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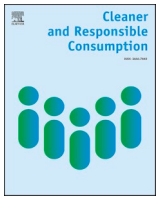

The effect of green competencies and values on carbon footprint on sustainable performance in healthcare sector

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ABSTRACT

This research investigates how green competencies and values associated with carbon footprint directly influence sustainable performance. Additionally, it seeks to assess the indirect influence of green competencies and values concerning carbon footprint on sustainable performance, mediated by the willingness to mitigate carbon emissions. The research model was analyzed using Structural Equation Modeling (SEM), and data from 269 healthcare organizations were employed for this purpose. The findings reveal several significant relationships. Firstly, Green competencies were observed to positively and significantly influence the willingness to mitigate carbon footprint. Secondly, values related to carbon footprint were also found to positively influence the willingness to mitigate carbon footprint. Furthermore, the willingness to mitigate carbon footprint was identified as a positive enhancer of sustainable performance within healthcare organizations. In terms of indirect relationships and the mediation effect of willingness to mitigate carbon footprint, the results indicate that this willingness acts as a mediator. It mediates the connection between green competencies and sustainable performance, as well as between values related to carbon footprint and sustainable performance. As a result, this study contributes theoretically to four distinct areas. Additionally, it offers practical insights for healthcare managers and policymakers. Lastly, the study suggests possible directions for future research endeavours.

1. Introduction

A consensus among scientists highlights that indeed the climate is undergoing changes, primarily attributed to human activities, including manufacturing organizations, and notably due to increased carbon emissions, contributing to the carbon footprint (Anttonen et al., 2023; Li et al., 2023; IPCC, 2018). However, engaging in pro-environmental actions is frequently perceived as challenging, as it may demand financial investments, substantial exertion, or entail sacrifices in terms of comfort or convenience. Consequently, businesses more inclined to embrace environmentally friendly actions rather than engaging in practices that could harm the environment, as part of their efforts to address climate change (Tolppanen and Kang, 2021; Tolppanen et al., 2021; Shui et al., 2023).

Therefore, this study seeks to examine the direct influence of green competencies and values associated with carbon footprint on sustainable performance. Moreover, it intends to investigate the indirect influence of green competencies and carbon footprint values on sustainable performance, mediated by the willingness to mitigate carbon footprint. Particularly within healthcare sector as healthcare providers have encountered a series of formidable challenges, including the rapid expansion of medical waste generation and escalating carbon emissions (Chen et al., 2021; Xu et al., 2021; Delina et al., 2023).

Hence, to address these pressing challenges, the WHO (2021) has introduced a fresh Call to Action designed to promoting environmentally-friendly practices in healthcare. several studies have discussed the significance of employees' environmental values as a crucial element in promoting a green culture and values within organizations. This includes aspects like the creation of eco-friendly product designs, sustainable resource management, energy conservation,

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pollution mitigation, waste reduction, and recycling initiatives. All these contribute to enhancing sustainable performance (Graves and Sarkis, 2018). However, none of these studies have examined the influence of green competences on sustainable performance. Many studies have shown that self-transcendent values like biospheric and altruistic values are positively related to pro-environmental behavior. On the other hand, self-enhancement values such as hedonistic and egoistic values are associated with less environmentally friendly behavior. While there is extensive research on the link between values and specific pro-environmental actions, there is a lack of studies that investigate the relationship between values and broader environmental lifestyle factors, such as carbon footprint (de groot and Steg, 2008; Steg et al., 2011; Steg, 2016). This situation presents a concern, given that a considerable body of research has demonstrated that engaging in pro-environmental actions is positively associated with achieving sustainable performance (Mady and Abdul Halim, 2023; Mady and Battour, 2023; Yu et al., 2023).

Therefore, the reason of this study is quadruple. First, Green competences refer to the skills and knowledge individuals possess related to sustainability practices (Cabral and Lochan Dhar, 2019; Yahya et al., 2022). Understanding how these competences influence organizational outcomes, such as sustainable performance, can provide insights into the role of individuals in driving positive environmental and business results. Second, Green competences are associated with greater environmental awareness and responsibility (Liobikiene and Juknys, 2016; Zaid et al., 2018; Cabral and Lochan Dhar, 2019; Parashar et al., 2023). Studying their impact on sustainable performance can reveal how individuals' behaviours, decisions, and actions influenced by these competences lead to the willingness of reducing carbon footprints and other sustainable outcomes. Third, Stakeholders, including customers, investors, and communities, increasingly expect organizations to contribute positively to environmental and social sustainability (Ayuso et al., 2011; Higgins and Coffey, 2016; Mousa and Othman, 2020). Demonstrating the influence of green competences and carbon footprint reductions on sustainable performance can align with these expectations. Fourth, reduction values of carbon footprint directly tie to environmental impact (Bocken and Allwood, 2012; Bhopal and Norheim, 2021; Guan et al., 2021; Rizan et al., 2021; Tolppanen and Kang, 2021; Tolppanen et al., 2021; Sharma et al., 2022; Tolppanen et al., 2022; Hussein, 2023). By examining how these reductions correlate with sustainable performance indicators, such as energy efficiency, waste reduction, and resource conservation, you can quantitatively assess the benefits of environmental initiatives.

Having said that, examining the impact of green competences and carbon footprint reduction on sustainable performance holds vital managerial implications. Managers must invest in fostering green competences through training, creating a culture valuing sustainability, and aligning efforts with overall sustainability strategy. This approach empowers employees to actively contribute to sustainability initiatives and guides resource allocation for effective outcomes. Additionally, a focus on carbon footprint reduction helps organizations proactively meet environmental standards, ensuring preparedness for regulatory requirements. This research informs strategic planning, decision-making, and resource allocation, enhancing both environmental responsibility and overall business performance.

