementation. Creating a strong sustainability mindset will enable the successful implementation of net zero economies. SMEs will need to send employees for regular training to technology-driven institutes and management institutes for training. Regular and intensive training programs will shape the workforce and prepare them to welcome a net zero economy. Therefore, SMEs need to emphasize intangible resources such as organizational culture and learning (Chowdhury *et al.*, 2022).

H3. Intangible resources have a positive relationship with sustainable net zero economy implementation.

2.3.4 Moderating effect of big data analytical intelligence. Data engineers are responsible for the extraction, transformation and storage of data, whereas data scientists apply data mining methods and algorithms to the data. Business intelligence is gained from the information extracted from the data. In a firm, specific business rules apply and business analysts and consultants follow these rules when performing business analytics. With the increasing complexity of business operations, it is critical to use business analytics and intelligence in an integrated way to gain an edge over competitors.

The degree to which a company integrates big data analytical intelligence into its business processes is reflected in its big data analytical intelligence assimilation (Gunasekaran *et al.*, 2017). Big data analytical intelligence has played an instrumental role in data-driven decision making. For instance, it has enabled greater mass customization ability and improved customer relationship performance (Zhang *et al.*, 2020). In a resource-constrained environment, not all firms have the same ability to integrate big data analytical intelligence with business processes. This was considered a moderating factor in a study by Bag *et al.* (2022a), where the empirical results showed that a high/low level of big data analytical intelligence strengthens/weakens the relationship between buyer–supplier partnerships and social sustainability. In the context of a net zero economy, the uncertainty level frequently increases because the system and associated processes are new to everyone. We argue that in such a situation, a high level of big data analytical intelligence can strengthen/weaken the impact of tangible resources, human skills and intangible resources on net zero economy implementation. Hence.

H4a. Big data analytical intelligence plays a moderating role on the path joining tangible resources and sustainable net zero economy implementation.

H4b. Big data analytical intelligence plays a moderating role on the path joining human skills and sustainable net zero economy implementation.

H4c. Big data analytical intelligence plays a moderating role on the path joining intangible resources and sustainable net zero economy implementation.

2.3.5 Sustainable net zero economy implementation and financial performance. Sustainable net zero implementation requires a high initial investment, but the long-term returns are attractive. By selling green products, firms can also earn higher profit margins, attract more customers and significantly increase their market share. Of course, the green product quality must add value or customers will not perceive it positively (D'Souza *et al.*, 2006).

According to Kwarteng *et al.* (2022), implementing circularity practices, which include minimizing, reusing, recycling, recovering and restoring the use of resources in production and usage, improves financial efficiency. Similarly, we argue that net zero economies will also enhance financial performance. Hence.

H5. Sustainable net zero economy implementation has a positive relationship with financial performance.

2.3.6 Sustainable net zero economy implementation and environmental performance. According to Haupt and Hellweg (2019), assessment techniques that can be used at all scales—from specific items to broader systems and even entire economies—are necessary to transition to a sustainable circular economy. Similarly, new assessment techniques are required in a net zero economy. Khan and DaddiIraldo (2020) have highlighted that circular economy practices improve environmental performance. Mishra *et al.* (2022a,b) have further argued that the transition to net zero economies will significantly enhance environmental performance. The use of eco-friendly materials in production, along with the use of recyclable materials and renewable resources like solar energy, wind energy, hydro energy and ocean energy, will reduce GHG emissions, minimize air pollution, improve the quality of air and reduce water usage, and all of these will lead to enhanced environmental performance (Rupani *et al.*, 2020; Ray *et al.*, 2022). Hence.

H6. Sustainable net zero economy implementation has a positive relationship with environmental performance.

2.3.7 Sustainable net zero economy implementation and social performance. As Mishra *et al.* (2022a,b) have observed, previous studies have not examined sustainability's social dimensions in the context of a net zero economy. We argue that net zero economy implementation will improve the quality of society. Net zero policies will include labor rights, a focus on the health and safety of the workforce, diversity practices, product responsibility and, above all, a social responsibility which will improve social performance. Hence.

