

Building a resilient economy: green initiatives and green entrepreneurship for women's empowerment

International
Journal of
Development
Issues

337

Nadia A. Abdelmegeed Abdelwahed
*Management Department, College of Business Administration,
King Faisal University, Al-Ahsa, Saudi Arabia*

Amanullah Channa
*Department of Economics, Shah Abdul Latif University Khairpur,
Shahdadkot Campus, Shahdadkot, Pakistan*

Mohammed A. Al Doghan
*Management Department, College of Business Administration,
King Faisal University, Al-Ahsa, Saudi Arabia, and*

Bahadur Ali Soomro
*Area Study Centre, Far East and Southeast Asia, University of Sindh,
Jamshoro, Pakistan*

Received 31 December 2024
Revised 5 March 2025
Accepted 17 March 2025

Abstract

Purpose – Women empowerment (WEN) and green entrepreneurship (GEP) are two essential concepts for societal development. This paper aims to examine the effect of green entrepreneurial skills (GESS), green opportunities (GOS) and green incentives (GIS) on WEN and GEP in a developing economy.

Design/methodology/approach – The study was based on quantitative cross-sectional data collected from women green entrepreneurs in Saudi Arabia. It used 314 valid cases to obtain results.

Findings – Using the structural equation model, the results demonstrate that GESS has a positive effect on WEN but a negative effect on GEP. GOS has a positive effect on both WEN and GEP. GIS's impact on WEN is negative and positive on GEP. Moreover, GEP has a positive effect on WEN. Finally, GEP does not support the development of an association between GESS, GOS and WEN, but it contributes to creating a positive connection between GIS and WEN.

Practical implications – The study's outcomes assist policymakers and planners in designing strategies for equipping women with GEP skills to bring their empowerment. Moreover, policymakers grasp the need for interventions that address women-specific barriers, promote equitable access to GOS and identify how incentive structures support rather than hinder women's participation in the green economy.

Originality/value – The study offers an integrated framework that integrates GESS, GOS, GIS, GEP and WEN in a single framework, along with direct and indirect paths in the Saudi Arabian women entrepreneurs' context.

Keywords Women empowerment, Green entrepreneurship, Green entrepreneurial skills, Green opportunities, Green incentives, Women entrepreneurs, Developing economy

Paper type Research paper



International Journal of
Development Issues
Vol. 24 No. 3, 2025
pp. 337-368
© Emerald Publishing Limited
1446-8956
DOI 10.1108/IJDI-12-2024-0329

This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [GRANTKFU251238].

Abbreviations

- WEN = Women empowerment;
- GEP = Green entrepreneurship;
- GESS = Green entrepreneurial skills;
- GOS = Green opportunities;
- GIS = Green incentives;
- SEM = Structural equation model;
- TVET = Vocational education and training;
- CMB = Common method bias;
- VIF = Variance inflation factor;
- CR = Composite reliability;
- AVE = Average variance extracted;
- HTMT = Heterotrait-monotrait;
- NFI = Normed fit index;
- SRMR = Standardized Root Mean Square Residual;
- PCI LL = Prediction confidence interval lower limit; and
- PCI UL = Prediction confidence interval upper limit.

1. Introduction

In the present era, women empowerment (WEN) is a significant enabler for the development of society in terms of social, cultural and economic factors (Swain and Floro, 2012; Chatterjee *et al.*, 2018). When women can make property decisions, they achieve economic independence and security, allowing them to invest in long-term assets that benefit future generations (Abdelwahed *et al.*, 2023; Ghosh *et al.*, 2024). Empowerment in health and family planning decisions leads to better health outcomes and control over reproductive health, reducing risks and enhancing growth opportunities. Being able to make decisions about their children’s education ensures higher enrolment rates and better academic performance and breaks the cycle of poverty, contributing to economic growth (Kaur, 2010; Mahsud and Ali, 2020; Mishra *et al.*, 2024). Women significantly contribute to bringing massive productivity to society through performing various roles such as leadership, innovation or creativity and making rational decisions (Modi *et al.*, 2014; Rao, 2018; Prabhu, 2020). According to Dewi *et al.* (2022) and Chatterjee and Malakar (2023), WEN brings positive societal changes by enhancing economic prosperity and well-being. Apart from that, performance, WEN and sustainability can be hugely ensured through green entrepreneurship (Bakari, 2013; Fallah and Soori, 2023; Islam, 2020). To further promote sustainability, well-being, prosperity and performance in society, several enablers, such as green incentives (GIS), green entrepreneurial skills (GESS) and green opportunities (GOS), are massively prominent and important (Kozlova and Volkova, 2019; Abdelwahed *et al.*, 2023; Manyati *et al.*, 2024; Yar *et al.*, 2024; Nwafor and Obinna (2024) and Mukherjee *et al.*, 2024). Furthermore, GIS confronts several circumstances that positively bring WEN and well-being to society (Demirel *et al.*, 2019; Oladeji *et al.*, 2024).

In addition to these three crucial aspects, the relevant literature identifies numerous constructs as substantial and positive enablers of the GEP, sustainable development, environmental sustainability and WEN in many contextual settings. These include effective educational programs, institutional structures, entrepreneurial activities, access to microfinance, social benefits, supportive institutional frameworks, access to resources, supportive policies, contrivance sustainable practices, digital skills training, resource capacities, government support, green entrepreneurial ecosystem, climate change, education,

new market opportunities, green skills training, technology integration, economic opportunities, conducive environment for eco-friendly business practices, market opportunities, educational programs, policy support, social networks, technology integration, etc. (Jabbar and Zaza, 2016; Der Boghossian, 2019; Potluri and Phani, 2020a, 2020b; Zhao *et al.*, 2021; Li *et al.*, 2022; Fallah and Soori, 2023; Abdelwahed *et al.*, 2023; Yasir *et al.*, 2023; Medhekar, 2024; Madhavi, 2024; Nwafor and Obinna, 2024; Handoko *et al.*, 2024; Mukherjee *et al.*, 2024). However, there are knowledge and contextual gaps in the literature that need to be filled. More clearly, the relevant literature does not offer any integrated model that combines the influence of GESS, GOS and GI on GEP and WEN. Besides, in the predictor relevance of GESS, GOS and GI, the assessment of the involvement of GEP towards WEN is missing, both directly and indirectly, between GESS, GOS and GI. Context-wise, such investigation among Saudi women entrepreneurs of green business still warrants consideration because they face massive challenges in terms of GEP and WEN. In the context of Saudi Arabia, there are many societal and cultural barriers that prevent women's full participation in entrepreneurial activities and sustainable business ventures (Abdelwahed *et al.*, 2022; Al-Nasrallah, 2023; Alzamel, 2024; Iram *et al.*, 2025). Keeping in view the significance of this problem or gaps, the researchers raised the questions:

- RQ1. What is the effect of GESS, GOS and GIS on the development of GEP and WEN among Saudi women green entrepreneurs?
- RQ2. What is the role of GEP in developing WEN among Saudi women green entrepreneurs?
- RQ3. How does GEP mediate the connection between GESS, GOS and GIS among Saudi women green entrepreneurs?

This study examines the effect of GESS, GOS and GIS on developing GEP and WEN among Saudi women. This study also investigates how these skills, opportunities and incentives contribute to the establishment and growth of green businesses and explores the role of GEP in empowering women economically, socially and personally. The results offer valuable perspectives for policymakers and organizations to construct plans that support Saudi women's participation in the green economy, contributing to sustainable development and gender equality in the region. The paper's organization consists of the introduction section, literature review and conceptual framework's development, methods, analysis, discussion, conclusion and implications and finally, ends with limitations and future research directions.

2. Literature review and conceptual framework's development

2.1 Green entrepreneurial skills (GESS)

Normally, entrepreneurial skills concentrate on starting and running a business, with a specific focus on market growth and profitability (Shane, 2003; Hisrich *et al.*, 2016). However, GESS augments this with a coating of social responsibility and environmental sustainability, which ensures business practices contribute to environmental balance with a robust societal impact (York and Venkataraman, 2010; Schaltegger and Wagner, 2011; Bakari, 2013). Green and sustainability are different terms, where "green" refers specifically to environmentally friendly practices (Rana and Alayed, 2018), while "sustainability" is a more broad and inclusive approach that integrates environmental protection with economic and social reflections (Moon, 2021; Polas *et al.*, 2022). GESS embraces the training and competencies required to effectively engage in sustainable business practices, which include comprehensive training in green business activities that provide the foundational knowledge

necessary for sustainability (Bakari, 2013). They also involve proficiency in green management, specifically focusing on how business operations minimize environmental impact. Skills in green team management are crucial for leading teams toward sustainable goals, although expertise in green business planning ensures that strategic initiatives prioritize environmental considerations (Nwafor and Obinna, 2024). GESS is confirmed to be the massive predictor of GEP and WEN (Bhattacharjee, 2017; Kozlova and Volkova, 2019; Sern, 2020; Abdelwahed *et al.*, 2023; Alabi *et al.*, 2023; Muaddab, 2024; Nwafor and Obinna, 2024). Similarly, Mukherjee *et al.* (2024), Muaddab (2024) and Yar *et al.* (2024) are known to contribute to several constructs, such as green skills training, green skills, green education and technology for the development of WEN, innovation and GEP. Skill development, i.e. green skills, leads to sustainable economic empowerment of women (Alabi *et al.*, 2023). In the context of sustainable development, GESS positively enhances WEN (Bhattacharjee, 2017). Likewise, several scholars, such as Papageorgiou *et al.* (2023) and Muaddab (2024), confirm GESS as a significant predictor of GEP.

2.2 Green opportunities (GOS)

GOS refers to the favorable conditions and visions that ease the adoption and growth of environmentally sustainable practices. There are several factors that enable businesses to stay up to date with the latest advancements in sustainable practices, such as the lack of entry barriers, permission of easy access for new participants in the green market, a vigorous demand for green products and services, indication of a consumer preference for sustainability, widespread possibilities for green procurement – which involves sourcing goods and services with minimal environmental impact – strong public support for green initiatives and green technology (Bakari, 2013; Ataman *et al.*, 2017; Anabaraonye *et al.*, 2021). In the literature, digital technologies contribute significantly to sustainable development and environmental performance by opening new avenues and opportunities to achieve WEN (Lecoutere, 2017; Li *et al.*, 2022; Madhavi, 2024; Denhere, 2024). In addition, GEP and WEN can be significantly developed through GOS (de Groot *et al.*, 2017; Denhere, 2024; Handoko *et al.*, 2024). These initiatives make and nurture women entrepreneurs to bring sustainable societal change through green technology and technological innovation (Soomro *et al.*, 2020; Trapp and Kanbach, 2021).

2.3 Green incentives (GIS)

GIS is a very important factor that examines and underscores the various circumstances that become favorable for the development of WEN and society's development and prosperity. These include several dimensions and incentives, i.e. access to technology, innovation grants, the obtainability of profits, lower taxation rates, grants and subsidies, green skill training and many more (Babiarz *et al.*, 2017; Bakari, 2013; Oladeji *et al.*, 2024). According to Sharma and Varma (2008), Suresh and Saravanan (2013), Chowdhury and Chowdhury (2011) and Modi *et al.* (2014), for women, the provision of microfinance for organizations has a massive contribution to WEN. In the same direction, activities and programs relating to health, i.e. family planning programs, provide social welfare, institutional structures and women's health empowerment (Kaur, 2010; Der Boghossian, 2019; Oladeji *et al.*, 2024; Israrud Din, 2024; Nichols, 2024). There are other factors, such as educational programs, market access, technology, entrepreneurial knowledge and skills and government support, that substantially contribute to the development of WEN and GEP (Farinelli *et al.*, 2011; Zeng and Ren, 2022; Mia *et al.*, 2022; Vasilescu *et al.*, 2023; Abdelwahed *et al.*, 2023).