The paper follows a structured organization consisting of six sections. In Section two, a review of existing literature pertaining to green competences, carbon footprint, and sustainable performance is presented, leading to the formulation of hypotheses for the research. Section three outlines the chosen methodology for the study. The subsequent section, Section four, provides a detailed account of the data analyses conducted and presents the obtained results. Section Five is devoted to a discussion of the results. The final section of the paper encompasses the implications of the research findings and acknowledges potential limitations of the study.

2. Literature review and hypotheses development

2.1. Sustainable performance in healthcare sector

As businesses embrace sustainable development, their objectives extend beyond conventional economic gains, necessitating a transition towards sustainable performance approach that focuses on the Triple Bottom Line (TBL) (Yu et al., 2023). This involves combining economic, social, and environmental performance factors (Hollos et al., 2012). According to stakeholder theory, businesses that strategically incorporate environmental and stakeholder interests into their activities are more likely to achieve expected advantages (Mitchell et al., 1997; Cennamo et al., 2009). In the context of stakeholder theory, managers are fundamentally tasked with creating mutually advantageous outcomes for diverse stakeholders, as opposed to concentrating on trade-offs (Freeman et al., 2010; Friedman and Miles, 2002). Another pivotal principle within stakeholder theory is the integration thesis, which posits that 'most business decisions or statements about business have some ethical content or an implicit ethical view' (Freeman et al., 2010, p. 7). In essence, this implies ensuring that a business conducts itself responsibly towards society, extending its considerations 'beyond the narrow economic, technical, and legal requirements of the firm' (Davis, 1973, p. 312). Consequently, by assimilating green competencies and a commitment to environmental responsibility into organizational practices, companies can preemptively address risks associated with carbon footprints, thereby ensuring compliance with environmental laws and regulations. This proactive stance aligns with the concerns of stakeholders and contributes substantively to the attainment of sustainable performance.

Therefore, the emergence of the sustainable performance approach aims to mitigate the compromised environmental effects resulting from economic activities. It achieves this by substituting complex methods with environmentally-friendly methods (Bombiak and Marciniuk-Kluska, 2018; Ullah et al., 2021).

Within the service sector, healthcare holds significance as a vital service provider. It stands out as a focal point for institutions that prioritize environmental matters due to the waste generated within this domain (Romero and Carnero, 2019). Even though some of healthcare organizations often disregards sustainable practices and the impact of its operations on the environment for the desire to avoid additional costs (Mbongwe et al., 2008; Yellowlees et al., 2010). Managers within this sector are experiencing increasing societal pressure concerning environmental concerns. Consequently, Their obligations go beyond delivering top-notch and cost-efficient services; they now include concerns related to environmental protection and the preservation of natural resources. (Pinzone et al., 2016). Consequently, healthcare managers are allocating additional resources to initiate environmentally-friendly projects, including energy efficiency enhancements, water conservation, sustainable procurement practices, recycling, and promoting sustainable mobility. Thus, Healthcare sustainability is progressively becoming a crucial objective within our society. This involves not only the necessity to establish adaptable healthcare services and enhance organizational efficiency, but also the recognition that integrating environmental strategies can lead to improved environmental conditions and overall well-being. Additionally, these strategies can yield significant cost benefits for healthcare organizations (Cavicchi et al., 2022).

A significant evaluation of sustainable performance can be achieved by assessing the performance across three pillars: economic, environmental, and social factors all of which are evaluated with equal importance (Svensson et al., 2018). While, environmental performance pertains to an organization's ability to reduce waste generation, control air emissions, and minimize the occurrence of environmental damages (Zhu et al., 2008; Zhang et al., 2022), social performance encompasses the impacts of environmentally friendly human resource management practices on social dimensions. It is associated with the reputation of an

organization and its products, from the viewpoints of diverse stakeholders (Newman et al., 2016). Economic performance is connected to the advancement of marketing and financial performance through the adoption of environmentally friendly practices. This can result in an enhanced organizational position compared to other entities (Shoaib et al., 2022).

2.2. Carbon footprint in healthcare sector

Carbon footprint is utilized as a measure to assess the amount of greenhouse gases emitted into the environment (Tolppanen and Kang, 2021). However, environmental issues stemming from climate change, air pollution, and heightened energy consumption are escalating in severity. On a global scale, we produce approximately 1.3 billion tons of urban waste annually, and this figure is projected to rise to 2.2 billion tons by 2025 (Luthra et al., 2022; Sharma et al., 2022). Despite a temporary decrease in global energy demand due to the COVID-19 pandemic, carbon dioxide emissions have risen by 6%, reaching a historic high of 36.3 billion tons during the ongoing economic recovery since 2021.[1] Of these, 0.61% was the carbon dioxide global share of Egypt. (Hussein, 2023). However, the healthcare sector generates various types of waste streams, each requiring distinct disposal methods and resulting in varying carbon footprints. The carbon footprint associated with healthcare waste disposal hinges on factors such as the composition of materials and the chosen disposal approach. The available disposal options are contingent upon the specific characteristics of the waste (Rizan et al., 2021). Healthcare represents a significant contributor to pollution. It holds the distinction of possessing the largest carbon footprint among service sectors and is accountable for approximately 4–5% of worldwide carbon emissions (Bhopal and Norheim, 2021).