H7. Sustainable net zero economy implementation has a positive relationship with social performance.

3. Research method

Flynn *et al.* (1990) have noted the need for more empirical research in OM. Thirty-three years have passed since their work was published, and since then a significant amount of empirical research papers has appeared in top journals. Other leading scholars have supported empirical research methods in the OM area (Filippini, 1997; Scudder and Hill, 1998; Brusco *et al.*, 2012). Empirical research constitutes data collection from field studies and observations. It differs from simulation or lab-based experiments. Previously, OM researchers preferred mathematical modelling because they perceived empirical research as soft and risky. However, the article by Flynn *et al.* (1990) provided a solid foundation of knowledge about empirical methods, which is followed in the current study. The theoretical foundation of this study was already established in Sections 1 and 2. A theory verification approach was used in this study. Its research design, involving a survey, will be discussed in detail in subsequent sub-sections. A data collection method using a structured questionnaire was preferred. Lastly, the sampling strategy, scale, pilot test, online mailing of questionnaires, non-response bias test and common method bias test are discussed in the implementation step.

3.1 Research context

This study is conducted in a developing economy like South Africa. South Africa, located at the southernmost point of Africa, is distinguished by a number of distinctive ecosystems. The Republic of South Africa (RSA) is a developing country. RSA's economy is the second largest in Africa and the continent's most industrialized, technologically progressive and diversified. Its GDP was worth 419 billion USD in 2021. Approximately 2.43% of RSA's GDP in 2021 came from agriculture, whereas 24.46 and 62.75% of the total value added came from industry and services, respectively [7]. Response to climate change has also received attention from RSA's government. Africa's greatest source of carbon emissions, RSA is responsible for 40% of the continent's emissions [8]. According to RSA's National Development plans for economic sustainability, collaboration is required to increase resilience to climate change. An emphasis is also placed on the digital economy [9]. Although governments and firms in many countries have taken initiatives to achieve net zero targets by 2050, in RSA, combating climate change is mostly about maintaining economic competitiveness and reducing joblessness and scarcity while achieving net zero [10]. It is clear that RSA is facing additional challenges beside the challenges to adopt net zero. However, the Boston Consulting Group (BCG) report indicates that by 2050, RSA will ensure a Just Transition. The report also pointed out that RSA needs to consider renewable energy sources, since a competitive, net zero economy in RSA depends on renewable energy [9]. The current study considers the manufacturing industry because it is particularly highly polluting, as indicated in previous studies (Rogerson, 1990; Maama *et al.*, 2021). The most hazardous industries in RSA are pulp and paper, chemicals and petroleum, cement, minerals and basic metals manufacturers (Rogerson, 1990).

3.1.1 Measures. The exogenous constructs considered are tangible resources, human skills, intangible resources and net zero economy adoption, while the endogenous constructs considered are financial performance, environmental performance and social performance. The items used to measure these latent constructs are presented in Table 1. The items were considered from previous studies and adapted in the context of this study. The age and size of a firm were chosen as control variables. Previous studies also used the same variables as control variables (e.g. Akter *et al.*, 2016).

3.1.2 Sampling design and data collection. The samples were selected randomly from the Paper Manufacturers Association of South Africa database (https://thepaperstory.co.za/about-pamsa/members/) and the Chemical and Allied Industries' Association (https://www.caia.co.za/membership/current-members/) database to control bias. Two criteria were considered while selecting the samples: firms had to (a) be of small or medium size and (b) have taken sustainability initiatives. The website of every firm and their annual reports were checked before considering them for this study. The paper manufacturing and chemical industries are highly polluting ones, and yet, at the same time, there is immense scope for resource circularity and achieving net zero. Therefore, the researcher considered these industries. A structured questionnaire was used for this empirical study. The pilot study was initiated in January 2022, involving 40 samples, and the model went through further tests. Based on the results which were found satisfactory, the final survey commenced in February 2022 and ended in July 2022. The survey questionnaire was distributed by email to the 800 potential respondents and was stopped after the receipt of 245 completed questionnaires. This cap was introduced due to time and financial concerns.

