Journal of Innovation & Knowledge 9 (2024) 100567

Journal of Innovation & Knowledge

https://www.journals.elsevier.com/journal-of-innovation-and-knowledge

Green entrepreneurial intention, knowledge management process, and green entrepreneurial behaviour through a lens of transformative innovation

Yanhui Wang[a], Qin Wang[b], Xuen Pan[c,*], Mário Nuno Mata[d,e]

[a] School of Economics and Management, Fuzhou University, Fuzhou, Fujian, China
[b] Business School, Shanghai Normal University Tianhua College, Shanghai, China
[c] School of Economics and Management Auditing, Shanghai University of Finance and Economics Zhejiang College, Jinhua, China
[d] ISCAL, Instituto Superior de Contabilidade e Administração de Lisboa, Instituto Politécnico de Lisboa, Avenida Miguel Bombarda 20, 1069-035 Lisbon, Portugal
[e] Business Research Unit (BRU-IUL), Instituto Universitário de Lisboa (ISCTE-IUL), 1649-026 Lisbon, Portugal

ARTICLE INFO

Article History:
Received 17 October 2023
Accepted 5 September 2024
Available online 30 October 2024

Keywords:
Knowledge management process
Green entrepreneurial intention
Green entrepreneurial behaviour
Transformative innovation

JEL classification:
O38
G10

ABSTRACT

Entrepreneurship accelerates a country's economy due to its great contribution to community welfare. In the context of sustainability, green entrepreneurial behaviour is beneficial, since it reduces environmental causalities. Small businesses, however, are seen as culprits, causing damage to the environment. Rapid changes in business dynamics emphasize the need for sustainable entrepreneurship which ensures environmental and social sustainability. This study extends current body of knowledge by introducing transformative innovation as a mediator in light of the normative dimension in which entrepreneurs are actors responsible for bringing change to systems through collective behaviour. In a sample of Chinese manufacturing entrepreneurs, the study reveals that the knowledge management process and green entrepreneurial intention are positively linked to green entrepreneurial behaviour. It also shows that transformative innovation is positively related to green entrepreneurial behaviour. Finally, it confirms that transformative innovation is a significant mediator. The study provides guidance for policymakers establishing policies related to achieving green entrepreneurial behaviour using effective knowledge management processes and transformative innovation.

Introduction

Entrepreneurship is the creation and management of business ventures to generate profit. It is an important driver of development and economic growth with a crucial impact on job markets, the design of innovative products and services, and social advancement. The most significant aspect of entrepreneurship is its ability to enhance economic growth. By introducing new and innovative ventures, entrepreneurs not only increase the number of jobs in the market but also stimulate innovation and increase competition, which leads to higher economic output and improves standards of living (Hudáková et al., 2023; Olanrewaju et al., 2020). Entrepreneurial firms promote innovation and fulfil specific needs in the market. By designing and introducing new products or services, entrepreneurial firms can transform industries. By creating new jobs and business ventures, entrepreneurs provide opportunities for people to enhance their economic circumstances and pursue their goals. In short, entrepreneurship is a significant driver, developing the economy by promoting innovation, creating economic value, and improving living standards (Kraus et al., 2020). By supporting and encouraging entrepreneurship, individuals, governments, and businesses can help unlock the potential of human creativity. However, all business activity and progress has a negative impact on the environment (Černevičiūtė & Liebutė, 2022; Wadhwani et al., 2020). As environmental crises increase, they become a threat to economic growth, people's living conditions and the safety of the planet, leading scholars, industrialists, and governments to focus on environmental solutions. This motivates green behaviour, especially in new and innovative business ventures (Muo & Azeez, 2019). Sustainable practices lead to the development of green entrepreneurial behaviour (GEB), which is the decisions and actions made by entrepreneurs to develop environmentally friendly and sustainable businesses (Ju et al., 2023). GEB focuses on eradicating the negative impact of business activities and encouraging sustainability (Hameed et al., 2021;

* Corresponding author.
E-mail addresses: yadihnc@outlook.com (Y. Wang), wq2187@sthu.edu.cn (Q. Wang), Z2011133@shufe-zj.edu.cn (X. Pan), mnmata@iscal.ipl.pt (M.N. Mata).