2.4 Green entrepreneurship (GEP)

The development of WEN is possible mainly through the enhancement of GEP, particularly with a focus on social connections, education, technology integration, financial enclosure, policy assistance, etc. (Islam, 2020; Mahsud and Ali, 2020; Ghosh *et al.*, 2024). GEP is also associated with different modes and strategies in sectors such as green tourism, sustainable agriculture and renewable energy, which positively affect WEN (Savastano *et al.*, 2022; Mahajan and Bandyopadhyay, 2021). GEP operates enterprises that practice pro-environmental practices, and it highlights environmentally friendly practices, which provide advantages in terms of sales promotion by reducing overall production and enhancing pre-tax earnings. Several environmental challenges, such as climate change, global warming and water pollution, massively resist sustainable economic growth in Nigeria (Anabaraonye *et al.*, 2023a). In this way, GEP is one of the massive and practical strategies to adapt and mitigate climate change, ultimately alleviating poverty and ensuring sustainable economic growth (Anabaraonye *et al.*, 2023b). Bakari (2013) argues that ecologically sustainable operations are enhanced by green entrepreneurs, thanks to a rise in expenditure on green procurement and experience an increase in personnel output. In the same context, GEP promotion and education programs help to develop skills and confidence among women, allowing them to undertake environmentally friendly activities in their organizations (Radović-Marković and Živanović, 2019; Fallah and Soori, 2023). A literature review assessment by Anabaraonye *et al.* (2021) demonstrates that promoting GE is necessary for attaining healthy environmental safety and economic growth. Climate change education is also a massive contributor to effectively achieving sustainable development goals. Furthermore, GE education and green entrepreneurial opportunities positively contribute to the sustainable development of Nigeria's plastic recycling industry (Anabaraonye *et al.*, 2022a, 2022b). Well-known scholars in the domain, like Fallah and Soori (2023) and Abdelwahed *et al.* (2022), highlight the substantial contribution of institutional frameworks and policies in creating GEP. Likewise, WEN can be improved through e-entrepreneurship, technology, markets and digital platforms (Islam, 2020; Abdelwahed *et al.*, 2022; Li *et al.*, 2023; Alzamel, 2024).

2.5 Women empowerment (WEN)

WEN involves the conviction in women's capacity to make decisions about property, guaranteeing that they possess the self-assurance and power to oversee and possess assets. It embraces the ability to make well-informed decisions concerning health and family planning, empowering women to have control over topics that are vital to their overall well-being and reproductive health (Swain and Floro, 2012; Chatterjee *et al.*, 2018; Yoopecth, 2021).

Relevant literature demonstrates the diverse factors that meaningfully enhance GEP, environmental sustainability, WEN and sustainable development, such as GESS, climate change, GOS, supportive policies, access to resources, GIS, education, green skills training, technology integration, economic opportunities, digital skills training, new market opportunities, contrivance sustainable practices, resource capacities, effective educational programs, institutional structures, entrepreneurial activities, access to microfinance, social benefits, supportive institutional frameworks, conducive environment for eco-friendly business practices, market opportunities, educational programs, policy support, social networks, technology integration, government support and green entrepreneurial ecosystem (Brandt and Svendsen, 2016; Chatterjee, 2016; Jabbar and Zaza, 2016; de Groot *et al.*, 2017; Radović-Marković and Živanović, 2019; Der Boghossian, 2019; Potluri and Phani, 2020a, 2020b; Zhao *et al.*, 2021; Li *et al.*, 2022;

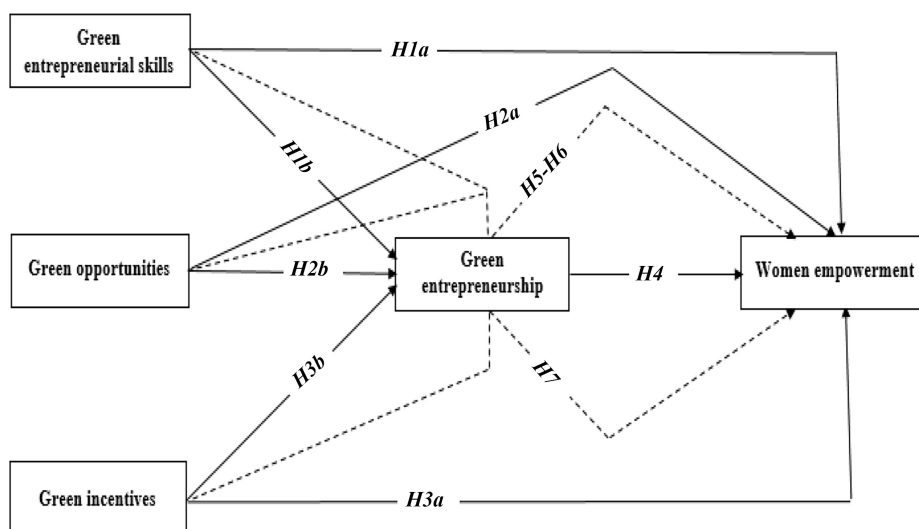
Fallah and Soori, 2023; Yasir *et al.*, 2023; Abdelwahed *et al.*, 2023; Medhekar, 2024; Madhavi, 2024; Nwafor and Obinna, 2024; Mukherjee *et al.*, 2024; Ghosh *et al.*, 2024; Handoko *et al.*, 2024).

However, research still needs to fill the gaps where existing literature has not investigated the effect of GESS, GOS and GI on both GEP and WEN in an integrated way. Moreover, in the presence of GESS, GOS and GI, any discussions on the direct or indirect contribution of GEP on WEN disappeared. Finally, contextually, this investigation among Saudi women entrepreneurs of green business needs to concentrate more on exploring their empowerment, despite Saudi women entrepreneurs confronting several challenges regarding GEP and WEN. For instance, Abdelwahed, Bastian and Wood (2022) exert the societal and cultural barriers that limit women's participation in entrepreneurial activities and sustainable business ventures. Corporate disclosures, policy initiatives and gender equality remain significant gaps in empowerment and support for women in green business and entrepreneurship (Al-Nasrallah, 2023). The role of e-entrepreneurship in boosting a green economy is noted. However, access to digital tools and platforms still needs to be improved for many Saudi women due to socio-economic factors (Alzamel, 2024). Likewise, green human resource management and green creativity are also massive barriers among women intrapreneurs (Iram *et al.*, 2025). Hence, there is a dire need to develop comprehensive support systems and policies to enable women's active participation in green business initiatives, particularly to align with Saudi Vision 2030 (Nieva, 2016; Rana and Alayed, 2018). To tackle these challenges, GEP has a central role in developing WEN in Saudi Arabia, where it delivers a pathway for women to be involved in sustainable economic activities, in turn nurturing their economic independence and social inclusion. This women's participation enhances their skills and competencies in evolving green technologies and generates opportunities to break free from traditional gender roles and establish themselves as leaders in the green economy.

Based on these gaps, the conceptual framework for this study inspects the impacts of GESS, GOS and GIS on WEN in Saudi Arabia, with GEP serving as a mediating variable (Figure 1). GESS has a direct effect on WEN, where GESS develops women's ability to participate in entrepreneurial activities. In the same way, GOS is the pre-requisite for women to establish their enterprises by providing the best chances and opportunities. The GIS construct, which comprises different kinds of support (financial and technical), is prominent for diminishing barriers for women. The contribution of GEP as a mediator positively reinforces WEN. Moreover, providing GOS for women empowers them as they start their green enterprises. In this way, this framework underscores the strong connection between these factors, emphasizing the meaningful contribution of GEP to the development of WEN.

2.6 Green entrepreneurial skills (GESS), women empowerment (WEN) and green entrepreneurship (GEP)

GESS prioritizes WEN by creating new job opportunities, improving informal finance and promoting sustainable development. Integrating GESS into training programs on gender empowerment and security provides women with the tools needed to participate in the labor market (Kwauk and Casey, 2022). Odoni's (2023) study shows Kenya Vocational Education and Training (TVET) integrating GESS and how it benefits women through development, especially through job and study development for young women. Rosyidah (2017) establishes that environmental skills training in Jakarta's fishing communities leads to more significant economic opportunities for women, underlining the significance of contextualized green skills training. In Southwest Nigeria, Alabi *et al.* (2023) provide



Source(s): Developed by the researchers

Figure 1. Conceptual model of the study

evidence that skill development, i.e. green skills, leads to sustainable economic empowerment for women. Likewise, in the empirical assessment of [Bhattacharjee \(2017\)](#), a combination of indigenous knowledge with GESS substantially boosts WEN, mainly in the context of sustainable development. For women refugees at the Zaatari camp in Jordan, the available vocational training programs for GESS enhance economic opportunities, which ultimately bring WEN ([Jabbar and Zaza, 2016](#)). In the same direction, [Mukherjee et al. \(2024\)](#) argue that digital skills training, integrated with GESS, significantly empowers poor, unemployed women in India. In the context of Harare, Zimbabwe, supporting policies regarding women's participation in GEP were enhanced through opportunities in green skills training ([Manyati et al., 2024](#); [Yasir et al., 2023](#)). Similarly, GESS and green technology play an enormous role in improving GEP ([Sern, 2020](#); [Papageorgiou et al., 2023](#); [Muaddab, 2024](#)). GESS enhances individuals' ability and competence, ultimately bringing economic growth and GEP in green industries ([Kozlova and Volkova, 2019](#); [Sern, 2020](#)). This empowers entrepreneurs to create new business opportunities and work to improve the environment ([Abdelwahed et al., 2023](#); [Nwafor and Obinna, 2024](#)).

Consequently, the domain literature confirms the links between GESS, WEN and GEP in various contexts, regions and organizations. Nevertheless, these links are further warranted among women entrepreneurs in Saudi Arabia. The main reason behind that under Vision 2030, Saudi Arabia more focus on the nation's ongoing transformation and development, specifically in WEN and GEP ([Al-Sadiq and Daghistani, 2021](#)), where women can assist in diversifying the economy and sustainability in Saudi Arabia ([Petrakis, 2020](#); [Alsharif et al., 2022](#); [Gupta et al., 2020](#); [Sadi and Al-Ghazali, 2021](#)). Therefore:

H1a. GESS positively enhances WEN.

H1b. GESS positively enhances GEP.

2.7 Green opportunities (GOS), women empowerment (WEN) and green entrepreneurship (GEP)

The various investigations resulting from GOS and WEN are approximately linked in this pattern. Likewise, the study by [Radović-Marković and Živanović \(2019\)](#) confirmed the bank investment and the contribution of education through the enhancement of GEP that economically empower women in this sense. Hence, WEN takes toward the sound surrounding sustainability results ([Achu et al., 2022](#)). Furthermore, digital technologies are available on various occasions for WEN and environmental sustainability from this perspective ([Denhere, 2024](#)). Parting with this, WEN encounters multiple problems, including the dearth of policy assistance, health issues and a limited approach to means, which are the specific challenges ([Chatterjee, 2016](#); [Handoko et al., 2024](#)). The study revealed that empowering rural women supports climate variable justification, as [Ajani et al. \(2013\)](#) explained. Moreover, transformation, marketing and informal food energy are essential for environmental sustainability and WEN ([de Groot et al., 2017](#)). Meanwhile, WEN has developed through agricultural partners and contributes to permaculture performances ([Lecoutere, 2017](#)). However, GOS has an essential influence on GEP enhancement. A vast study of literature discusses that a more in-depth research task is required to impart knowledge regarding an awareness related to environmental understanding, which influences commercial performance ([Golsefid-Alavi et al., 2021](#); [Nordin and Hassan, 2019](#)). Education and policy support are reasoned to enhance GEP and GOS in Nigeria, and they indicate such a way to improve economic growth ([Ataman et al., 2017](#); [Anabaraonye et al., 2021](#)). In a similar pattern, GOS was developed for adult users in Pakistan who need green means being present for marketers ([Soomro et al., 2020](#)). The private market indicates that it can facilitate the promotion of management ([Burzyńska et al., 2018](#); [Trapp and Kanbach, 2021](#)).

In Turkey, cultural and economic factors and GOS significantly influence GEP ([Uslu et al., 2015](#)). In the empirical assessments of [Harini and Meenakshi \(2012\)](#) and [Makhloufi et al. \(2022\)](#), GEP is an alternative business solution that protects the environment and enhances environmental performance through GOS and green entrepreneurial orientation. The integration of opportunity, GOS and resource capacities are the better predictors of sustainable competitive advantage, GEP environmental performance and sustainability ([Mathur and Tandon, 2016](#); [Gunawan and Fraser, 2016](#); [Li et al., 2022](#); [Madhavi, 2024](#)).

Consequently, domain researchers have established the association between GOS, WEN and GEP. Contextually, the confirmation of these associations needs further concentration among Saudi women as, at present, Saudi Arabia strongly emphasizes developing green industries and creating entrepreneurial opportunities ([Al-Fattah, 2022](#)). GOS in Saudi Arabia, such as renewable energy projects, sustainable agriculture and environmental technologies, are exclusive in their scale and government backing compared to other contexts ([Khan and El-Garaihy, 2020](#)). These creativities provide new pathways for WEN, as the green economy may offer fewer traditional barriers for women entrepreneurs in a conservative society where they are typically confronted by constraints ([Alarifi et al., 2021](#)). Furthermore, with the government's active promotion of sustainability and entrepreneurship, these GOS are able to catalyze new forms of entrepreneurship, specifically in emerging sectors such as clean energy and waste management ([Mirza and Olayan, 2021](#); [Abdelwahed et al., 2023](#)). Thus, we developed:

H2a. GOS positively enhances WEN.