Previous research indicates that, on average, the healthcare sector contributes around 5% to the national carbon dioxide (CO2) footprint in countries belonging to the Organisation for Economic Co-operation and Development (OECD), as well as in China and India (Mousa and Othman, 2020). This places the healthcare sector's importance on par with that of the food sector (Pichler et al., 2019). According to Bhopal and Norheim (2021), efforts to diminish healthcare's carbon footprint can be achieved, in part, by implementing national and regional structural policies (such as transitioning to cleaner energy sources), enacting regulations (such as enhancing building efficiency standards) and embracing innovative strategies (like electrified transportation networks). While these measures may not be directly linked to the healthcare sector, they can still have an impact. Furthermore, significant emissions reduction can be accomplished by effectively allocating resources within the healthcare system. The scientific consensus affirms that the climate is undergoing transformation, primarily influenced by human activities that result in elevated greenhouse gas (GHG) emissions (IPCC, 2018). Notably, individuals contribute to about 65–72% of total carbon emissions. This suggests that businesses must promote and motivate their employees to participate in actions with lower environmental impact rather than opting for actions with higher environmental impact in order to mitigate climate change (Tolppanen and Kang, 2021; Tolppanen et al., 2021).

2.3. Green competences

The concept of green competencies entails people's capability to engage with their environment in a manner that is both productive and characterized by significant passion (Steele, 1980). Three factors are essential for engaging with the environment in an environmentally conscious manner. Firstly, there must be an awareness of environmental issues and a desire to safeguard the environment, thereby minimizing harm. Secondly, a fundamental understanding of environmental concepts is necessary. Lastly, skills like waste and emissions reduction play a role in ensuring environmental protection (Steele, 1980). Likewise, Fraijo-Sing et al. (2013) articulated that green competencies consist of two fundamental components: environmental knowledge and skills. These elements should be applied in alignment with the ecological demands stipulated by society. Furthermore, Corral-Verdugo (2002), conducted research on green competencies, treating them as a higher-level construct that includes environmental perception, motives, attitudes, and empirically validated this concept. The study defined green competencies as comprising effective responses, green motives, perceptions, and beliefs necessary for the preservation of the natural environment. Hence, drawing from an extensive review of literature, Cabral and Lochan Dhar (2019) reached a conclusion that green competencies are structured as hierarchical dispositional constructs. These constructs encompass green knowledge, green skills, green awareness, green attitudes, green abilities, and green behaviour.

Green knowledge is "general knowledge about the facts, concepts, and relationship regarding the natural environment and the entire ecosystem" (Lo and Fryxell, 2003, p. 48). Green knowledge holds significance for employees as it empowers them to become eco-literate, which entails the ability to identify concepts and behaviours linked to the preservation and conservation of the environment (Laroche et al., 2001).

Green skills encompass distinct capabilities necessary for creating products, services, or operations with consideration for climate change. These skills are comprehensive and involve competencies aligned with sustainability, including professional skills, vocational skills, and generic skills like those needed for eco-innovation and problem-solving (Department for Business Innovation and Skills, 2011) cited from (Cabral and Lochan Dhar, 2019). Green skills play a role in ensuring the positive outcomes of putting an environmental management system into action. This encompasses backing education aimed at promoting sustainability and enhancing environmentally friendly actions (Kanyimba et al., 2014). Abilities can be understood as inherent capacities that facilitate learning and lead to enhanced job performance. In the context of green competencies,

green abilities refer to the dimension that empowers employees to enhance their capacity for sustainable development (Gerhart, 2005). Green abilities assist employees in their self-development and performance enhancement, enabling them to contribute to environmental conservation efforts (Cabral and Lochan Dhar, 2019).

Green awareness has been investigated across a range of contexts, involving an appreciation of different facets. Instances encompass awareness regarding the effects of air pollution (He and Liu, 2018), customers' recognition of the production process and carbon footprint (Garcia et al., 2019), acknowledgment of energy consumption during production (Shrouf et al., 2017), and understanding of environmental risks and cost-benefit evaluations (Peng and Liu, 2016). Green awareness was recognized as a crucial factor for the successful implementation of environmental management systems.

Green attitude is defined as an individual's cognitive evaluation of the importance of protecting the environment. It has been described as encompassing emotional inclinations that involve evaluative actions aimed at participating in environmental performance (Lee, 2008). Green attitude stands as a pivotal element that motivates stakeholders to engage in environmentally friendly behavior (Bergin-Seers and Mair, 2009). Therefore, it is important to cultivate a green attitude amongst the workforce.

Green behaviour indicates to the actions exhibited by organization members that are not only scalable but also connected to and have an impact on environmental sustainability, either by contributing to or detracting from it (Ones and Dilchert, 2012). Green behaviour encompasses initiatives such as establishing production processes that

[1] IEA. 2021. Global Energy Review: CO2 Emissions in 2021: Part of Global Energy Review. https://www.iea.org/reports/global-energy-review-co2-emissions-in2021-2.

proprieties the environment and consistently calculating environmental costs. These endeavours yield significant effects on the environmental and can result in enhancements to financial performance (Cheng et al., 2019).

Having said that, green competencies can play a pivotal role in assisting an organization in achieving its environmentally friendly goals, meeting stakeholders' expectations related to environmental concerns (Yahya et al., 2022), and fostering a willingness to actively reduce carbon footprint. According to Halila and Rundquist (2011), green competencies is one of the crucial elements of an organization's success is the positive influence it has on the environment. Similarly, Teece (2010) indicates that the combination of various capabilities, such as green competencies, can be employed for proactive environmental actions. Therefore, it is postulated that.

H1. Green Competencies motivate willingness to mitigate carbon footprint.