The response rate was around 30%, which is acceptable in social science research. The demographic profiles of participants are given in Table 2. This table shows that the most responses were received from the age groups ranging between 41 and 51 years, and also from logistics and SC managers who are responsible for resource management in SC networks.

3.1.3 Non-response bias. Any empirical study where the data are collected through field studies using questionnaires is prone to suffer from non-response bias. This happens due to the receipt of responses at different points in time. For instance, in this study, the first set of 96 responses was received immediately after the questionnaires were distributed; these can be called early respondents. However, after follow-ups, another 149 responses were received; these can be called late respondents. Levene's test was performed in SPSS 26.0, and the results indicate that the p values are higher than 0.05, meaning that data obtained in different phases are homogenous.

3.1.4 Common method bias. For any self-reported data, there is a danger of common method biases originating from several sources (Podsakoff and Organ, 1986). Hence, we performed common method variance (CMV) checks as per the suggestion of Podsakoff *et al.* (2012) and MacKenzie and Podsakoff (2012). In an effort to impose a procedural remedy, we told the respondents to give answers to the questions that were asked in light of peer consultation rather than personal experience. To rule out the existence of CMV, statistical testing was used. Harman's Single-Factor test was carried out, and the results indicated that

Construct	Item no	Items	Source (adapted from)
Tangible Resources (TAR)	TAR1	"We have developed the green technology infrastructure required for a net zero economy"	Gupta and George (2016), Bag *et al.* (2021b), Virmani *et al.* (2022)
	TAR2	"We have adopted digital technologies like IoT, BDA and blockchain to speed up net zero economy adoption"	
	TAR3	"We focused on advanced manufacturing technology readiness to facilitate net zero economies"	
Human Skills (HUS)	HUS1	"We are focusing on improving the technical skills of employees for using green technology in manufacturing"	
	HUS2	"We make our employees aware of environmental protection laws and offer training to them on decarbonization in supply chains"	
	HUS3	"We recruit new employees who have good exposure to reducing, recycling and reusing aspects"	
	HUS4	"We train our managers to coordinate effectively with all supply chain actors"	
Intangible Resources (INR)	INR1	"We have implemented lean and green-related sustainability culture in the organization"	
	INR2	"We constantly train our employees to consider resources circularity while making business decisions"	
	INR3	"We can search for new and relevant knowledge related to the net zero economies"	
	INR4	"We can acquire new and relevant knowledge related to the net zero economies"	
	INR5	"We can assimilate relevant knowledge related to the net zero economies"	
Big Data Analytical Intelligence (BDI)	BDI1	"We use applications for big data analytics, and they incorporate information from both internal and external sources"	Zhang *et al.* (2020)
	BDI2	"Big data analytics is used to glean knowledge about hidden patterns, correlations, market trends and client preferences"	
	BDI3	"Big data analytical intelligence is used as an essential tool in the supply chain department"	
	BDI4	"Big data analytical intelligence is employed for making decisions in every major functional area"	
	BDI5	"Utilizing a thorough understanding of the big data analytical intelligence, we use it to drive change, minimize inefficiencies and quickly respond to changes in resources"	

Table 1.
Operationalization of constructs

(*continued*)