H2b. GOS positively enhances GEP.

2.8 Green incentives (GIS), women empowerment (WEN) and green entrepreneurship (GEP)

The GIS factor has excellent prominence and importance in developing WEN, which leads to sustainable economic development. The institutional policies and structures positively enhance women's socio-economic development (2010; [Der Boghossian, 2019](#); [Israrud Din, 2024](#)). According to [Radović-Marković and Živanović \(2019\)](#), education financial support passively empowers women to engage in GEP. In the same way, entrepreneurial activities, financial resources and access to microfinance enhance WEN ([Chowdhury and Chowdhury, 2011](#); [Suresh and Saravanan, 2013](#); [Modi et al., 2014](#)). Sustainable agricultural practices, i.e. millet farming, validate the intersection of GIS and WEN, contributing to broader social benefits ([Medhekar, 2024](#)). Similarly, health-related initiatives, community-based health projects and family planning programs exhibit social and health empowerment that can boost women's overall economic status ([Babiarz et al., 2017](#); [Nichols, 2024](#); [Oladeji et al., 2024](#)).

GIS comprised of financial subsidies, grants, tax breaks and supportive institutional frameworks can have a substantial contribution to nurturing GEP by plummeting initial cost barriers and making a conducive environment for eco-friendly business practices ([Sîrb, 2017](#); [Nikolaou et al., 2018](#); [Potluri and Phani, 2020a](#); [Zhao et al., 2021](#); [Zeng and Ren, 2022](#); [Vasilescu et al., 2023](#)). According to [Yasir et al. \(2023\)](#), GIS is essential for generating a flourishing green entrepreneurial ecosystem that aligns entrepreneurial activities and GEP with environmental goals.

Consequently, GIS positively predicts both GEP and WEN. In the context of developed countries, GEP is shaped and enhanced by market forces, i.e. funding, incentives, policies regarding tax reductions, funds and financial support for green start-ups and the initiatives of tax exemptions toward maintaining of eco-friendly and pro-environmental businesses ([Alkhalaf and Yousif, 2020](#)). In this way, these steps of incentives and financial assistance positively empower and nature women to play their significant contribution in the society and get the sustainability ([Ibrahim and Kayed, 2021](#)). Consequently, to confirm the effective role of GIS toward WEN and GEP, this further takes serious concentrations, specifically in the context of women in Saudi Arabia ([Al-Mutairi et al., 2021](#); [Alqahtani, 2021](#); [Alarifi and Naser, 2022](#)). Thus, we developed:

H3a. GIS positively enhances WEN.

H3b. GIS positively enhances GEP.

2.9 Green entrepreneurship (GEP) and women empowerment (WEN)

GEP plays a pivotal role in WEN by addressing several key areas, such as education, financial access, sector-specific opportunities, policy support, social networks, technology integration, etc. Education also has a robust role in equipping women with the skills and knowledge necessary for GEP. Educational and GEP programs empower women and also provide knowledge on sustainable practices and environmental management, which is necessary to start and manage green businesses efficiently ([Radović-Marković and Živanović, 2019](#); [Potluri and Phani, 2020b](#); [Fallah and Soori, 2023](#)). According to [Abdelwahed et al. \(2022\)](#) and [Fallah and Soori \(2023\)](#), institutional frameworks and policies support the enabling environment for women in GEP, where these policies that promote gender equality, deal incentives for green ventures and deliver regulatory support are essential. Likewise, strong networks also empower women by providing mentorship, resources and emotional support, which are critical for overcoming the obstacles female entrepreneurs face ([Islam, 2020](#); [Li, Murad and Ashraf, 2023](#)). GEP and technology

integration, specifically e-entrepreneurship, open new avenues for women with access to digital platforms, markets and information, which ultimately empowers them (Abdelwahed *et al.*, 2022; Alzamel, 2024). Similarly, sector-specific strategies and approaches, such as sustainable agriculture, renewable energy and green tourism, deliver targeted opportunities for women (Mahajan and Bandyopadhyay, 2021; Savastano *et al.*, 2022).

As a result, GEP's reputation for achieving WEN is very substantial. However, its confirmation among women in Saudi Arabia is still at the infancy stage (Alghamdi and Park, 2020; Alyamani, 2020). Thus, to further confirm this, we expect:

H4. GEP positively enhances WEN.

2.10 Green entrepreneurship (GEP) as mediator

GEP is the influential and important factor that reinforces the development of the connections between GESS, GOS, GIS and WEN. This is possible through acquiring and polishing green technology skills, competencies and digital platforms, which will eventually enhance GEP and sustainability in several contexts and industries (Skordoulis *et al.*, 2022). In the assessment of Ebrahimi and Mirbargkar (2017), GEP brings professional development and opportunities. Similarly, GOS generates new ideas and notions regarding permaculture and renewable energy that significantly enhance WEN. Besides, GIS also massively boosts WEN through the provision of various financial assistance and text reduction strategies (Zhao *et al.*, 2021). Furthermore, GEP assists in changing the economy by developing sustainable development and competitive advantage (Doan and Nguyen, 2021; Umar and Khan, 2023; Shehzad *et al.*, 2024). The literature also highlights the consistent positive effects of GESS, GOS and GIS on GEP and WEN (Babiarz *et al.*, 2017; Nikolaou *et al.*, 2018; Nordin and Hassan, 2019; Potluri and Phani, 2020a; Zhao *et al.*, 2021; Kwauk and Casey, 2022; Mia *et al.*, 2022; Abdelwahed *et al.*, 2023; Handoko *et al.*, 2024; Ghosh *et al.*, 2024; Nichols, 2024; Oladeji *et al.*, 2024; Alabi *et al.*, 2023; Manyati *et al.*, 2024).

As a result, the domain literature underlines the bridging contribution of GEP between GESS, GOS, GIS and WEN. Besides, it also offers consistent associations between GESS, GOS, GIS, GEP and WEN. In Saudi Arabia, the role of GEP as a mediator between GESS, GOS, GIS and WEN is critical due to the country's unique socio-economic transformation under Vision 2030 (Alshammari, 2021). GESS equips women with the knowledge and capacity to navigate emerging industries. Still, it is through GEP that these skills lead to real empowerment by providing platforms for innovation, leadership and business ownership (Al-Moammar and Alsahli, 2022). Likewise, GOS in renewable energy, sustainable agriculture and eco-friendly technologies offer women access to new markets. However, GEP mediates this connection by enabling women to capitalize on these opportunities, creating businesses that benefit the environment while also enhancing their socio-economic status and decision-making power (Alsharif and Alqurashi, 2021). Finally, GIS – such as government grants, tax exemptions and supportive policies – are critical drivers of entrepreneurship in Saudi Arabia (Alraja, 2021). To confirm the contribution of GEP as a mediator in the economy of Saudi Arabia, we expect:

H5. GEP mediates the connection between GESS and WEN.

H6. GEP mediates the connection between GOS and WEN.

H7. GEP mediates the connection between GIS and WEN.

3. Methods

3.1 Approach and respondents

We applied a deductive approach and collected cross-sectional data, as this is regarded as the best approach to predicting facts and providing an accurate picture of the phenomenon with numbers and figures (Prabhu, 2020). Moreover, researchers like Swain and Floro (2012), Bakari (2013), Chatterjee *et al.* (2018), Der Boghossian (2019), Zhao *et al.* (2021), Li *et al.* (2022), Abdelwahed *et al.* (2023), Medhekar (2024), Nwafor and Obinna (2024), Mukherjee *et al.* (2024), Ghosh *et al.* (2024) and Handoko *et al.* (2024) applied the same strategy to explore their hypotheses on WEN, GEP, GOS, GIS and GESS.

The study's respondents are women entrepreneurs in Saudi Arabia. These women have successfully started and run green businesses, which are established with great experiences, challenges and the impact of green initiatives on their empowerment. In the WEN of Saudi Arabia, entrepreneurship, e-entrepreneurship and GEP have contributed significantly to boosting a green economy. However, Saudi women still confront challenges and resistance in different aspects, such as GESS, GOS and GI (Alzamel, 2024; Iram *et al.*, 2025). Therefore, it is necessary to develop a robust support system and related policies to enable women's active participation in green business initiatives, aligning with Saudi Vision 2030 (Nieva, 2016; Rana and Alayed, 2018).

3.2 Authentication of survey tool and data collection

We applied the survey questionnaire to get the required responses using several approaches, such as online and offline. We ensured its reliability and validity through a pilot test by collecting 26 responses before the launch of large-scale data collection. We provided the reliability of the survey through Cronbach's alpha (α) to gauge its internal consistency and validity ensured by university professors who confirmed its content validity and format of the survey. The experts suggested minor modifications. Consequently, we launched a valid and reliable study for large-scale data collection.

We used convenience sampling to reach the respondents (Kivunja, 2015) quickly. This approach is characterized by its simplicity, affordability and adherence to the most effective methods for conducting online and offline research (Winton and Sabol, 2022). In an online survey, we disseminated online links through WhatsApp groups and Facebook to get out to most women, enabling them to complete the online survey. We also visited numerous locations where women work within organizations and entrepreneurial platforms – initially, we distributed 550 survey forms and received 318 samples of raw data, with a response rate of 57.81%. After data cleaning and screening, four forms were discarded due to the presence of missing data of more than 5% of each construct of an outlier. Finally, we used 314 valid samples to conclude the study outcomes.

We applied G*Power to determine the suitable size required for the study, a technique that is best for researchers to warrant their surveys are suitably planned to observe their findings' effectiveness with the assumptions, i.e. validity and reliability (Verma *et al.*, 2020; Faul *et al.*, 2009). In our study, we used this technique and five main predictors (based on several regressions) to decide the effect size, where the test suggested the requirement of 138 samples. Our sample size fulfils the sufficiency requirement, as a sample size of 200–300 participants is generally sufficient for stable parameter estimation in SEM, mainly when the model is not overly complex (Westland, 2010; Kline, 2015). Furthermore, it is also in line with the requirement of the Monte Carlo simulation method, which suggests that a sample size of 314 must yield reliable parameter estimates and standard errors for the specified model. Therefore, our sample size of 314 is desirable to conclude the results, showcasing the thoroughness of our research methodology.

We maintained the ethical values of respondents, assuring them of their confidentiality, anonymity and strict preference for their responses. We got a signed informed consent from each to confirm their acceptance. We made everything accessible so respondents could feel relaxed when filling out the forms. Finally, we requested that they return the filled survey within a week.

3.3 Common method bias

Confirming the common method bias (CMB) is an indispensable feature of research to determine the validity of the empirical results. In this respect, we applied two methods – VIF and Harman’s one-factor test as advised by Podsakoff *et al.* (2003), Kock (2015) and Kock and Lynn (2012) – and anticipated that bias exists when any researcher applies the same data collection method using the same questionnaire. To tackle these issues, we applied the variance inflation factor (VIF) because of its great prominence in assessing quantitative empirical studies for the insurance of CMB. All values of VIF for all respective factors must be below 3.3, which warrants any CMB’s nonexistence. In this way, in our results, all the values of VIF for the inner model established no single-source bias, which may be a significant concern in our data set (Table 1). Furthermore, as we collected the responses for the constructs (independent and dependent) from the same respondents, we applied Harman’s one-factor test to determine the likelihood of CMB (Podsakoff *et al.*, 2003; Baumgartner *et al.*, 2021). The test outcomes suggested the first factor’s variance as 44.07%, lower than the suggested value of 50% (Podsakoff *et al.*, 2003). At the same time, the other four factors explain 61.9% of the cumulative variance, which is higher than the recommended values (50%). Thus, CMB is also not an issue of this study in light of Harman’s one-factor test.

3.4 Measures

We adopted all the scale items from domain literature and assessed with a five-point Likert scale: “strongly agree = 1 to strongly disagree = 5.” In detail, we assessed GEP with 15 items, GESS with six items, GOS with five items and GIS with ten items from Bakari’s study (2013). Finally, we assessed WEN by adopting four items from Swain and Floro (2012) and Chatterjee *et al.* (2018) (see details in Table 2).