Indeed, sustainable performance is garnering considerable focus on both micro and macroeconomic scales. However, the link between sustainable performance and green competencies continues to be an intriguing area for investigation. Dedication to sustainable practices serves as the foundation for allocating resources and creating the conditions necessary to foster prosperity in both the present and the future (Shoaib et al., 2022). There is now a widespread acknowledgment that through the adoption of support for eco-friendly actions, organization members indeed can actively contribute to the pursuit of sustainable performance (Hoegh-Guldberg et al., 2018). The active involvement of employees in various positive activities holds a pivotal role in advancing business greening, including their willingness to mitigate carbon footprint (Dumont et al., 2017; Shen et al., 2021). This, in turn, contributes to promoting sustainable performance (Ercantan and Eyupoglu, 2022). Green competencies pertain to specific pro-environmental practices within work environments that enhance employees' inclination to actively reduce their carbon footprint (Tian and Robertson, 2019). Highlighting green competencies functions as a role model, strengthening pro-environmental attitudes and behaviours among employees, while also promoting ethical standards that contribute to achieving sustainable performance. Since the emergence of the sustainable performance approach aims to tackle the compromised economic activities that negatively affect environmental. This entails substituting complex methods with practices that are environmentally friendly (Ullah et al., 2021). This suggests that possessing certain skills and knowledge related to sustainability (green competences) impacts individuals' willingness to take action to reduce their carbon footprint, which, in turn, leads to improved sustainable performance.

Our assumption based on, individuals with strong green competences tend to exhibit a higher degree of awareness, understanding, and commitment to environmental sustainability. This heightened awareness and understanding translate into a greater willingness to take concrete actions to reduce their carbon footprint, such as adopting eco-friendly behaviours, minimizing waste, and optimizing resource use. Individuals who are more willing to actively reduce their carbon footprint due to their strong green competences often contribute positively to sustainable performance outcomes. The health and well-being of healthcare practitioners that include lifestyle factors, including exercise habits, diet, and stress … etc are crucial indicators of the organizational environment commitment.

H2. Green Competencies enhance sustainable performance through the mediating role of willingness to mitigate carbon footprint.

2.4. Values on carbon footprint

Values is one of the well-established concepts in the environmental studies, with numerous studies conducted under the framework of the value-belief-norm (VBN) theory. According to this theory, a considerable body of studies has shown that values, especially those related to the biosphere, significantly influence the formation of environmental attitudes (Hansla et al., 2008; Lee, 2011; Papagiannakis and Lioukas, 2012; Van Riper and Kyle, 2014a, 2014b; Lynch and Ferasso, 2023). The VBN posits that behaviour occurs when an individual's core values are perceived to be at risk, and the individual believes that by taking action, they can mitigate this threat (Stern et al., 1999; Saboya de Aragão and Alfinito, 2021). Therefore, there is a significance of values in motivating individuals' willingness to mitigate anti climate actions (Steg et al., 2011; Steg, 2016; Tolppanen and Kang, 2021; Tolppanen et al., 2022). Furthermore, Schwartz (1994), differentiates between self-enhancement values, encompassing egoistic and hedonic values that centre around personal interests, and self-transcendence values, comprising biospheric and altruistic values that emphasize collective concerns (Thelken and de Jong, 2020; Jacobs, 2023). Both sets of values contribute to fostering pro-environmental behaviours and cultivating a readiness to mitigate actions that harm the environment (Schwartz, 2010; Barber et al., 2014; Steg et al., 2014). However, other scholars have emphasized that there are diverse elements that influence the willingness to participate in green actions, such as attitudes (Steg and Vlek, 2009), the convenience in taking action (Attari et al., 2010), knowledge (Kollmuss and Agyeman, 2002), worldview or person's perspective (Hawcroft and Milfont, 2010) and the degree of risk aversion among individuals (Gifford, 2011; Howlett, 2014).

When assessing the influence of values on willingness to mitigate carbon footprint, it is appropriate to recognize that values are regarded as the guiding principles that shape an individual's life choices. In studies focused on pro-environmental behavior, values have consistently been identified as significant factors influencing behavior (Schwartz, 2010; Urien and Kilbourne, 2011; Jacobs et al., 2018). It seems to play a pivotal role in shaping behavior, irrespective of cultural differences (Hawcroft and Milfont, 2010). Given that environmental concern frequently exhibits a correlation with values (Dietz et al., 1998), an analogous correlation is also expected between values and willingness to mitigate carbon footprint.

H3. Values on Carbon footprint motivate willingness to mitigate carbon footprint.

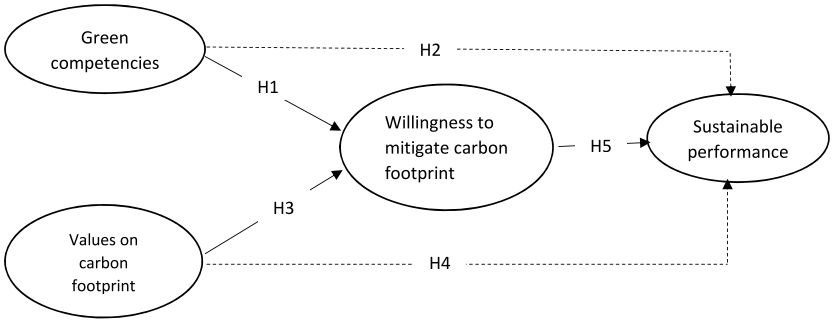
) among other factors such as green management (Suleman, 2021), pro-environmental attitude and GHRM practices (Shoaib et al., 2022). Indeed, values on carbon footprint is one of the fundamental drivers of pro-environmental employees' behaviour (Shoaib et al., 2022) that positively influence sustainable performance (Saleem et al., 2020). Mao et al. (2017), employed the reduction of carbon emissions as a means to positively enhance sustainable performance. Carbon footprint holds relevance in the business environment, as businesses incorporate decarbonization strategies into their operational practices (Sartal et al., 2020). Firms utilize low carbon practices to seamlessly incorporate carbon efficiency into their strategies, aiming to sustain performance and create products aligned with carbon footprint assessment. This approach entails mapping their GHG emissions (Jabbour et al., 2015; Gerged et al., 2021). It also enhances the willingness to mitigate the carbon emissions (Wong et al., 2012). Businesses, particularly those in the manufacturing sector, are progressively recognizing the importance of both economic and environmental advantages linked to sustainable performance (Aslam et al., 2021). Consequently, the TBL concept is regarded as the most effective tool for evaluating a firm's sustainable performance (Gimenez et al., 2012). Therefore, values placed on reducing carbon footprint positively influence the dimensions of the TBL. When organizations place emphasis on and integrate initiatives aimed at diminishing their carbon footprint (demonstrating willingness to reduce carbon emissions), this action can notably bolster sustainable performance across its three dimensions - economic, social, and environmental.