Construct	Item no	Items	Source (adapted from)
Sustainable Net Zero Economy Implementation (SNZ)	SNZ1	"We emphasize effective planning and management to align resources appropriately for net zero economy adoption"	Homrich *et al.* (2018), Yadav *et al.* (2020)
	SNZ2	"We have focused on internal sustainable development for the implementation of a net zero economy"	
	SNZ3	"We have focused on sustainable supplier development for the implementation of a net zero economy"	
	SNZ4	"We have focused on sustainable customer development for the implementation of a net zero economy"	
Financial Performance (FIP)	FIP1	"Increase in return on investment from net zero initiatives"	Wong *et al.* (2018)
	FIP2	"Increase in market share after taking from net zero initiatives"	
	FIP3	"Increase in total profit from products/services from net zero initiatives"	
Environmental Performance (ENP)	ENP1	"Reduction in hazardous/harmful materials used in manufacturing product/service delivery"	Wong *et al.* (2018)
	ENP2	"Reduction in the use of electricity"	
	ENP3	"Reduction in total fuel consumption used in the transportation of products/services"	
	ENP4	"Reduction in the total raw material used"	
	ENP5	"Reduction in total packaging materials used"	
	ENP6	"Reduction in air emissions"	
	ENP7	"Reduction in the solid waste disposal"	
Social Performance (SOP)	SOP1	"Respect for labour rights has improved community resilience"	Bag *et al.* (2022a)
	SOP2	"The health and safety of workers have improved in the workplace"	
	SOP3	"Social responsibility initiatives have increased the happiness of the local community"	
	SOP4	"More emphasis is given to diversity practices through the hiring of locals, women and disabled people"	
	SOP5	"Focus on product responsibility has reduced societal issues"	

Source(s): Author's own compilation

Table 1.

the maximum covariance explained by one factor was 40.79% (<50%). Therefore, CMV was controlled in the study.

The analysis of data and findings is presented in the next section.

4. Data analysis

PLS-SEM was used for data analysis because the objective was prediction, and both the formative measurement specification and reflective measurement specification were

Table 2.
Demographic profile

Demographic variable		South Africa Frequency	Percentage (%)
Age Group	20–30	18	7.35
	31–40	57	23.27
	41–50	110	44.90
	51–60	48	19.59
	Above 60	12	4.90
Educational Qualifications	Postgraduate	55	22.45
	Graduate	102	41.63
	Diploma	88	35.92
Designation	CEO/President/Owner/Managing Director	4	1.63
	Head of Business Unit or Department	56	22.86
	Health, Safety and Environment Manager	34	13.88
	Commercial Manager	27	11.02
	Information Technology Manager	26	10.61
	Logistics and SC Manager	98	40.00
No. of Employees in your Organization	Less than 100	54	22.04
	101–300	77	31.43
	301–500	114	46.53
	501–1,000	0	0.00
	More than 1,000	0	0.00
Age of the Organization (Years)	Above 20	176	71.84
	10 to 20	61	24.90
	Less than 10	8	3.27

Source(s): Author's own work

considered in this study. Here, the measurement philosophy used was total variance-based (Hair *et al.*, 2017). The data analysis was done using WarpPLS 8.0 software. In SC literature, Dubey *et al.* (2019, 2022) used PLS-SEM.

4.1 Measurement model

First, we checked the model fit and quality indices. The results were satisfactory (see Table 3).

In empirical research, the research design is useless unless it shows good reliability and validity (Nunnally, 1978; Flynn *et al.*, 1990).

The degree to which a survey, summed scale or item repeatedly produces the same findings when given to the same subjects is referred to as its reliability (Flynn *et al.*, 1990).

On the other hand, the validity of a scale or item determines whether it measures the intended measure and is free from measurement error (Flynn *et al.*, 1990; O'Leary-Kelly and Vokurka, 1998).

Cronbach's Alpha (CA) is the most generally used indicator of a measure's internal consistency (Cronbach and Meehl, 1955). CA coefficient was above 0.60 and therefore acceptable as suggested by Nunnally (1967), and the composite reliability (CR) was equal to or above 0.80 (Hair *et al.*, 2013). The average variance extracted (AVE) was equal to or above a cut-off value of 0.50 (Fornell and Larcker, 1981). Hence, this demonstrates the reliability of the scale and items.