4. Results

4.1 The characterization of the participants

We collected data from women green entrepreneurs in Saudi Arabia. The demographic profile of the respondents suggests a majority of respondents ($n = 131$ or 41.72%) were aged between 31 and 40 years; 36.94% ($n = 116$) were 18–30 years; 14.01% ($n = 44$) were

Table 1. Full collinearity testing

Construct	VIF
Green entrepreneurship [GEP]	1.672
Green entrepreneurial skills [GESS]	1.821
Green opportunities [GOS]	2.553
Green incentives [GIS]	2.096
Women empowerment [WEN]	1.482

Source(s): Estimated by the researchers

Table 2. Survey questionnaire

Construct	Item details	Developer
Green entrepreneurship [GEP]	GEP1: Sales due to green activities have increased GEP2: Relatives' production has reduced GEP3: My business has increased pre-tax profit GEP4: Number of employees has increased GEP5: My expenditure on green procurement is growing GEP6: My customers needing green product is growing GEP7: Expenditure on non-green procurement is reducing GEP8: My image as a green business is getting stronger GEP9: There has improved customer satisfaction GEP10: Number of repeat buyers for green product is growing GEP11: I have an access to foreign markets GEP12: I have access to green technology GEP13: Green activity gives my business competitive advantage GEP14: There is support for green product innovation GEP15: There is reliable consultancy firms for green business	Bakari (2013)
Green entrepreneurial skills [GESS]	GESS1: I have the training in green business activities GESS2: I have skills in green management GESS3: I have skills in green team management GESS4: I have skills in green business planning GESS5: I have skills in green marketing activities GESS6: I can easily notice a green business opportunity	Bakari (2013)
Green opportunities [GOS]	GOS1: There are no entry barriers into market I serve GOS2: There is a high demand for a green production and services GOS3: There are wide opportunities for green procurement GOS4: The public has support for green activities GOS5: I have access to information on green technology	Bakari (2013)
Green incentives [GIS]	GIS1: The taxation system favors green business activity GIS2: Attractive incentives provide by the government GIS3: Presence of environment-minded management GIS4: Expectation of benefits of green business ventures GIS5: Benefits from diversify into new market	Bakari (2013)

(continued)

Table 2. Continued

Construct	Item details	Developer
Women empowerment [WEN]	GIS6: Grain of expertise to improve green business	Swain and Floro (2012) and Chatterjee <i>et al.</i> (2018)
	GIS7: Availability of profitable ways of doing green business	
	GIS8: Easy product regulations in green business activity	
	GIS9: Easily to modify products for green-oriented markets	
	GIS10: Closeness to foreign markets needing green products	
	WEN1: I believe that I can take property-related decisions	
	WEN2: I believe that I can take health and family planning decisions	
	WEN3: I believe that I can take children education related decisions	
	WEN4: I believe that my impact is strong when I bring myself into my work	
Source(s): Adopted from the domain literature		

41–50 years and only 7.33% ($n = 23$) were 51 and more years of age. With regard to the education level, a majority of respondents ($n = 111$ or 35.35%) had a bachelor's degree; 21.02% ($n = 66$) had high school or equivalent; 17.83% ($n = 56$) possessed an associate degree; and only 1.28% ($n = 4$) had doctorate degrees. Concerning experience in GEP, 29.30% ($n = 92$) have 4–7; 25.48% ($n = 80$) have 1–3 years; 24.20% ($n = 76$) have 8–10 years; 12.10% ($n = 38$) possessed more than ten years; and only 8.92% ($n = 28$) had less than one year of experience in GEP (see details in Table 3).

4.2 Measurement model

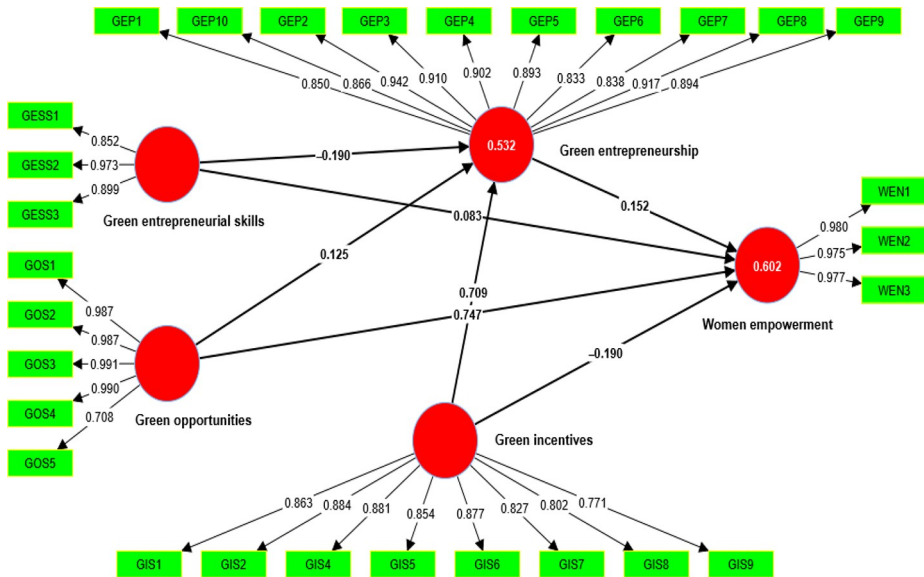
We used partial least squares (SmartPLS4) to conduct the structural equation modeling (SEM) (Ringle *et al.*, 2015). At the initial stage, in the measurement model, we followed the recommendations of Hair *et al.* (2022) by checking the aspects, i.e. the factor loadings (> 0.7), composite reliability (CR) (> 0.7) and an average variance extracted (AVE) to establish convergent validity and reliability. As presented in Table 1, the majority of the scale's items are noted as above threshold values (> 0.70) (Hair *et al.*, 2022), except for a few items, i.e. GEP11, GEP12, GEP13, GEP14, GEP15, GESS4, GIS3, GIS10 and WEN4 (Table 2 and Figure 2). We deleted unloaded items accordingly (Hair *et al.*, 2022) because items with low loadings might affect the overall reliability of the measurement model (Martynova *et al.*, 2018; Hair *et al.*, 2019). Subsequently, the remaining items more accurately capture the intended construct and lead to a more consistent and reliable set of measurements. Continuing this, we ensured CR and AVE, where we found these above threshold values (CR $\Rightarrow 0.70$; AVE $\Rightarrow 0.50$) for the rest of the constructs of the model (Table 4 and Figure 2).

In the second stage, to examine the essential aspect of the model (discriminant validity), we conducted the heterotrait-monotrait (HTMT) ratio. This mode (HTMT) has the most significant prominence because of its base on a multi-trait-multimethod matrix (Henseler *et al.*, 2015). The values of HTMT should not exceed 0.85 (Kline, 2016), whereas, in the perception of Gold *et al.* (2001), the values of HTMT should range from less than 0.90. In

Table 3. Demography

Indicator	Characteristics	Samples	%
Age [years]	18–30	116	36.94
	31–40	131	41.72
	41–50	44	14.01
	51+	23	7.33
	Total	314	100.0
Education level	High school or equivalent	66	21.02
	Associate degree	56	17.83
	Bachelor's degree	111	35.35
	Master's degree	77	24.52
	Doctorate degree	04	1.28
	Total	314	100.0
Experience in green entrepreneurship [years]	< 1	28	8.92
	1–3	80	25.48
	4–7	92	29.30
	8–10	76	24.20
	>10	38	12.10
	Total	314	100.0

Source(s): Researchers' own questionnaire's data



Source(s): Estimated by the researchers

Figure 2. Measurement model

this manner, in our analysis, the values of HTMT were found to be less than 0.85, warranting no discriminant validity issue (Table 5). Furthermore, we ensured Fornell and Larcker (1981). We noted the AVE value square-rooted and confirmed against the construct’s inter-correlation with other constructs in the present study model (Chin, 2010). We found it satisfactory (Table 6).

4.3 Structural model

At the initial stage, we observed the model fitness to ensure validity by using leading indicators, i.e. the standardized root mean square residual (SRMR) and the normed fit index (NFI), as recommended by Henseler et al. (2014) and Hair et al. (2017). In these indicators, SRMR must be lower than 0.08, and NFI must be higher than 0.90; our SRMR value appeared to be 0.069, and the NFI value was 0.920. These values ensured the quality of the model. We applied bootstrap samples with 10,000 samples through a one-tailed test, in line with the recommendations of Hair et al. (2022). The R² co-efficient of determination value was noticed as 0.602, including GESS, GOS, GIS and GEP. Similarly, 0.532 was observed with a combination of GESS, GOS and GIS constructs. These values recommend a high level of contribution of R² with 60% and 53%, respectively (Hair et al., 2022). As a result, our model has satisfactory explanatory power. As mentioned in Table 5 and Figure 3, the effect of GESS on WEN is positive, while GESS’s effect on GEP is found to be negative ($H1a = \beta = 0.083, p < 0.05$; $H1b = \beta = -0.190, p > 0.05$). Hence, $H1a$ is accepted, and $H1b$ is rejected. Moreover, there is a positive effect of GOS on WEN and GEP ($H2a = \beta = 0.747, p < 0.05$; $H2b = \beta = 0.125, p < 0.05$). Henceforth, $H2a$ and $H2b$ are supported. Likewise, GIS is the negative predictor of WEN and positive of GEP ($H3a = \beta = -0.190, p > 0.05$; $H3b = \beta = 0.709$,

Table 4. Measurement model

Constructs	Items	Loading	AVE	CR	Alpha (α)
Green entrepreneurship [GEP]	GEP1	0.850	0.784	0.973	0.969
	GEP10	0.866			
	GEP2	0.942			
	GEP3	0.910			
	GEP4	0.902			
	GEP5	0.893			
	GEP6	0.833			
	GEP7	0.838			
	GEP8	0.917			
Green entrepreneurial skills [GESS]	GEP9	0.894			
	GESS1	0.852	0.827	0.935	0.926
	GESS2	0.973			
	GESS3	0.899			
Green incentives [GIS]	GIS1	0.863	0.716	0.953	0.943
	GIS2	0.884			
	GIS4	0.881			
	GIS5	0.854			
	GIS6	0.877			
	GIS7	0.827			
	GIS8	0.802			
	GIS9	0.771			
Green opportunities [GOS]	GOS1	0.987	0.882	0.974	0.963
	GOS2	0.987			
	GOS3	0.991			
	GOS4	0.990			
	GOS5	0.708			
Women empowerment [WEN]	WEN1	0.980	0.955	0.985	0.977
	WEN2	0.975			
	WEN3	0.977			

Note(s): Deleted items = GEP11, GEP12, GEP13, GEP14, GEP15, GESS4, GIS3, GIS10, WEN4; CR = Composite reliability; AVE = Average variance extracted; α = Alpha reliability

Source(s): Estimated by the researchers

Table 5. Heterotrait-monotrait ratio (HTMT)

Construct	1 GEP	2 GESS	3 GIS	4 GOS	5 WEN
1. GEP					
2. GESS	0.079				
3. GIS	0.713	0.184			
4. GOS	0.178	0.045	0.130		
5. WEN	0.142	0.063	0.071	0.782	

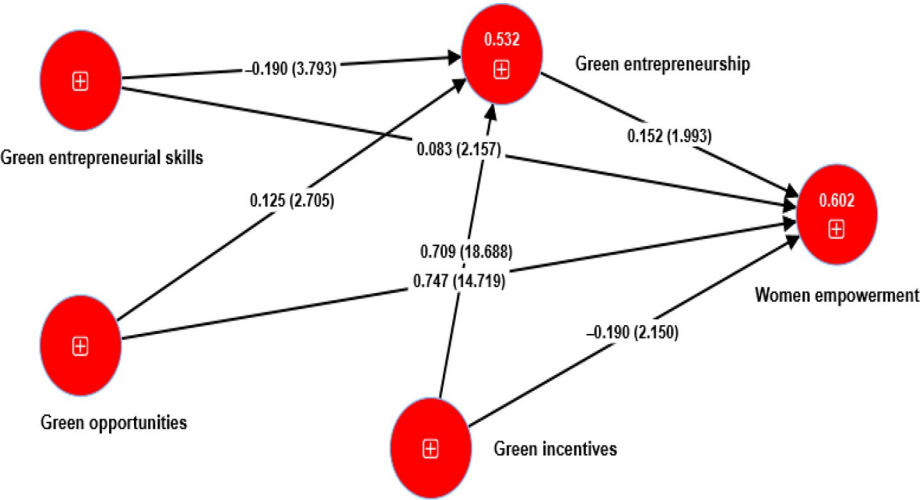
Note(s): GESS = Green entrepreneurial skills; GOS = Green opportunities; GIS = Green incentives; GEP = Green entrepreneurship; WEN = Women empowerment

Source(s): Estimated by the researchers

Table 6. Fornell–Larcker criterion

Construct	1 GEP	2 GESS	3 GIS	4 GOS	5 WEN
1. GEP	0.885				
2. GESS	0.589	0.909			
3. GIS	0.696	0.129	0.846		
4. GOS	0.172	0.074	0.586	0.939	
5. WEN	0.141	0.100	0.310	0.763	0.977

Note(s): “Diagonals represent the square root of the average variance extracted (AVE) while the other entries represent the correlations.” GESS = Green entrepreneurial skills; GOS = Green opportunities; GIS = Green incentives; GEP = Green entrepreneurship; WEN = Women empowerment
Source(s): Estimated by the researchers



Source(s): Estimated by the researchers

Figure 3. Structural model

$p < 0.05$), which rejects $H3a$ and accepts $H3b$. Furthermore, $H4$ is accepted by highlighting a positive effect of GEP on WEN ($H4 = \beta = 0.152, p < 0.05$).