https://doi.org/10.1016/j.jik.2024.100567

Vukašina et al., 2022). The main aspect of this behaviour is the adoption of sustainable and green practices, which can help eradicate waste and minimize the use of non-renewable energy sources. This can be achieved through various projects such as recycling programmes, sourcing material from more sustainable sources, and integrating energy-efficient equipment. GEB promotes the manufacturing of green products and services, which involves designing and creating products that have a positive impact on the environment or are environmentally friendly. The main focus is to create a positive impact on society to save future generations. This behaviour includes social and environmental initiatives and the involvement of national and international organizations. In addition, GEB helps incorporate a culture of sustainability in organizations, which promotes sustainable practice among employees and encourages them to promote innovative and creative ideas to address the environmental crisis the world is experiencing (Li et al., 2022). Governments might provide funding, tax relaxation, and facilitation for entrepreneurial firms with an emphasis on sustainability. Hence, GEB is becoming increasingly important, and consumers are showing concern about sustainable or organic products and services and show more interest in buying products from organizations that implement green operations in manufacturing. Entrepreneurial firms adopting green strategies and policies not only contribute to saving the planet but also position themselves for long-term success by creating positive brand images and responding to changes in consumer preferences. However, there are several factors, such as the knowledge management process, green entrepreneurial intention, and transformative information, which play a significant role in green entrepreneurial behaviour (Fiszeder & Malecka, 2022).

Traditionally, the knowledge management process (KMP) is defined as the process of creating, capturing, organizing, storing, utilizing, and evaluating the knowledge and information within a firm (Brazauskaite et al., 2022; Tiwari, 2022). However, the modern illustration of the KMP transcends the internal limits of firms. Now, it is seen as a process that indeed replicates the whole mechanism across organizational boundaries (Diab, 2021; Yeboah, 2023). With an inter-organizational perspective, the KMP can better represent the diffusion of transformative innovations. Hence, neglecting this perspective generates an aberration as it disregards the collectivism of the advanced innovation ecosystem (Abubakar et al., 2019). Green entrepreneurial intention (GEI) is the intention of individuals to engage in environmentally friendly and sustainable behaviour to address environmental issues. GEI involves a person's willingness and motivation to perform and adopt green practices such as recycling, minimizing energy consumption, and buying green products (Qazi et al., 2020). Transformative innovation is the design and development of new services, products, or business ventures that create significant economic, social, or environmental change. These innovations transform existing industries, create new markets, and have the ability to tackle societal challenges (Loorbach et al., 2020). GEB refers to the commitment of organizations to achieving sustainability goals by implementing sustainable practice, fostering social responsibility, and developing innovative services and products (Ameer & Khan, 2022). This behaviour shows that entrepreneurial firms are interested in having a positive impact on the environment. All these variables play crucial roles in the development of green businesses which address the environmental crisis and make firms competent and eco-friendly.

The manufacturing sector in China is experiencing significant development and growth, and entrepreneurship is playing a significant role. Entrepreneurial firms in China have shown significant growth over the past few years, and the country is emerging as a hub for start-ups and innovative activity (Song et al., 2022; Xu & Li, 2022). China has one of the highest rates of entrepreneurial activity in the world, with 12.5% of adults involved in running or starting a business. China's manufacturing sector is dynamic and leads to innovation and growth in the Chinese economy. Green entrepreneurship has gained huge attention in China, as the government focuses on environmental issues and transforming into a sustainable economy. China has several sustainable and green start-ups, with more than 10,000 environmental protection firms established in 2020. The government has integrated and introduced various strategies and policies to support and encourage green entrepreneurship, such as subsidies, tax incentives, and funding for research. Another initiative is the 'Made in China 2025' plan, which aims to transform manufacturing into a high-tech, innovative, and environmentally friendly sector. This plan encourages firms to adopt green practices to enhance sustainable development, minimize emissions, and increase energy efficiency (Guaita Martínez et al., 2021; Huang, 2022). GEB has become a significant focus in China, as the country transforms to a sustainable economy. However, the country still struggles to make firms sustainable and environmentally friendly. The development and growth of the manufacturing industry in China causes damage to the environment and rapid use of resources. Manufacturing not only plays a significant role in economic output but also has a negative impact on the environment (Dymek et al., 2022; Xin et al., 2022). Along with governmental policy-making bodies, industrialists trying to create a green business environment are struggling to incorporate green practice and strategies in manufacturing. To fill this gap, the objective of this study of the manufacturing industry of China is to analyse the role of variables which encourage GEB. This paper investigates the role of KMP, GEI, and transformative innovation in promoting and encouraging GEB.

This paper is comprised of five sections. The introduction discusses the theme of the study and presents the problem statement and research gap. The second section, the literature review, covers the existing literature, and hypotheses are developed considering previous evidence. The methodology section provides the details of the study sample, population, and data techniques. The findings section is followed by the formulation of policies and concluding remarks.