For instance, values related to carbon footprint can positively impact economic performance through operational efficiency by encouraging

organizations to optimize resource use, minimize waste, and streamline processes (Li et al., 2020); cost reduction by Implementing energy-efficient practices and transitioning to renewable energy sources (Sharma et al., 2021); and innovation and market opportunities by developing eco-friendly products or services (Jabbour et al., 2015). Similarly, values related to carbon footprint can positively impact social performance through stakeholder engagement by promoting transparency and accountability (Nguyen et al., 2021) and employee morale as employees who work for organizations with strong environmental values may feel more engaged and satisfied (Garay-Rondero et al., 2020). In the same vine, values related to carbon footprint can positively impact environmental performance (Aslam et al., 2021; Sharma et al., 2021). According to Shoaib et al. (2022), the higher values on carbon footprint motivate the willingness to mitigate carbon footprint; that in turn enhance sustainable performance. Moreover, the willingness to mitigate carbon footprint positively affects sustainable performance; therefore, it is hypothesized that.

H4. Values on Carbon footprint enhance sustainable performance through the mediating role of willingness to mitigate carbon footprint.

H5. tainable performance.



3. Research methods

3.1. Sample and data collection

Data for this study was collected through a self-reported questionnaire administered to 342 organization works in healthcare sector. The data collection spanned from February to May 2023 and was conducted in three stages. The initial stage involved an online questionnaire, garnering 91 responses. This was followed by a postal questionnaire, resulting in 136 responses. Subsequently, phone call reminders were employed to encourage participants to return the pre-posted questionnaire, yielding 51 additional responses. Among the 278 total responses collected throughout the three stages, 9 questionnaires with missing values were excluded from the sample.

Out of the 269 valid responses, 72% were provided by males and 28% by females. General managers accounted for 33% of the responses, middle managers for 47%, and other staff members (e.g., secretaries, employees) for the remaining 20%. In terms of operational duration, 69% of the firms had been in operation for 10–15 years, 21% for 5–10 years, 7% for less than 5 years, and 3% for over 15 years.

3.2. Measures

The research model encompassed 19 latent variables, which were categorized into four primary research variables. Six dimensions, as outlined by Cabral and Lochan Dhar (2019), were employed to assess green competences. These dimensions encompass green knowledge (3 Items), green skills (3 Items), green abilities (4 Items), green attitude (7 Items), green behaviour (10 Items), and green awareness (4 Items). Participants were requested to complete two sets of questionnaires pertaining to their carbon footprint. One set gauged their values, while the other assessed their willingness to mitigate their carbon footprint. Values were evaluated using a modified 16-item scale originally devised by Steg et al. (2014) and previously employed by Tolppanen and Kang (2021). The scale was employed to evaluate participants' fundamental values, including altruistic (4 Items), hedonic (3 Items), biospheric (4 Items), and egoistic values (5 Items). The willingness was assessed through a 17-item adapted scale drawn from Tolppanen et al. (2021). The questions categorized across five categories: recycling (2 Items), lifestyle (5 Items), transportation (4 Items), diet (4 Items), consumption (2 Items), and driving (3 Items). The measurement of sustainable performance used by Mousa and Othman (2020) and adapted from literature (Longoni et al., 2018; Paulraj, 2011; Zaid et al., 2018), comprising five items for environmental, four items for economic performance, along with seven items for social performance. Respondents were asked to rate their level of agreement about each statement on a continuous scale from 1 to 10 (1 = strongly disagree, 10 = strongly agree).

4. Data analysis and results

4.1. Measurement model

The assessment of the reflective measurement model was based on four criteria: indicator reliability, internal consistency, convergent validity, and discriminant validity. These criteria align with the recommendations of (Hair et al., 2017). In Table 1, the indicators' loadings for all research items were examined, and they all met the indicator reliability threshold, which is typically desired to be higher than 0.60 (Hair et al., 2011).

For internal consistency, composite reliability (CR) values were used. The CR values for are research constructs exceeded the threshold of 0.70, indicating good internal consistency (Hair et al., 2011). Convergent validity was assessed using the Average Variance Extracted (AVE) value for each construct. The AVE values were all higher than 0.50, indicating that the scales demonstrated convergent validity (Hair et al., 2011). Discriminant validity was evaluated following the approach proposed by Fornell and Larcker (1981). This approach involves comparing the square root of the AVE of each construct with its correlation with other constructs (Chin, 2010). The results are presented in Table 2. These analyses collectively support the soundness of the reflective measurement model.

4.2. Assessing the structural model-direct and indirect effects

The SEM-Pls methodology was employed to assess the structural model. The fitness of the structural model to the data was evaluated through various goodness-of-fit indicators. Notably, the R-squared (R^2) value associated with the central endogenous construct, Sustainable Performance, was calculated at 0.491. This value indicates that approximately 49% of the variability in sustainable performance can be explained by the exogenous variables. Cohen's (1992) guidelines

Table 1
Assessing the measurement model.