With regard to mediating analysis, we used the bootstrap method to guesstimate the direct effect using Smart PLS software, a widely accepted method recommended by researchers in the field, such as [Preacher and Hayes \(2004, 2008\)](#) and [Hair et al. \(2022\)](#). Bootstrapping is a nonparametric resampling technique that is best for its statistical accuracy and strength ([Zhao et al., 2010](#)). In the analysis, GEP does not mediate the connection between GESS and WEN and GOS and WEN but positively mediates the association between GIS and WEN ($H5 = \beta = -0.029, p > 0.05$; $H6 = \beta = 0.019, p > 0.05$; $H7 = \beta = 0.108, p < 0.05$). Consequently, $H5$ – $H6$ are rejected, and $H7$ is accepted ([Table 7, Figure 3](#)).

Table 7. SEM estimations

H.No.	Proposed paths	Std (β)	Mean	SD	t-value	p-value	95% confidence interval		f^2	Decision
							Lower limit	Upper limit		
H1a	GESS $\rightarrow$ WEN	0.083	0.078	0.038	2.157	0.031	-0.016	0.141	0.0151	Accepted
H1b	GESS $\rightarrow$ GEP	-0.190	-0.185	0.050	3.793	0.000	-0.268	-0.058	0.0748	Rejected
H2a	GOS $\rightarrow$ WEN	0.747	0.748	0.051	14.719	0.000	0.646	0.844	1.3417	Accepted
H2b	GOS $\rightarrow$ GEP	0.125	0.123	0.046	2.705	0.007	0.031	0.213	0.0342	Accepted
H3a	GIS $\rightarrow$ WEN	-0.190	-0.186	0.088	2.150	0.032	-0.356	-0.011	0.0427	Rejected
H3b	GIS $\rightarrow$ GEP	0.709	0.711	0.038	18.688	0.000	0.633	0.783	1.0491	Accepted
H4	GEP $\rightarrow$ WEN	0.152	0.148	0.076	1.993	0.046	0.000	0.298	0.0352	Accepted
H5	GESS $\rightarrow$ GEP $\rightarrow$ WEN	-0.029	-0.027	0.017	1.736	0.083	-0.064	0.001	0.0007	Rejected
H6	GOS $\rightarrow$ GEP $\rightarrow$ WEN	0.019	0.018	0.011	1.735	0.083	-0.001	0.042	0.0003	Rejected
H7	GIS $\rightarrow$ GEP $\rightarrow$ WEN	0.108	0.105	0.054	1.983	0.047	0.000	0.213	0.0110	Accepted

Note(s): Effect size = f^2 [none = 00; small = 0.02; medium = 0.15; large = 0.35]; $p \leq 0.5$; GESS = Green entrepreneurial skills; GOS = Green opportunities; GIS = Green incentives; GEP = Green entrepreneurship; WEN = Women empowerment

Source(s): Estimated by the researchers

5. Discussion

This study explored the effect of GESS, GOS and GIS on WEN and GEP. It identified the impact of GEP on WEN, and GEP's mediating effect in developing the connection between GESS, GOS and GIS on WEN among women green entrepreneurs in Saudi Arabia. The study's results confirmed a positive impact of GESS on WEN but a negative on GEP. These associations are supported by different studies, such as [Jabbar and Zaza \(2016\)](#), [Rosyidah \(2017\)](#), [Bhattacharjee \(2017\)](#), [Rao \(2018\)](#), [Odondi \(2023\)](#), [Alabi et al. \(2023\)](#), [Manyati et al. \(2024\)](#), [Muaddab \(2024\)](#) and [Yar et al. \(2024\)](#), but are not supported by [Kozlova and Volkova \(2019\)](#), [Sern \(2020\)](#), [Papageorgiou et al. \(2023\)](#) and [Muaddab \(2024\)](#). These positive results suggest that different entrepreneurial skills related to green perspectives, such as training in green business activities, build confidence and self-reliance and open up other employment opportunities. Skills in green management and team management empower women to take on leadership roles, nurturing inclusive and productive environments while endorsing sustainable practices. Proficiency in green business planning certifies strategic development and efficient resource allocation, even though green marketing skills improve market reach and brand value. The capability to identify green business opportunities drives innovation and creativity, leading to economic empowerment and financial independence.

GEP is significant in attaining WEN. More clearly, the green technology skills used for GEP bring more sustainability and GESS to the environment ([Skordoulis et al., 2022](#)). In the perception of [Ebrahimi and Mirbargkar \(2017\)](#), there is a significant and praiseworthy role of GEP in encouraging women. Likewise, the contribution of GOS is to bring new notions and areas in the direction of permaculture and renewable energy, ultimately leading to improving WEN. The contribution of GIS is associated with the provision of WEN in several aspects, such as taxation for green measures and various financial assistance ([Zhao et al., 2021](#); [Umar and Khan, 2023](#)). Similarly, GEP supports the use of GESS and access to GOS and helps women benefit from motivation, ultimately empowering them and contributing to stable development ([Karimi and Nabavi Chashmi, 2019](#); [Abdelwahed et al., 2023](#)).

The results established a positive effect of GOS on WEN and GEP. These outcomes are in line with relevant literature ([Phan, 2013](#); [Chatterjee, 2016](#); [Gunawan and Fraser, 2016](#); [de Groot et al., 2017](#); [Soomro et al., 2020](#); [Trapp and Kanbach, 2021](#); [Li et al., 2022](#); [Makhloufi et al., 2022](#); [Madhavi, 2024](#); [Denhere, 2024](#); [Ghosh et al., 2024](#)). These results suggest that GOS positively impacts WEN and GEP because the absence of economic barriers leads to more women entering the green economy, encouraging participation and reducing gender gaps in employment. The high demand for green products and services provides an important business opportunity for women to earn income and achieve economic independence. Extensive opportunities for green procurement open up new markets for women-owned businesses and foster sustainable growth. Similarly, public support for green activities improves social validation, and community engagement empowers women to take leadership roles in environmental initiatives. Access to information on green technology prepares women with the knowledge and skills needed to innovate and remain competitive, advancing their professional development and empowerment.

The study's findings confirmed a negative effect of GIS on WEN but a positive on GEP. These results are in line with several studies, such as [Nikolaou et al. \(2018\)](#), [Potluri and Phani \(2020a\)](#), [Zhao et al. \(2021\)](#), [Mia et al. \(2022\)](#) and [Abdelwahed et al. \(2023\)](#) and in contradiction with [Sharma and Varma \(2008\)](#), [Suresh and Saravanan \(2013\)](#), [Medhekar \(2024\)](#), [Nichols \(2024\)](#) and [Oladeji et al. \(2024\)](#). The results demonstrate that GIS hurt WEN but positively affected GEP for several reasons. The taxation system, attractive government incentives and environment-minded management create favorable conditions for green business, promoting GEP. Entrepreneurs are drawn to green ventures' expected benefits,

market diversification and profitability, supported by easy regulations and the ability to modify products for green markets. However, these incentives often favor established, male-dominated businesses, and women may need more equal access to capital, networks and expertise required to benefit from these opportunities. Consequently, while GEP embellishes, the structural inequalities and barriers faced by women result in their empowerment being negatively affected.

Likewise, the analysis confirmed a positive connection between GEP and WEN, which is reinforced by various scholars in the domain (Radović-Marković and Živanović, 2019; Potluri and Phani, 2020b; Abdelwahed *et al.*, 2022; Savastano *et al.*, 2022; Fallah and Soori, 2023; Fallah and Soori, 2023; Alzamel, 2024). These results demonstrate that GEP positively impacts WEN by enhancing their financial independence and confidence. Increased sales and profits from green activities boost income, allowing women to make informed property, health, family planning and education decisions. Business growth, signified by more employees and a more substantial market presence, reinforces their autonomy and self-worth.

In the last, GEP is not found to be the mediator between GESS, GOS and WEN but does have a positive impact on developing GIS and WEN. In the domain literature, these outcomes are supported by several scholars in the field, such as Karimi and Nabavi Chashmi (2019), Zhao *et al.* (2021), Mia *et al.* (2022), Abdelwahed *et al.* (2023) and Handoko *et al.* (2024). These results suggest that GESS, GOS and WEN are not connected through GEP as they may have yet to make any noticeable contribution to training in green business activities, green skills, teamwork and green business opportunities. More barriers as well as lower demands and opportunities may provide resistance to developing these associations. Moreover, there may be a need for proper access to information and green technology. On the other hand, GEP mediates the positive link between GIS and WEN. In light of these results, excellent and effective incentives may enhance the WEN. The government and other agencies may support the development of WEN through GIS and GEP.

6. Conclusion

Overall, the results suggest a positive effect of GESS on WEN but a negative on GEP. GOS has a positive and substantial effect on both WEN and GEP. The impact of GIS on WEN is negative, while positive on GEP. Moreover, GEP is the positive predictor of WEN. Finally, concerning mediating effects, the GEP does not play any meaningful and positive role in developing an association between GESS, GOSS and WEN. At the same time, it positively contributes to creating a positive connection between GIS and WEN among women green entrepreneurs in Saudi Arabia.

7. Implications of the study

The study offers several practical and theoretical contributions. Practically, the study's findings help policymakers and planners develop strategies for equipping women with skills in terms of GEP, which significantly enhance their empowerment. Through this, higher authorities could initiate training programs and educational initiatives to concentrate more on GEP and foster women's economic participation and leadership in sustainable business ventures. The study's outcome assists in underscoring the critical role of creating and promoting green business opportunities in attaining dual objectives of gender empowerment and sustainable economic development. In this regard, policymakers could concentrate on creating a supportive environment that comprises access to green markets, resources and networks, which can benefit women and influence these opportunities effectively. It would also support the decision to enhance GIS in promoting GEP as they might unintentionally

drawback women, possibly due to structural barriers or biases within the incentive distribution mechanisms. Henceforth, policymakers must design gender-sensitive incentives to ensure equitable access for women entrepreneurs. Moreover, this study's findings ideally encourage more women to participate in GEP and can thus be a strategic approach to achieving sustainable development goals with social benefits and gender equality. The study's insights offer practical implications for policymakers, educators and practitioners aiming to improve WEN through GEP in Saudi Arabia. Policymakers must realize the need for targeted interventions that address women-specific barriers, promote equitable access to GOS and ensure that incentive structures support rather than hinder women's participation in the green economy. The study's outcomes provide insights into WEN and GEP, such as decision-making, market trends and innovation strategies. Entrepreneurs can use these findings to polish their approaches, minimize risks and optimize the allocation of resources. Besides, entrepreneurs can redesign their business models to align with market demands or customer essentials. This leads to competitiveness and sustainability in both society and business spheres. The study assists in addressing sustainability and social impacts, which can guide entrepreneurs toward adopting more environmentally and socially responsible business practices, thus contributing to societal well-being.

Concerning theoretical implications, the study's findings contribute to the literature on gender, entrepreneurship and sustainability by highlighting the links between GESS, GOS and GIS and their impacts on WEN and GEP. The positive effect of GESS on WEN, but not on GEP, demonstrates that more than skills alone may be required to foster GEP without supportive structures and opportunities. The dual positive impact of GOS on both WEN and GEP highlights the critical role of market and resource access in translating skills into entrepreneurial activity and empowerment. The contrasting effects of GIS on WEN and GEP underscore the need to design incentive mechanisms that are inclusive and gender-sensitive. Besides, the mediation analysis reveals that GEP can act as a bridge to mitigate some adverse effects of GIS on WEN, suggesting that nurturing green enterprises can have broader socio-economic benefits. These understandings extend existing theoretical frameworks by highlighting the need for an integrated approach that considers skills, opportunities and incentives to achieve gender equality and sustainable entrepreneurship goals.

8. Limitations and future research directions

The study is limited as it applied only quantitative methods based on cross-sectional data, and its conceptual framework did not underprop any relevant theory. The study is restricted to only a few constructs, such as GESS, GOS, GIS, GEP and WEN. On a contextual basis, the study only targeted green women entrepreneurs in Saudi Arabia based on a convenience sampling technique with online and offline sources. Besides, the study used a single source of data collection, i.e. a survey questionnaire. The study is limited for potential endogeneity issues due to the cross-sectional design. This raises concerns about reverse causality – where the outcomes could influence the predictors – and omitted variable bias, where unaccounted-for variables may impact the observed relationships. Finally, the conclusions of the study are drawn from only 314 samples.