Furthermore, the convergent and discriminant validity were checked, as per Campbell and Fiske (1959). Convergent validity refers to the extent to which results from different ways of measuring a variable are consistent. The loadings were found to be above 0.60. The AVE was

Model fit and quality indices	Values	Remarks
Average path coefficient (APC)	0.401, $p < 0.001$	Significant
Average R-squared (ARS)	0.558, $p < 0.001$	Significant
Average adjusted R-squared (AARS)	0.555, $p < 0.001$	Significant
Average block VIF (AVIF)	3.886, acceptable if ≤ 5, ideally ≤ 3.3	Within normal limits
Average full collinearity VIF (AFVIF)	4.954, acceptable if ≤ 5, ideally ≤ 3.3	Within normal limits
Tenenhaus GoF (GoF)	0.631, small ≥ 0.1, medium ≥ 0.25, large ≥ 0.36	Large GoF
Sympson's paradox ratio (SPR)	0.778, acceptable if ≥ 0.7, ideally = 1	Okay
R-squared contribution ratio (RSCR)	0.923, acceptable if ≥ 0.9, ideally = 1	Okay
Statistical suppression ratio (SSR)	1.000, acceptable if ≥ 0.7	Okay
Nonlinear bivariate causality direction ratio (NLBCDR)	0.767, acceptable if ≥ 0.7	Okay

Table 3.
Model fit and quality indices (WarpPLS software output)

also calculated (see Table 4). Hence, the scale and items used demonstrate convergent validity.

The level of distinctiveness among measures of various latent variables is known as discriminant validity. In Table 5, the square root of the AVE is presented in the diagonals of the correlation matrix. Discriminant validity was established because the diagonal values exceeded the intercorrelations of the construct with the other constructs (Fornell and Larcker, 1981).

The measuring model was deemed satisfactory in general because the results revealed evidence of satisfactory reliability (AVE > 0.50, CA > 0.60, CR > 0.80); convergent validity (loadings > 0.60), as shown in Table 4; and discriminant validity (Sq. rt. AVEs > intercorrelations of the construct), as shown in Table 5. Therefore, we proceeded with structural model testing.

4.2 Structural model

The full structural model is shown in Figure 2, and the summary is presented in Table 6.

The summary Table 6 shows that all hypotheses were supported. However, the effect of control variables was found to be non-significant.

5. Discussion

5.1 Theoretical contributions

The theoretical contributions of this research can be explained in line with the questions "What," "How" and "Why" (Dubin, 1978). The "What" question is concerned with the factors that were considered in the study. Here, factors such as tangible resources, human skills and intangible resources were considered carefully to explain the adoption of a net zero economy. Two factors, i.e. comprehensiveness and parsimony, are important to ensure that the correct factors were used in the study. Therefore, we referred to the PBV and other selected relevant factors and ensured that all factors added value to an understanding of the net zero economies from a resource perspective. The "How" question concerns the factors linked with each other. The factors (see Figure 1) are linked with arrows (paths) to the ovals (factors). The conceptualization was done in this phase. Jointly, the "What" and "How" questions form the domain or subject of the theory (Dubin, 1978). Thirdly, "Why" establishes the assumptions of the theory.

To exhibit a successful research work, it is crucial to demonstrate expression clarity, the influence of the research, timeliness and relevancy (Whetten, 1989). The current study is