Constructs	Loading
Green Competences: (α = 0.87, CR = 0.90, AVE = 0.76)	
Green Knowledge (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation uses less polluting industrial processes and products.	0.745
The organisation has developed a green program (waste management, control of effluents, inventory of pollution sources).	0.806
The organisation has developed a drafting of environmental emergency plans and measures.	0.743
Green Skills (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation creates skills in energy conservation.	0.905
The organisation provides skills in reducing the consumption of materials.	0.616
The organisation facilitates adequate skills in environmental protection.	0.944
Green Abilities (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation enables us to solve simple to complex environmental tasks.	0.886
The organisation helps to find out the several solutions for environmental issues.	0.707
The organisation created a platform that helps to associate different environmental concepts.	0.991
The organisation ensures that the employee can relate the past environmental problem with the new issues.	0.713
Green Attitude (α = 0.87, CR = 0.90, AVE = 0.76)	
It is essential for the organisation to promote green living.	0.678
I strongly agree that more environmental protection works are needed from my organisation.	0.901
It is very important to raise environmental awareness among employees.	0.777
Environmental protection works are not simply a waste of money and resources.	0.820
Environmental protection issues are our business.	0.769
The organisation think environmental protection is meaningful.	0.991
It is wise for organisation to spend a vast amount of money on promoting environmental protection.	0.666
Green Behaviour (α = 0.87, CR = 0.90, AVE = 0.76)	
The employees in organisation try to learn more about the environment.	0.810
The organisation finds ways of working that are better for the environment.	0.645
The organisation offers ideas for reducing our impact on the environment.	0.899
The organisation shares knowledge about the environment with others.	0.913
The organisation applies new ideas for reducing our impact on the environment.	0.819
The organisation performs environmental tasks that are not required.	0.888
The organisation questions the practices that are likely to hurt the environment.	0.774
The organisation reuses materials.	0.634
The employees reduce their energy use.	0.834
The organisation supports the employees to solve environmental problems in society.	0.917
Green Awareness (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation facilitates the use of environmentally friendly products.	0.884
The organisation encourages the employees recycle.	0.816
The organisation creates understanding among the employees to learn about environmental issues.	0.888
The organisation educates employees regarding the negative impact caused to environment.	0.978
Values on Carbon Footprint: (α = 0.91, CR = 0.90, AVE = 0.62)	
Altruistic (α = 0.87, CR = 0.90, AVE = 0.76)	
Equality: Equal opportunity for less average carbon footprint for a person	0.935
A world at peace: Free of carbon footprint	0.909
Social justice: Correcting our actions, care for the greenhouse gases.	0.894
Helpful: Working for clean environment	0.900
Hedonic (α = 0.87, CR = 0.90, AVE = 0.76)	
Enjoying green life: Enjoying food, leisure, etc.	0.812
Self-indulgent: Doing pleasant things that consist with the environmental concern	0.609
Pleasure with green actions: Joy, gratification of desires	0.720
Biospheric (α = 0.87, CR = 0.90, AVE = 0.76)	
Protecting the environment: Preserving nature	0.977
Preventing pollution: Protecting natural resources	0.899
Respecting the earth: Harmony with other species	0.944
Unity with nature: Fitting into nature.	0.917
Egoistic (α = 0.87, CR = 0.90, AVE = 0.76)	
Ambitious: Hard working, aspiring	0.600
Wealth: Material possessions, money	0.734
Influential: Having an impact on people and events	0.770
Authority: The right to lead or command	0.800
Social power: Control over others, dominance.	
Willingness to Mitigate Carbon Footprint: (α = 0.88, CR = 0.89, AVE = 0.70)	
Recycling (α = 0.87, CR = 0.90, AVE = 0.76)	
Recycle all organisation paper, cardboard, metal and glass	0.965
use all leftovers and not throw any material away	0.900
Living (α = 0.87, CR = 0.90, AVE = 0.76)	
Turn off all organisation appliances when not in use	0.777
The organisation spends less water consumption per week	0.787
Change to green electricity	0.863
Change to nuclear electricity	0.859
Change old windows to new ones.	0.836
Transport (α = 0.87, CR = 0.90, AVE = 0.76)	0.934
The organisation encourages employees to walk or bike all short distances	
The organisation encourages employees to change the long-distance holiday flight to a short/mid-distance holiday flight	0.974
The organisation encourages employees to change the mid-distance holiday flight to a domestic long-distance train trip	0.862
The organisation encourages employees to change to a car-free life.	0.880

(*continued on next page*)

Table 1 (*continued*)