Future directions suggest examining this model based on mixed and qualitative methods. Also, the conceptual framework must apply any suitable domain theory to underpin the model of the study. Other related factors, such as green culture, green HRM practices, pro-environmental behavior, climate change, leadership, etc., must be applied in future studies. Male respondents from different sectors could also be targeted when investigating GEP and empowerment. Future research may strengthen methodological rigor by using longitudinal data or implementing techniques such as instrumental variables or fixed effects models.

Finally, forthcoming researchers could consider extending the sample size to get more valid results in future.

References

- Abdelwahed, N.A.A., Bastian, B.L. and Wood, B.P. (2022), "Women, entrepreneurship, and sustainability: the case of Saudi Arabia", *Sustainability*, Vol. 14 No. 18, pp. 1-18.
- Abdelwahed, N.A.A., Al Doghan, M.A., Saraih, U.N. and Soomro, B.A. (2023), "Green entrepreneurship in Saudi Arabia: shaping the landscape of the greener economy", *Journal of Small Business and Enterprise Development*, Vol. 30 No. 7, pp. 1352-1376.
- Achuo, E., Asongu, S. and S Tchamyou, V. (2022), "Women empowerment and environmental sustainability in Africa", *SSRN Electronic Journal*, ASPROWORDA Working Paper 003/22, doi: [10.2139/ssrn.4000269](https://doi.org/10.2139/ssrn.4000269).
- Ajani, E.N., Onwubuya, E.A. and Mgbenka, R.N. (2013), "Approaches to economic empowerment of rural women for climate change mitigation and adaptation: implications for policy", *Journal of Agricultural Extension*, Vol. 17 No. 1, pp. 23-34.
- Alabi, B.B., Olasehinde, S.A. and Danladi, J. (2023), "Skill development and economic empowerment among women in selected states in southwest Nigeria", *International Journal of Science Academic Research*, Vol. 4 No. 4, pp. 5385-5392.
- Alarifi, G. and Naser, M. (2022), "Green incentives and women's participation in entrepreneurship: a Saudi Arabian perspective", *Journal of Entrepreneurship and Public Policy*, Vol. 11 No. 3, pp. 285-301.
- Alarifi, G., Robson, P. and Thurairajah, N. (2021), "Women entrepreneurs in the green economy: the case of Saudi Arabia", *International Journal of Gender and Entrepreneurship*, Vol. 13 No. 1, pp. 85-102.
- Al-Fattah, S.M. (2022), "Vision 2030 and the green economy: the role of emerging opportunities in Saudi Arabia", *Journal of Sustainable Development Studies*, Vol. 40 No. 3, pp. 189-202.
- Alghamdi, S. and Park, J. (2020), "Green entrepreneurship in Saudi Arabia: exploring opportunities for women entrepreneurs", *International Journal of Gender and Entrepreneurship*, Vol. 12 No. 3, pp. 259-275.
- Alkhalaf, S. and Yousif, H. (2020), "Green business incentives and their impact on entrepreneurial growth in Saudi Arabia", *Sustainability Review*, Vol. 14 No. 1, pp. 110-125.
- Al-Moammar, R. and Alsahli, S. (2022), "Women's empowerment through green entrepreneurship: a case study in Saudi Arabia", *Journal of Entrepreneurship and Innovation Management*, Vol. 12 No. 3, pp. 132-148.
- Al-Mutairi, A., Saeed, A. and Al-Dossary, H. (2021), "Government-driven green incentives and their effect on sustainable business practices in Saudi Arabia", *Journal of Business Venturing*, Vol. 36 No. 5, pp. 102-117.
- Al-Nasrallah, W. (2023), "The decade long story of gender equality and female empowerment: a case study of corporate disclosures in Saudi Arabia", *Sustainability Accounting, Management and Policy Journal*, Vol. 14 No. 1, pp. 216-241.
- Alqahtani, S. (2021), "The role of government policies in women's empowerment and green entrepreneurship in Saudi Arabia", *Middle Eastern Economic Studies*, Vol. 16 No. 2, pp. 133-150.
- Alraja, M. (2021), "The impact of green incentives on women's empowerment through entrepreneurship: a study of Saudi Arabia", *Journal of Public Policy and Environmental Sustainability*, Vol. 9 No. 2, pp. 115-129.
- Al-Sadiq, J. and Daghistani, M. (2021), "Vision 2030 and the role of women in Saudi Arabia's economy", *Journal of Developmental Economics*, Vol. 34 No. 2, pp. 45-58.

- Alshammari, A. (2021), "The role of entrepreneurial skills in promoting green businesses and women empowerment in Saudi Arabia", *Sustainability Journal*, Vol. 13 No. 5, pp. 289-305.
- Alsharif, S. and Alqurashi, H. (2021), "Women's empowerment in Saudi Arabia: how green entrepreneurship unlocks green opportunities", *Journal of Entrepreneurship and Regional Development*, Vol. 33 No. 4, pp. 523-540.
- Alsharif, F., Alsanousi, M. and Ahmed, N. (2022), "Gender and entrepreneurship in Saudi Arabia: policy reforms and societal changes", *Middle Eastern Studies Journal*, Vol. 58 No. 4, pp. 509-530.
- Alyamani, H. (2020), "Green entrepreneurship as a pathway to empowerment: the Saudi context", *Sustainability and Development Studies*, Vol. 15 No. 2, pp. 192-204.
- Alzamel, S. (2024), "Exploring the role of e-entrepreneurship in fostering future green economy and environmental policies: a study on Saudi women entrepreneurs", *Journal of Environmental Assessment Policy and Management*, Vol. 26 No. 1, p. 2450002.
- Anabaraonye, B., Ewa, B.O. and Hope, J. (2021), "The psychological benefits of poetry and its innovative use in green entrepreneurship in Nigeria", *Covenant Journal of Entrepreneurship (CJoE)*, Vol. 5 No. 1, pp. 2682-5295.
- Anabaraonye, B., Ewa, B.O., Anukwonke, C.C., Eni, M. and Anthony, P.C. (2021), "The role of green entrepreneurship and opportunities in agripreneurship for sustainable economic growth in Nigeria", *Covenant Journal of Entrepreneurship*, Vol. 5 No. 1, pp. 2682-5295.
- Anabaraonye, B., Nwobu, E.A., Nwagbo, S.N.C., Ewa, B.O. and Okonkwo, U.C. (2022a), "Green entrepreneurial opportunities in the plastic recycling industry for sustainable development in Nigeria", *International Journal of Research in Civil Engineering and Technology*, Vol. 3 No. 1, pp. 20-25.
- Anabaraonye, B., Orji, E.I., Ewa, B.O. and Arinze, C. (2023a), "Green entrepreneurial opportunities in wastewater management: Implications for sustainable economic growth in Nigeria", *Covenant Journal of Entrepreneurship (CJoE)*, Vol. 7 No. 1, pp. 36-41.
- Anabaraonye, B., Okon, O.E., Ewa, B.O., Adeniyi, T.F. and Nwobu, E.A. (2022b), "Green entrepreneurship education for sustainable development in Nigeria", *International Journal of Research in Civil Engineering and Technology*, Vol. 3 No. 1, pp. 16-19.
- Anabaraonye, B., Ezuma, S., Emone, E., Olisah, N.C. and Ewa, B.O. (2023b), "The role of the world bank group in green financing to enhance green entrepreneurship in Nigeria", *Covenant Journal of Entrepreneurship (CJoE)*, Vol. 7 No. 1, pp. 52-55.
- Ataman, K., Mayowa, J.O., Senkan, E. and Mayowa, A.J.I.B.O.L.A. (2017), "Green entrepreneurship: an opportunity for entrepreneurial development in Nigeria, theme: 'entrepreneurship and the knowledge economy'", 1st Covenant University International Conference on Entrepreneurship (CU-ICE), pp. 88-98.
- Babiarz, S.K., Miller, G. and Valente, C. (2017), "Family planning and women's economic empowerment: incentive effects and direct effects among Malaysian women", *SSRN Electronic Journal*, Vol. 471, doi: [10.2139/ssrn.3125137](https://doi.org/10.2139/ssrn.3125137).
- Bakari, A.M. (2013), "Green entrepreneurial practices among small and medium enterprises in Mombasa county, Kenya", Doctoral dissertation, School of business, University of Nairobi.
- Baumgartner, H., Weijters, B. and Pieters, R. (2021), "The biasing effect of common method variance: some clarifications", *Journal of the Academy of Marketing Science*, Vol. 49 No. 2, pp. 221-235.
- Bhattacharjee, S. (2017), "Empowerment of women and skill development through indigenous knowledge: a study on the Karbis of Karbi Anglong, Assam", *Anveshana: search for Knowledge*, Vol. 7 No. 2, pp. 66-90.
- Brandt, U.S. and Svendsen, G.T. (2016), "When can a green entrepreneur manage the local environment?", *Journal of Environmental Management*, Vol. 183 No. 2016, pp. 622-629.

- Burzyńska, D., Jabłońska, M. and Dziuba, R. (2018), "Opportunities and conditions for the development of green entrepreneurship in the polish textile sector", *Fibres and Textiles in Eastern Europe*, Vol. 2 No. 128, pp. 13-19.
- Chatterjee, P. (2016), "Women empowerment through engineering education: opportunities and challenges", *IOSR Journal of Human and Social Science (IOSR-JHSS)*, Vol. 21 No. 2, pp. 98-102.
- Chatterjee, B. and Malakar, K.D. (2023), "Women empowerment for sustainable social development: interlinkages and dynamics", *South Asian Journal of Social Studies and Economics*, Vol. 20 No. 3, pp. 219-226.
- Chatterjee, S., Gupta, D.S. and Upadhyay, P. (2018), "Empowering women and stimulating development at bottom of pyramid through micro-entrepreneurship", *Management Decision*, Vol. 56 No. 1, pp. 160-174.
- Chin, W.W. (2010), "How to write up and report PLS analyses", in Vinzi, V. Esposito, Chin, W. W., Henseler, J. and Wang, H. (Eds), *Handbook of Partial Least Squares: Concepts, Methods and Application*, Springer, pp. 645-689.
- Chowdhury, S.S. and Chowdhury, S.A. (2011), "Microfinance and women empowerment: a panel data analysis using evidence from rural Bangladesh", *International Journal of Economics and Finance*, Vol. 3 No. 5, pp. 86-96.
- de Groot, J., Mohlakoana, N., Knox, A. and Bressers, H. (2017), "Fuelling women's empowerment? An exploration of the linkages between gender, entrepreneurship and access to energy in the informal food sector", *Energy Research and Social Science*, Vol. 28 No. 2017, pp. 86-97.
- Demirel, P., Li, Q.C., Rentocchini, F. and Tamvada, J.P. (2019), "Born to be green: new insights into the economics and management of green entrepreneurship", *Small Business Economics*, Vol. 52 No. 4, pp. 759-771.
- Denhere, V. (2024), "African women's empowerment and environmental sustainability in the digital age: implications, challenges and opportunities", *Africa Growth Agenda*, Vol. 21 No. 2, pp. 10-15.
- Der Boghossian, A. (2019), "Trade policies supporting women's economic empowerment: trends in WTO members (No. ERSD-2019-07)", WTO Staff Working Paper, doi: [10.30875/eda9a0d4-en](https://doi.org/10.30875/eda9a0d4-en).
- Dewi, R., Eliyana, A. and Anwar, A. (2022), "The role of women entrepreneurship antecedents in supporting social and economic well-being", *Problems and Perspectives in Management*, Vol. 20 No. 2, pp. 438-447.
- Doan, A.T. and Nguyen, T.T. (2021), "Green innovation, green entrepreneurship, and Vietnamese SME development: the role of market turbulence", *Recent Developments in Vietnamese Business and Finance*, pp. 337-381.
- Ebrahimi, P. and Mirbargkar, S.M. (2017), "Green entrepreneurship and green innovation for SME development in market turbulence", *Eurasian Business Review*, Vol. 7 No. 2, pp. 203-228.
- Fallah, M.R. and Soori, M. (2023), "Presenting a framework for the successful entry of women entrepreneurs into green entrepreneurship", *Journal of Science and Technology Policy Management*, Vol. 14 No. 3, pp. 467-486.
- Farinelli, F., Bottini, M., Akkoyunlu, S. and Aerni, P. (2011), "Green entrepreneurship: the missing link towards a greener economy", *Atdf Journal*, Vol. 8 Nos 3/4, pp. 42-48.
- Faul, F., Erdfelder, E., Buchner, A. and Lang, A.G. (2009), "Statistical power analyses using G* power 3.1: tests for correlation and regression analyses", *Behavior Research Methods*, Vol. 41 No. 4, pp. 1149-1160.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with un observable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