Items	Loadings	CR	AVE
TAR1	0.865	0.821	0.609
TAR2	0.615		
TAR3	0.837		
HUS1	0.730	0.818	0.532
HUS2	0.652		
HUS3	0.693		
HUS4	0.830		
INR1	0.789	0.880	0.594
INR2	0.753		
INR3	0.749		
INR4	0.799		
INR5	0.762		
BDI1	0.749	0.880	0.595
BDI2	0.798		
BDI3	0.786		
BDI4	0.698		
BDI5	0.820		
SNZ1	0.756	0.852	0.590
SNZ2	0.770		
SNZ3	0.740		
SNZ4	0.805		
FIP1	0.761	0.803	0.578
FIP2	0.669		
FIP3	0.841		
ENP1	0.783	0.937	0.680
ENP2	0.825		
ENP3	0.792		
ENP4	0.818		
ENP5	0.810		
ENP6	0.861		
ENP7	0.877		
SOP1	0.852	0.915	0.683
SOP2	0.774		
SOP3	0.880		
SOP4	0.799		
SOP5	0.824		

Table 4.
Assessment of model (WarpPLS software output)

	TAR	HUS	INR	BDI	SNZ	FIP	ENP	SOP
TAR	*0.780*							
HUS	0.703	*0.729*						
INR	0.716	0.711	*0.771*					
BDI	0.758	0.766	0.704	*0.771*				
SNZ	0.705	0.705	0.768	0.774	*0.768*			
FIP	0.620	0.670	0.664	0.687	0.695	*0.760*		
ENP	0.674	0.698	0.702	0.717	0.684	0.703	*0.824*	
SOP	0.671	0.665	0.672	0.700	0.704	0.731	0.808	*0.827*

Table 5.
Discriminant validity (WarpPLS software output)

timely work because the “Race to Zero” is a worldwide campaign involving different stakeholders who are striving to achieve net zero carbon emissions by 2050. One of the themes of COP26 was the need to minimize GHG emissions.

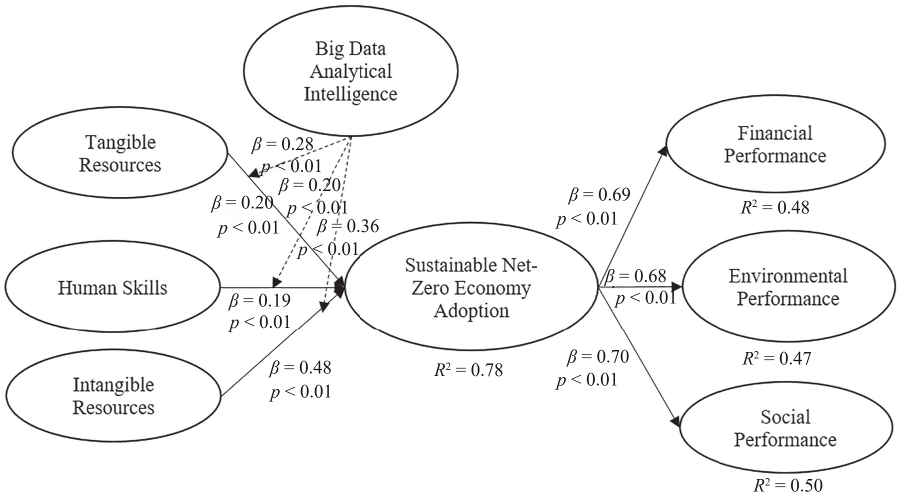


Figure 2.
Tested model (WarpPLS software output)

Hypotheses	β	*p*-value	Hypotheses supported (Y/N)
H1	0.20	<0.01	Y
H2	0.19	<0.01	Y
H3	0.48	<0.01	Y
H4a	0.28	<0.01	Y
H4b	0.20	<0.01	Y
H4c	0.36	<0.01	Y
H5	0.69	<0.01	Y
H6	0.68	<0.01	Y
H7	0.70	<0.01	Y

Source(s): Author's own work

Table 6.
Results of hypotheses testing

Some recent review papers, including Mishra *et al.* (2022a) and Nyangchak (2022), have provided many exciting research directions for the future. Both studies observed that resource management is one of the critical factors influencing the net zero economies. However, no studies have previously examined the impact of various resources on net zero under the moderating effect of big data analytical intelligence. Hence, the current study makes new contributions to the domain of net zero economies. One of the interesting findings is that intangible resources have a much stronger impact on a sustainable net zero economy than tangible resources and human skills. Moreover, the impact of a sustainable net zero economy strongly influences social performance. The managerial implications of these findings are presented in the next section.