Constructs	Loading
Diet (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation encourages employees eating a vegetarian main meal once a week	0.767
The organisation encourages employees to change beef to chicken once a week	0.669
The organisation encourages employees to change half of your main meals to vegetarian	0.769
The organisation encourages employees to change to a 100% vegan diet.	0.888
Consumption (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation encourages buy some of second hand machines, tools, material, … etc.	0.914
The organisation uses phones, furniture, appliances … etc as long as possible, before buying a new one.	0.911
Driving (α = 0.87, CR = 0.90, AVE = 0.76)	
The organisation changes a gasoline car to a hybrid car	0.675
The organisation changes a gasoline car to an electric car	0.943
The organisation changes a gasoline car to a car that runs on biogas?	0.776
Sustainable Performance: (α = 0.95, CR = 0.93, AVE = 0.83)	
Environmental Performance (α = 0.87, CR = 0.90, AVE = 0.76)	0.881
Direct and indirect toxic emissions are reduced	0.942
Increase the volume of recycled materials and reduce waste	0.779
Commitment to the system of separating medical waste from the public sewage system. Increase the rate of purchase of environmentally friendly goods	0.620
Increase activities that protect our natural environment such as the presence of green areas in the organisation.	0.851
Reduced the risk of environmental accidents such as medical waste leakage, poisoning or radiation emissions.	0.933
Economic performance (α = 0.87, CR = 0.90, AVE = 0.76)	0.950
Growth in the organisation's profits is due to the energy consumption and materials reduction	0.898
Rise in the market share of the enterprise and improve the reputation of the organization	0.919
Reduce the cost of energy use	0.960
Reduce processing fees and waste disposal	
Social Performance (α = 0.87, CR = 0.90, AVE = 0.76)	
Increase attention in the rules of the health and safety of employees, especially when using hazardous materials and radiation	0.800
Improving community health and safety, and infection control	0.834
Developing economic activities in the community and providing more job opportunities	0.979
Reducing the impact of the organisation's waste on the community	0.918
Improving the quality of service provided, and commitment to the code of ethics	0.787
develop and design better service and participation of staff initiatives in management decisions	0.952
Increased commitment to professional ethics, infection control and antibiotic control policy.	0.886

classify R^2 values as small (0.02), medium (0.13), and large (0.26). additionally, the R-squared (R^2) value willingness to mitigate carbon footprint was 0.378. This value indicates that approximately 38% of the variability in willingness to mitigate carbon footprint can be explained by green competences and values on carbon footprint.

Furthermore, the predictive capacity of the model was ascertained using the Q^2 value, which stood at 0.319. This value being greater than zero affirms the model's ability to predict outcomes along the specified paths (Henseler et al., 2014). Additionally, the model met the criteria for overall goodness-of-fit indexes as prescribed for SEM-Pls (Hair et al., 2017): $\chi 2$ (232) = 520.23, $p < 0.001$; $\chi 2/d.f. = 1.98$; Comparative Fit Index (CFI) = 0.93; Normed Fit Index (NFI) = 0.91; Non-Normed Fit Index (NNFI) = 0.90; Standardized Root Mean Residual (SRMR) = 0.031.

The statistical outcomes validated all the three direct research hypotheses, as presented in Table 3. Green Competences (GC) significantly positively influence Willingness to Mitigate Carbon Footprint (WMCF) ($\beta = 0.431$; $t = 18.601$; $p = 0.016$). Values on Carbon Footprint (VOCF) significantly positively influence Willingness to Mitigate Carbon Footprint (WMCF) ($\beta = 0.401$; $t = 14.710$; $p = 0.000$). Willingness to Mitigate Carbon Footprint (WMCF) enhance Sustainable Performance (SP) ($\beta = 0.291$; $t = 9.344$; $p = 0.000$). Regarding the indirect relationships that investigate the mediating effect of Willingness to Mitigate Carbon Footprint (WMCF), the results indicate that WMCF mediate the

Table 2
Discriminant validity assessment.

	(1)	(2)	(3)	(4)
(1) GC	**0.959**			
(2) VCFP	0.612	**0.995**		
(3) WMCF	0.445	0.098	**0.920**	
(4) SP	0.371	0.187	.030	**0.933**

Note: Green Competences (GC); Willingness to Mitigate Carbon Footprint (WMCF); Values on Carbon Footprint (VOCF); Sustainable Performance (SP).

Table 3
Hypothesis testing.

Hypotheses	Path	β	S.D.	t-value	p-value	Conclusion
H1	GC→WMCF	0.431	0.108	18.601	0.001	Supported
H3	VCFP→WMCF	0.401	0.060	14.710	0.000	Supported
H5	WMCF→SP	0.291	0.139	9.344	0.000	Supported
	Indirect impacts	β	lower	upper	p-value	
H2	GC→WMCF→SP	0.121	0.100	0.270	0.000	Supported
H4	VCFP→WMCF→SP	0.239	0.132	0.293	0.000	Supported

Note: The t values near 1.65, 1.96, and 2.58 are considered with the significance level of 10%, 5% and 1%, respectively (Two-sided test).

relationship between GC and SP (β = 0.121, p = 0.000). Finally, WMCF mediate the relationship between VCFP and SP (β = 0.239, p = 0.000).

5. Discussion

The primary objective of this study was to examine the direct effects of green competencies and carbon footprint values on sustainable performance. Furthermore, the research aimed to delve into the indirect effects of these factors on sustainable performance. This indirect influence was explored through the mediating role of the willingness to mitigate carbon footprint. In essence, the study sought to uncover both the immediate and mediated relationships between these variables in the context of sustainable performance.

The study's findings unveil noteworthy relationships. Firstly, it was observed that green competencies exert a positive and significant impact on individuals' willingness to mitigate their carbon footprint. Likewise, Fraijo-Sing et al. (2010) articulated that green competencies serve to enhance and align with the ecological demands set forth by society. Additionally, (Corral-Verdugo, 2002) pointed out that green competencies encompass a combination of effective responses, green motives, perceptions, and beliefs that play a vital role in safeguarding the natural environment. Indeed, green competencies hold a crucial position in aiding organizations to attain their eco-friendly objectives and meet the anticipations of stakeholders concerning environmental matters (Yahya et al., 2022). They also play a role in cultivating a willingness to actively mitigate carbon footprint. In the same vein, Halila and Rundquist (2011), underline that an organization's positive influence on the environment stands out as a significant success factor of green competencies. Similarly, Teece (2010), highlights that the amalgamation of different capabilities, including green competencies, can be harnessed for anticipatory environmental actions (e.g., carbon footprint).