- Ghosh, S., Mahapatra, M.S., Tandon, N. and Tandon, D. (2024), "Achieving sustainable development goal of women empowerment: a study among self-help groups in India", *FIIB Business Review*, Vol. 13 No. 4, pp. 477-491.
- Gold, A.H., Malhotra, A. and Segars, A.H. (2001), "Knowledge management: an organizational capabilities perspective", *Journal of Management Information Systems*, Vol. 18 No. 1, pp. 185-214.
- Golsefid-Alavi, M., Sakhdari, K. and Alirezaei, A. (2021), "A review of the literature on entrepreneurship and the environment: opportunities for researching on the green entrepreneurial orientation", *Environmental Engineering and Management Journal*, Vol. 20 No. 5, pp. 819-839.
- Gunawan, J. and Fraser, K. (2016), "Exploring young and green entrepreneurship in Indonesia: an introduction", *Journal of Asian Business Strategy*, Vol. 6 No. 8, pp. 185-194.
- Gupta, V., Turban, D. and Pareek, A. (2020), "Gender and entrepreneurship: exploring new frontiers", *Entrepreneurship Theory and Practice*, Vol. 44 No. 2, pp. 321-342.
- Hair, J.F., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2022), *A Primer Partial Least Squares Structural Equation Modeling (PLS-SEM)*, 3rd ed., Sage, Thousand Oaks, CA.
- Hair, J.F., Jr, Matthews, L.M., Matthews, R.L. and Sarstedt, M. (2017), "PLS-SEM or CB-SEM: updated guidelines on which method to use", *International Journal of Multivariate Data Analysis*, Vol. 1 No. 2, pp. 107-123.
- Hair, J.F., Lds Gabriel, M., Silva, D.D. and Braga, S. (2019), "Development and validation of attitudes measurement scales: fundamental and practical aspects", *RAUSP Management Journal*, Vol. 54 No. 4, pp. 490-507.
- Handoko, W., Sulaiman, A.I., Sugito, T. and Sabiq, A. (2024), "Empowering former women migrant workers: enhancing socioeconomic opportunities and inclusion for sustainable development", *Academic Journal of Interdisciplinary Studies*, Vol. 13 No. 1, pp. 199-210.
- Harini, V. and Meenakshi, D.T. (2012), "Green entrepreneurship alternative (business) solution to save environment", *Asia Pacific Journal of Management and Entrepreneurship Research*, Vol. 1 No. 3, pp. 79-89.
- Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modeling", *Journal of the Academy of Marketing Science*, Vol. 43 No. 1, pp. 115-135.
- Henseler, J., Dijkstra, T.K., Sarstedt, M., Ringle, C.M., Diamantopoulos, A., Straub, D.W., David Ketchen, J., Hair, J.F., Hult, G.T.M. and Calantone, R.J. (2014), "Common beliefs and reality about PLS: comments on Rönkkö and Evermann (2013)", *Organizational Research Methods*, Vol. 17 No. 2, pp. 182-209.
- Hisrich, R.D., Peters, M.P. and Shepherd, D.A. (2016), *Entrepreneurship*, McGraw-Hill Education.
- Ibrahim, A. and Kayed, R. (2021), "Incentivizing green entrepreneurship in the Saudi context: a policy analysis", *International Journal of Innovation and Sustainable Development*, Vol. 15 No. 4, pp. 367-380.
- Iram, T., Bilal, A.R., Saeed, T. and Liaquat, F. (2025), "Nurturing green creativity in women intrapreneurs through green HRM: testing moderated mediation model – a step toward Saudi vision 2030", *Kybernetes*, Vol. 54 No. 1, pp. 159-181.
- Islam, N. (2020), "Women empowerment through entrepreneurship development in Bangladesh: a multivariate analysis", *International Journal of Management (IJM)*, Vol. 11 No. 10, pp. 379-392.
- Israrud Din, A. (2024), "Empowering women in politics: strategies for achieving equal participation", *Harf-o-Sukhan*, Vol. 8 No. 1, pp. 797-809.
- Jabbar, S.A. and Zaza, H.I. (2016), "Evaluating a vocational training programme for women refugees at the Zaatar camp in Jordan: women empowerment: a journey and not an output", *International Journal of Adolescence and Youth*, Vol. 21 No. 3, pp. 304-319.

- Karimi, R.F. and Nabavi Chashmi, S.A. (2019), "Designing green entrepreneurship model in sustainable development consistent with the performance of Tehran industrial towns", *Journal of Business-to-Business Marketing*, Vol. 26 No. 1, pp. 95-102.
- Kaur, R. (2010), "Institutional structure and women empowerment", *Asia-Pacific Journal of Rural Development*, Vol. 20 No. 2, pp. 103-124.
- Khan, S. and El-Garaihy, W. (2020), "Green innovation and sustainability in Saudi Arabia: opportunities for women entrepreneurs", *Journal of Environmental Policy and Planning*, Vol. 22 No. 5, pp. 638-654.
- Kivunja, C. (2015), "Innovative methodologies for 21st century learning, teaching and assessment: a convenience sampling investigation into the use of social media technologies in higher education", *International Journal of Higher Education*, Vol. 4 No. 2, pp. 1-26.
- Kline, R.B. (2015), *Principles and Practice of Structural Equation Modeling*, 4th ed. Guilford Press.
- Kline, R.B. (2016), *Principles and Practice of Structural Equation Modeling*, The Guilford Press, New York, NY, p. 2016. ISBN 978-1-4625-2334-4.
- Kock, N. (2015), "Common method bias in PLS-SEM: a full collinearity assessment approach", *International Journal of e-Collaboration*, Vol. 11 No. 4, pp. 1-10.
- Kock, N. and Lynn, G. (2012), "Lateral collinearity and misleading results in variance-based SEM: an illustration and recommendations", *Journal of the Association for Information Systems*, Vol. 13 No. 7, pp. 546-580.
- Kozlova, O. and Volkova, I. (2019), "Green skills' of a new generation of managers and entrepreneurs as a potential of company leadership", *3rd International Conference on Social, Economic, and Academic Leadership (ICSEAL 2019)*, Atlantis Press, pp. 366-370.
- Kwauk, C.T. and Casey, O.M. (2022), "A green skills framework for climate action, gender empowerment, and climate justice", *Development Policy Review*, Vol. 40 No. S2, p. e12624.
- Lecoutere, E. (2017), "The impact of agricultural co-operatives on women's empowerment: Evidence from Uganda", *Journal of Co-Operative Organization and Management*, Vol. 5 No. 1, pp. 14-27.
- Li, C., Murad, M. and Ashraf, S.F. (2023), "The influence of women's green entrepreneurial intention on green entrepreneurial behavior through university and social support", *Sustainability*, Vol. 15 No. 13, pp. 1-17.
- Li, W., Sun, Y. and Gao, Y. (2022), "Relationship between green entrepreneurship orientation, integration of opportunity and resource capacities and sustainable competitive advantage", *Frontiers in Psychology*, Vol. 13, p. 1068734.
- Madhavi, T. (2024), "Growing a sustainable future: exploring the benefits and challenges of green entrepreneurship", *Communications on Applied Nonlinear Analysis*, Vol. 31 No. 5s, pp. 67-78.
- Mahajan, R. and Bandyopadhyay, K.R. (2021), "Women entrepreneurship and sustainable development: select case studies from the sustainable energy sector", *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. 15 No. 1, pp. 42-75.
- Mahsud, N.K. and Ali, R. (2020), "Higher education, employment opportunities and women empowerment in Pakistan", *Pakistan Journal of Distance and Online Learning*, Vol. 6 No. 1, pp. 85-113.
- Makhloufi, L., Laghouag, A.A., Meirun, T. and Belaid, F. (2022), "Impact of green entrepreneurship orientation on environmental performance: the natural resource-based view and environmental policy perspective", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 425-444.
- Manyati, T.K., Kalima, B.G., Owolabi, T. and Mutsau, M. (2024), "Exploring the potential for enhancing green skills training, innovation and sustainable livelihoods in informal spaces of Harare, Zimbabwe: identifying gaps and opportunities", *IIMBG Journal of Sustainable Business and Innovation*, Vol. 2 No. 1, pp. 60-79.

- Martynova, E., West, S.G. and Liu, Y. (2018), "Review of principles and practice of structural equation modeling", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 25 No. 2, pp. 325-329.
- Mathur, S. and Tandon, N. (2016), "Green entrepreneurship: the emerging paradigm for sustainable growth and development in India-a study of the millennials", *Indian Journal of Science and Technology*, Vol. 9 No. 1, pp. 1-11.
- Medhekar, A. (2024), "Economic empowerment of women, millet farming, and sustainable development", *In the Role of Women in Cultivating Sustainable Societies through Millets*, IGI Global, pp. 230-250.
- Mia, M.M., Rizwan, S., Zayed, N.M., Nitsenko, V., Miroshnyk, O., Kryshstal, H. and Ostapenko, R. (2022), "The impact of green entrepreneurship on social change and factors influencing AMO theory", *Systems*, Vol. 10 No. 5, pp. 1-19.
- Mirza, M. and Olayan, M. (2021), "Green business and sustainable practices in Saudi Arabia: a gender perspective", *International Journal of Environmental Research*, Vol. 15 No. 2, pp. 211-223.
- Mishra, S.P., Mishra, D.P. and Mohapatra, S. (2024), "Women empowerment gaining right trajectory: a perspective from MSME, Odisha, India", *Journal of Economics, Management and Trade*, Vol. 30 No. 3, pp. 10-29.
- Modi, A., Patel, K.J. and Patel, K.M. (2014), "Impact of microfinance services on rural women empowerment: an empirical study", *IOSR Journal of Business and Management*, Vol. 16 No. 11, pp. 1-8.
- Moon, C. (2021), "Entrepreneurship and sustainability: Plugging the green skills gap with empathy, compassion and connectedness to nature", *Entrepreneurship, Institutional Framework and Support Mechanisms in the EU*, Emerald Publishing Limited, pp. 177-194.
- Muaddab, H. (2024), "Promoting green skill and green vocational education for a circular economy: a literature review", *Journal of Education: Development and Review*, Vol. 1 No. 1, pp. 8-20.
- Mukherjee, T., Ilavarasan, P.V. and Kar, A.K. (2024), "Empowering through digital skills training: an empirical study of poor unemployed working-age women in India", *Information Technology for Development*, Vol. 30 No. 3, pp. 562-583.
- Nichols, C. (2024), "Equity and empowerment effects: multiple styles of 'voluntarism' in community-based health projects", *World Development*, Vol. 174 No. 2024, p. 106448.
- Nieva, F.O. (2016), "Towards the empowerment of women: a social entrepreneurship approach in the kingdom of Saudi Arabia", *International Journal of Innovation and Regional Development*, Vol. 7 No. 3, pp. 161-183.
- Nikolaou, I.E., Tasopoulou, K. and Tсарarakis, K. (2018), "A typology of green entrepreneurs based on institutional and resource-based views", *The Journal of Entrepreneurship*, Vol. 27 No. 1, pp. 111-132.
- Nordin, R. and Hassan, R.A. (2019), "The role of opportunities for green entrepreneurship towards investigating the practice of green entrepreneurship among SMEs in Malaysia", *Review of Integrative Business and Economics Research*, Vol. 8 No. 2019, pp. 99-116.
- Nwafor, G. and Obinna, C. (2024), "The role of green entrepreneurial skills in enhancing production economy in Nigeria", *Covenant Journal of Entrepreneurship*, Vol. 8 No. 2, pp. 53-57.
- Odondi, W. (2023), "Empowering youth through green-skills: a study of technical and vocational education and training in Kenya", *Namibia Journal of Technical Vocational Education and Training*, Vol. 1 No. 2023, pp. 35-51.
- Oladeji, O., Oladeji, A., Halima, A. and Baitwabusa, A.E. (2024), "Financial incentive for community health workers, a necessity for achieving universal health coverage: integrated literature review", *International Journal of Community Medicine And Public Health*, Vol. 11 No. 1, pp. 545-555.
- Papageorgiou, G., Tsappi, E., Konis, E., Abreu, R. and Indarti, N. (2023), "Developing green entrepreneurship skills in Indonesia: an educational perspective", *European Conference on Innovation and Entrepreneurship*, Vol. 18 No. 2, pp. 704-709.