5.2 Managerial implications

To achieve a sustainable net zero economy, managers must prioritize the management of resources, including tangible resources, human skills and intangible resources such as culture and organizational learning. The lack of interest in sustainable net zero practices can be addressed by developing a lean, green and digital culture within an organization, leading to innovative approaches and achieving net zero by balancing the emission and removal of

GHG from the environment. It is crucial for SMEs to utilize Industry 4.0-based digital technologies for knowledge management, particularly big data analytics for effective resource management and achieving net zero. In addition, the adoption of a net zero economy would enhance societal performance, and firms should consider the potential of their resources to improve social performance when making budgeting decisions. Achieving decarbonization and net zero by 2050 will require a strong organizational culture, including creating awareness among SC actors; running continuous training for stakeholders; and linking key performance indicators and measurement systems to carbon emission reduction targets.

6. Conclusion

This study has achieved two research objectives. First, it has identified the resources influencing net zero adoption and examined the influence of net zero adoption on firm performance. Drawing on PBV, a model was developed with a few testable hypotheses. The model was further tested using samples from SMEs in RSA. The findings indicate that resource management is essential for achieving a sustainable net zero. The findings also show that net zero positively and significantly influences SMEs' performance. Nonetheless, societal performance is influenced to a greater extent, indicating that net zero can help planet Earth become greener and more suitable for future generations.

Like all research studies, this work has certain limitations. Firstly, it was assumed in this study that net zero is a practice that every firm must implement to achieve a common goal. i.e. to make the Earth a greener and more sustainable place to live. In this case, it is not a competition between firms to gain an edge over others. Instead, it is a responsibility to save the environment and the human race by providing a better-quality ecosystem. However, it may not be the case when the institutional pressures will vary and some governments/customers would force the firms to specifically adopt certain sets of net zero policies and action plans. In that case, the relationships could better be explained using an RBV perspective.

Secondly, the study considered cross-sectional data to test the theoretical model. In future, researchers can conduct a longitudinal study to see the effect of resource management on net zero economy adoption. Furthermore, cross-country comparisons can also be performed to measure the impact of culture in different countries. Future studies can also be performed to examine the effect of coercive pressures on resources and the indirect effect of these pressures on net zero economy adoption. The current research has made a unique contribution by examining the effect of resources on net zero economy adoption, and it has laid the foundation for future studies in this area.

Notes

1. https://www.un.org/en/climate-action/race-net-zero-economy
2. https://www.mckinsey.com/capabilities/sustainability/our-insights/the-economic-transformation-what-would-change-in-the-net-zero-transition
3. https://www.pwc.co.uk/services/sustainability-climate-change/insights/net-zero-economy-index.html
4. https://www.economist.com/films/2021/07/30/what-is-net-zero?gclid=Cj0KCQjwnvOaBhDTARIsAJf8eVMNFphYWpGaj30TM2eBzPTTlPn-kMG0HX27TTjRhaojUruE-ngvJOkaAtYuEALw_wcB&gclsrc=aw.ds
5. https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero
6. https://www.mckinsey.com/capabilities/sustainability/our-insights/delivering-the-climate-technologies-needed-for-net-zero

7. https://www.statista.com/statistics/371233/south-africa-gdp-distribution-across-economic-sectors/
8. https://www.bloomberg.com/opinion/articles/2022-09-11/climate-change-south-africa-may-hold-the-key-to-global-net-zero?leadSource=uverify%20wall
9. https://www.worldbank.org/en/country/southafrica/overview#2
10. https://web-assets.bcg.com/02/47/e21f3c70493b8e34632f4663893d/bcg-report-net-zero-in-south-africa-it-all-hinges-on-renewables-september2022.pdf

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