Secondly, values associated with carbon footprint also displayed a positive influence on the willingness to mitigate carbon footprint. These findings are in line with previous literature. For instance, self-enhancement values, including egoistic and hedonic values centred on personal interests, and self-transcendence values, which encompass biospheric and altruistic values emphasizing collective concerns, play a role in promoting pro-environmental behaviours and encouraging a willingness to take actions that reduce harm to the environment (Schwartz, 2010; Barber et al., 2014; Steg et al., 2014). Likewise, the importance of values in motivating individuals' readiness to engage in actions that mitigate climate-related issues is evident in the literature (Steg et al., 2014; Tolppanen and Kang, 2021; Tolppanen et al., 2022).

Thirdly, the willingness to engage in carbon footprint mitigation was identified as a facilitator of enhanced sustainable performance within healthcare organizations. This finding aligns with the conclusions drawn by Saleem et al. (2020), who highlighted that the aspiration for sustainable performance is closely tied to the pro-environmental behaviour of employees. Likewise, sustainable performance is attained by replacing intricate approaches with environmentally-conscious practices, as emphasized by studies like Bombiak and Marciniuk-Kluska (2018) and Ullah et al. (2021).

Finally, with respect to indirect relationships and the mediating role of the willingness to mitigate carbon footprint, the results suggest that this willingness operates as a mediator. It mediates the connections between green competencies and sustainable performance, as well as between values linked to carbon footprint and sustainable performance. As stated by Suleman (2021), organizations can actively enhance their sustainable performance by adopting and promoting green practices, thereby encouraging their employees to actively contribute to environmentally-friendly initiatives. Furthermore, Ercantan and Eyupoglu (2022), emphasize that the active engagement of employees in a range of greening activities leads to an increased willingness to reduce carbon footprint; this heightened willingness, in turn, plays a crucial role in promoting sustainable performance within organizations. Similarly, in line with this perspective, Mady and Battour (2023), shedding light on green practices serves as an exemplar, reinforcing pro-environmental attitudes and behaviours among employees. This process is intertwined with the cultivation of ethical standards, ultimately driving towards the attainment of sustainable performance goals.

6. Implications

6.1. Theoretical implications

Researching the impact of green competences and carbon footprint reductions on sustainable performance contributes to the broader understanding of the relationship between human capital, behavior, and sustainability outcomes. It adds to the growing body of knowledge on effective strategies for achieving sustainable business practices.

In essence, studying the impact of green competences and carbon footprint reduction values on sustainable performance provides insights into the mechanisms through which individuals, skills, and behaviors contribute to organizational sustainability goals. This research can guide strategic decisions, improve employee engagement, enhance stakeholder relations, and promote long-term resilience in the face of environmental challenges.

This research guides the effective implementation of sustainability strategies. Organizations are increasingly adopting sustainability strategies to achieve positive social, environmental, and economic outcomes. By examining the impact of green competences, we can identify how well-equipped employees are to implement these strategies effectively, contributing to overall sustainable performance.

6.2. Managerial implications

Examining the impact of green competences and the reduction values of carbon footprint on sustainable performance has several significant managerial implications for organizations. These implications can guide decision-making, resource allocation, and strategic planning to enhance both environmental responsibility and overall business performance.

Managers should recognize the importance of fostering green competences among employees. This involves investing in training and education to develop skills related to sustainability practices, environmental awareness, and carbon footprint reduction. By developing these competences, organizations can empower employees to contribute actively to sustainability initiatives.

Managers should work towards creating a culture that values sustainability and responsible environmental practices. By promoting green competences and carbon footprint reduction, managers can establish an organizational norm that encourages all employees to actively participate in sustainability efforts.

Understanding the impact of green competences and carbon footprint reduction on sustainable performance allows managers to align these efforts with the organization's overall sustainability strategy. It provides a foundation for integrating sustainability practices across departments, processes, and functions.

Managers can allocate resources more effectively by focusing on initiatives that have proven to enhance sustainable performance. This might involve directing resources towards training programs, technology upgrades, or projects that align with carbon footprint reduction and yield positive outcomes.

A focus on carbon footprint reduction helps organizations proactively address regulatory requirements related to environmental sustainability. Managers can ensure the organization is prepared to meet existing and future environmental standards.

7. Limitations and future research

This research does not exist without its limitations. While this research focused only on the relationship between green competences

and values on carbon footprint on sustainable performance, Future research could consider how green competences and carbon footprint reduction contribute to long-term organizational resilience, CSR or organisational citizenship behaviours. These efforts can mitigate climate-related risks, improve resource efficiency, and enhance the organization's ability to adapt to changing environmental conditions. In this investigation, the evaluation of green competences was conducted using the six dimensions delineated by Cabral and Lochan Dhar 2019. However, future research endeavors could expand upon this framework by incorporating Pedersen's (1999) scale, which posits that green competencies encompass (1) resource conservation, practice skills, and outdoor skills within the domain of environmental skills, (2) conscientiousness as an integral component of an individual's attitude, style, and awareness, and (3) knowledge acquisition and the methods employed in seeking and cultivating environmental knowledge; or Corral-Verdugo (2002) who discussed green competencies as a higher-order dispositional variable, which consists of environmental perception and motives as well as attitudes. This study focused on illustrating the impacts of green competencies and values on carbon footprint practices on sustainable performance using three pillars of SP (environmental, economic, social). Additional study may wish to focus on important topics related to this sector, such as financial performance, organizational performance, or behavioural performance. While this research focused on healthcare sector from a developing country, further research could examine the same research framework using large-scale companies or other industries, such as service industries. Therefore, further research to consider different samples would be recommended.

CRediT authorship contribution statement

Reda Shaker Abdelkareem: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Khalid Mady:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Shahesta Elsaid Lebda:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Eman Salah Elmantawy:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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