- Petrakis, P. (2020), "The green economy transition: a case study of Saudi Arabia", *Environmental Economics and Policy Studies*, Vol. 22 No. 3, pp. 245-263.
- Phan, L.Y. (2013), "Women's empowerment and fertility changes", *International Journal of Sociology of the Family*, Vol. 39 Nos 1/2, pp. 49-75.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.
- Polas, M.R.H., Kabir, A.I., Sohel-Uz-Zaman, A.S.M., Karim, R. and Tabash, M.I. (2022), "Blockchain technology as a game changer for green innovation: Green entrepreneurship as a roadmap to green economic sustainability in Peru", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 8 No. 2, pp. 1-19.
- Potluri, S. and Phani, B.V. (2020a), "Incentivizing green entrepreneurship: a proposed policy prescription (a study of entrepreneurial insights from an emerging economy perspective)", *Journal of Cleaner Production*, Vol. 259 No. 2020, pp. 1-11.
- Potluri, S. and Phani, B.V. (2020b), "Women and green entrepreneurship: a literature based study of India", *International Journal of Indian Culture and Business Management*, Vol. 20 No. 3, pp. 409-428.
- Prabhu, J.J. (2020), "A study on women empowerment and entrepreneurial intention among small business of women entrepreneurs in the Czech Republic", *Quantitative Economics and Management Studies*, Vol. 1 No. 5, pp. 312-318.
- Preacher, K.J. and Hayes, A.F. (2004), "SPSS and SAS procedures for estimating indirect effects in simple mediation models", *Behavior Research Methods, Instruments and Computers*, Vol. 36 No. 4, pp. 717-731.
- Preacher, K.J. and Hayes, A.F. (2008), "Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models", *Behavior Research Methods*, Vol. 40 No. 3, pp. 879-891.
- Radović-Marković, M. and Živanović, B. (2019), "Fostering green entrepreneurship and women's empowerment through education and banks' investments in tourism: evidence from Serbia", *Sustainability*, Vol. 11 No. 23, pp. 1-16.
- Rana, D. and Alayed, R.S. (2018), "Green business: sustainability within Saudi vision", *International Journal of Advance Study and Research Work*, Vol. 1 No. 9, pp. 2581-5997.
- Rao, M.S.R. (2018), "A study on rural women empowerment in India: through the eyes of entrepreneurship and skill development", *International Journal of Research in Social Sciences*, Vol. 8 No. 3, pp. 500-515.
- Ringle, C.M., Wende, S. and Becker, J.M. (2015), "SmartPLS 3", Boenningstedt: SmartPLS GMBH, available at: www.smartpls.com/ (accessed June 2024).
- Rosyidah, I. (2017), "Empowering women's economy by improving environment skills in a fisherman community in Kepulauan Seribu, Jakarta", *Third International Conference on Social and Political Sciences (ICSPPS 2017)*, Atlantis Press, pp. 153-160.
- Sadi, M.A. and Al-Ghazali, B. (2021), "Entrepreneurship and sustainable development in Saudi Arabia", *International Journal of Entrepreneurship and Innovation*, Vol. 22 No. 1, pp. 67-78.
- Savastano, M., Samo, A.H., Channa, N.A. and Amendola, C. (2022), "Toward a conceptual framework to foster green entrepreneurship growth in the agriculture industry", *Sustainability*, Vol. 14 No. 7, pp. 1-16.
- Schaltegger, S. and Wagner, M. (2011), "Sustainable entrepreneurship and sustainability innovation: categories and interactions", *Business Strategy and the Environment*, Vol. 20 No. 4, pp. 222-237.
- Sern, L.C. (2020), "Green skills for green industries: meeting the needs of the green economy", *Advances in Business, Management and Entrepreneurship*, CRC Press, pp. 544-548.

- Shane, S. (2003), *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*, Edward Elgar Publishing.
- Sharma, P. and Varma, S.K. (2008), "Women empowerment through entrepreneurial activities of self-help groups", *Indian Research Journal of Extension Education*, Vol. 8 No. 1, pp. 46-51.
- Shehzad, M.U., Jianhua, Z., Naveed, K., Zia, U. and Sherani, M. (2024), "Sustainable transformation: an interaction of green entrepreneurship, green innovation, and green absorptive capacity to redefine green competitive advantage", *Business Strategy and the Environment*, Vol. 33 No. 7, pp. 7041-7059.
- Sîrb, S.E. (2017), "Barriers and incentives to green entrepreneurship in transition economies—case study of SMEs in Romania", Un published Master of Science Thesis, INDEK 2017:154 KTH Industrial Engineering and Management Industrial Management SE-100 44 STOCKHOL.
- Skordoulis, M., Kyriakopoulos, G., Ntanos, S., Galatsidas, S., Arabatzis, G., Chalikias, M. and Kalantonis, P. (2022), "The mediating role of firm strategy in the relationship between green entrepreneurship, green innovation, and competitive advantage: the case of medium and large-sized firms in Greece", *Sustainability*, Vol. 14 No. 6, pp. 1-18.
- Soomro, R.B., Mirani, I.A., Sajid Ali, M. and Marvi, S. (2020), "Exploring the green purchasing behavior of young generation in Pakistan: opportunities for green entrepreneurship", *Asia Pacific Journal of Innovation and Entrepreneurship*, Vol. 14 No. 3, pp. 289-302.
- Suresh, S.S. and Saravanan, S. (2013), "Women empowerment through self-help groups: a case study", *Economic Affairs*, Vol. 58 No. 2, pp. 147-154.
- Swain, R.B. and Floro, M. (2012), "Reducing vulnerability through microfinance: evidence from Indian self-help group program", *Journal of Development Studies*, Vol. 48 No. 5, pp. 605-618.
- Trapp, C.T. and Kanbach, D.K. (2021), "Green entrepreneurship and business models: deriving green technology business model archetypes", *Journal of Cleaner Production*, Vol. 297 No. 2021, p. 126694.
- Umar, M. and Khan, A.U. (2023), "Examining the mediating role of green entrepreneurship between entrepreneurial motivation and enterprises' development", *Contemporary Issues in Social Sciences and Management Practices*, Vol. 2 No. 3, pp. 334-346.
- Uslu, Y.D., Hancioğlu, Y. and Demir, E. (2015), "Applicability to green entrepreneurship in Turkey: a situation analysis", *Procedia – Social and Behavioral Sciences*, Vol. 195 No. 2015, pp. 1238-1245.
- Vasilescu, M.D., Dimian, G.C. and Gradinaru, G.I. (2023), "Green entrepreneurship in challenging times: a quantitative approach for European countries", *Economic Research-Ekonomska Istraživanja*, Vol. 36 No. 1, pp. 1828-1847.
- Verma, J.P., Verma, P., Verma, J.P. and Verma, P. (2020), "Use of G* power software, determining sample size and power in research studies: a manual for researchers, 55-60", available at: https://link.springer.com/chapter/10.1007/978-981-15-5204-5_5
- Westland, J.C. (2010), "Lower bounds on sample size in structural equation modeling", *Electronic Commerce Research and Applications*, Vol. 9 No. 6, pp. 476-487.
- Winton, B.G. and Sabol, M.A. (2022), "A multi-group analysis of convenience samples: free, cheap, friendly, and fancy sources", *International Journal of Social Research Methodology*, Vol. 25 No. 6, pp. 861-876.
- Yar, A., Hamdan, M. and Anshari, M. (2024), "Green education to promote green technological skills", *Harnessing Green and Circular Skills for Digital Transformation*, IGI Global, pp. 72-85.
- Yasir, N., Babar, M., Mehmood, H.S., Xie, R. and Guo, G. (2023), "The environmental values play a role in the development of green entrepreneurship to achieve sustainable entrepreneurial intention", *Sustainability*, Vol. 15 No. 8, pp. 1-27.
- Yoopetch, C. (2021), "Women empowerment, attitude toward risk-taking and entrepreneurial intention in the hospitality industry", *International Journal of Culture, Tourism and Hospitality Research*, Vol. 15 No. 1, pp. 59-76.

- York, J. and Venkataraman, S. (2010), "The entrepreneur–environment nexus: Uncertainty, innovation, and allocation", *Journal of Business Venturing*, Vol. 25 No. 5, pp. 449-463.
- Zeng, J. and Ren, J. (2022), "How does green entrepreneurship affect environmental improvement? Empirical findings from 293 enterprises", *International Entrepreneurship and Management Journal*, Vol. 18 No. 1, pp. 409-434.
- Zhao, M., Liu, J. and Shu, C. (2021), "Pursuing sustainable development through green entrepreneurship: an institutional perspective", *Business Strategy and the Environment*, Vol. 30 No. 8, pp. 4281-4296.
- Zhao, X., Lynch, J.G. Jr. and Chen, Q. (2010), "Reconsidering Baron and Kenny: myths and truths about mediation analysis", *Journal of Consumer Research*, Vol. 37 No. 2, pp. 197-206.

Further reading

- Al-Ghamdi, F. and Badawi, N. (2021), "Women empowerment through sustainable entrepreneurship: Insights from Saudi Arabia", *Middle Eastern Journal of Entrepreneurship and Innovation*, Vol. 7 No. 2, pp. 115-130.
- Al-Mahmoud, H. and Alhassan, A. (2021), "The role of green entrepreneurship in mediating government incentives and women empowerment", *Sustainability Studies Journal*, Vol. 22 No. 4, pp. 245-259.
- Alqahtani, H. and Alsabhan, A. (2022), "The impact of green businesses on women's socioeconomic empowerment in Saudi Arabia", *Journal of Business Ethics*, Vol. 169 No. 1, pp. 217-230.
- Alshehri, A. (2021), "Women's empowerment and economic diversification in Saudi Arabia: the role of green entrepreneurship", *Journal of Development Policy*, Vol. 19 No. 4, pp. 77-92.
- Anghel, G.A. and Anghel, M.A. (2022), "Green entrepreneurship among students—social and behavioral motivation", *Sustainability*, Vol. 14 No. 14, pp. 1-19.
- Elsawalhy, H. and Elzek, Y. (2023), "What will the entrepreneurial students of tourism and hotels intent to do after graduation: self-employment or green entrepreneurship", *International Journal of Hospitality and Tourism Systems*, Vol. 16 No. 2, pp. 81-91.
- Fertő, I. and Bojnec, Š. (2024), "Empowering women in sustainable agriculture", *Scientific Reports*, Vol. 14 No. 1, pp. 1-7.
- Gaur, B.S., Das, B., Misra, A., Mallick, S. and Patel, J.B. (2024), "The role of media in shaping perceptions of women's empowerment: challenges and opportunities for change", *Journal of Informatics Education and Research*, Vol. 4 No. 1, pp. 1550-1556.
- Majlesi, K. (2016), "Labor market opportunities and women's decision making power within households", *Journal of Development Economics*, Vol. 119 No. 2016, pp. 34-47.
- Melay, I., O'Dwyer, M., Kraus, S. and Gast, J. (2017), "Green entrepreneurship in SMEs: a configuration approach", *International Journal of Entrepreneurial Venturing*, Vol. 9 No. 1, pp. 1-17.
- Nistoroiu, B.F., Zaharia, A. and Vuković, P. (2024), "Challenges of developing a green, resilient economy from the perspective of gender equality in female entrepreneurship", *Entrepreneurship and Development for a Green Resilient Economy*, Emerald Publishing Limited, pp. 165-179.
- Potluri, S., Ananthram, S. and Phani, B.V. (2024), "Women green entrepreneurship: conceptualisation and use of bricolage for policy recommendations", *Business Strategy and the Environment*, Vol. 33 No. 6, pp. 5485-5502.
- Salaheldeen, M., Ateeq, A., Al Ani, Z., Alzoraiki, M., Ali, S.A. and Milhem, M. (2024), "Green entrepreneurship and sustainability in developing countries: opportunities, challenges, and future research directions", *The AI Revolution: Driving Business Innovation and Research*, Vol. 1 No. 2024, pp. 525-534.
- Setiawan, H.H. and Wismayanti, Y.F. (2023), "The green economy to support women's empowerment: social work approach for climate change adaptation toward sustainability development", *Climate Change, Community Response and Resilience*, Elsevier, pp. 225-240.

- Shain, F. (2013), "The girl effect': exploring narratives of gendered impacts and opportunities in neoliberal development", *Sociological Research Online*, Vol. 18 No. 2, pp. 181-191.
- Sohail, M. (2014), "Women empowerment and economic development-an exploratory study in Pakistan", *Journal of Business Studies Quarterly*, Vol. 5 No. 4, pp. 210-221.
- Wang, Y. and Ye, D. (2024), "Enhancing rural revitalization in China through digital economic transformation and green entrepreneurship", *Sustainability*, Vol. 16 No. 10, pp. 1-18.
- Webster, K., Chen, C. and Beardsley, K. (2019), "Conflict, peace, and the evolution of women's empowerment", *International Organization*, Vol. 73 No. 2, pp. 255-289.

Corresponding author

Nadia A. Abdelmegeed Abdelwahed can be contacted at: nabdelwahed@kfu.edu.sa