Literature review

We intend to present a theoretical framework for actors (entrepreneurs) in innovation systems of transformative innovation in light of the normative dimension of sustainability. It is not straightforward to integrate sustainability goals into an innovation system (IS) framework because the existing IS paradigm is not able to efficiently accommodate the complexity of sustainability's normative elements. This statement can be justified with the argument that particularly normative elements are ethical considerations and stakeholder interest, which traditional innovation frameworks fail to address as they are geared to focus on economic efficiency (Schlaile et al., 2017; Urmetzer & Pyka, 2020). Empirical literature pertaining to the issue, demands a focus on sustainable transition which is possible when systematic changes occur in the presence of sustainability. However, it is important to note that sustainability initiatives face multiple barriers including insufficient stakeholder engagement, due to the rigid mechanisms of existing paradigms (Hermundsdottir & Aspelund, 2021). Thus, a transformation of the IS paradigm is needed, dedicated to sustainability. However, the specific dedication demands a vigorous consideration of three prime questions: what, why, and by and for whom (Tainter, 2014; O'Brien, 2012). These questions raise further questions, such as how long, at what scale, and at what cost. All these questions need to be acknowledged in order to achieve sustainable transformation (Schlaile et al., 2017; Turnheim et al., 2015).

The central question of what to sustain highlights the copious issue of the directionality of innovation systems. Directionality revolves around the ultimate goal of IS. In terms of sustainability, it exemplifies the right transformational path which integrates socio-economic, environmental, cultural, technological, and other sub-systems (Daimer et al., 2012; Lindner et al., 2016). Defining the directionality of IS requires consideration of a variety of sustainable

pathways and related actors. Unfortunately, it is often assumed that the correct direction is already known (Almudi et al., 2017; Schot & Steinmueller, 2017). The process can be quite slow due to contemporary problems. For example, the evolutionary nature of innovation creates uncertainty and demands boundedly rational actors. Transformation is an open-ended journey, with uncertain outcomes, in which even defined goals are not foreseeable. This complexity makes it challenging to achieve systemic goals, especially in the presence of problems and multiple actors with conflicting expectations (Stirling, 2009; Warnke et al., 2016). Thus, it is imperative to be aware of those agents who have the power to address issues and help communities achieve sustainable outcomes. The question of why speaks to legitimacy issues and leads to further questions: Why should innovation systems have transformation goals? Who decides the respective direction pathway? It is risky to depend on the centrally planned approaches of governments because state monopolies create judicial norms which are ambiguous. Transformation relies on cultural, economic, and geographical conditions and change can happen radically in both systems and regulations, highlighting the necessity of negotiations at various levels (Berkhout et al., 2010; Urmetzer & Pyka, 2017). Meanwhile, bottom-up approaches are not guaranteed to come to innovative solutions, even when all actors agree to follow a particular pathway. Grassroots transformation requires a force capable of discouraging non-sustainable activities and managing power relations. Scholars argue that goals, norms, beliefs, and values are shaped through culturally evolutionary processes, creating barriers to answering both questions (Berkhout, 2006; WBGU, 2011). The third question, by and for whom, concerns responsibility issues. Responsibility is linked to agency, and it matters who holds the power to make changes and who bears the consequences. In IS literature, responsibility receives less attention than directionality or legitimacy. Although corporate social responsibility has a well-established scholarly history, the idea is difficult to adapt to innovation and transformation, due to heterogenous actors and uncertain outcomes. Sometimes, these complex interactions are the root of unknown causalities (Parodi, 2015; Parodi et al., 2010; Waring et al., 2015). Individual and collective action can be responsible for inflicting positive or negative transformative innovation. The precondition of transformative innovation is dealing with these directionality, legitimacy, and responsibility issues. Thus, a framework is required to produce an integrated answer (Biermann et al., 2010; Patterson et al., 2017).

The preceding discussion clearly explains the major factors of the proposed framework, including actors, systems, and streams. These three elements are crucial for explaining transformative change, which only occurs when all three elements are in related positions. Further, this study extended the normative dimensions of sustainability which encourage transformative innovation to include the three crucial elements of actors, streams, and systems. Actors are strategic and interpretive, operating individually or as part of alliances. Their actions can create solutions to problems and bringing changes to systems. Streams are defined as values created through knowledge that can address the needs of society. Finally, systems are referred to as a set of solutions through which societies meet their needs. Through this lens, transformative innovation occurs when actors (in our case entrepreneurs) are responsible for bringing change. However, without the knowledge management process, this is not possible. Sustainable behaviour is shaped through such factors, indicating the indirect association, and highlighting the importance of transformative innovation as a significant mediator.

Hypothesis development

Knowledge management and green entrepreneurial behaviour

Green entrepreneurship is becoming increasingly significant due to the immediate need for environmentally friendly and sustainable solutions. Green entrepreneurship could help organizations address environmental challenges while helping manufacturers promote green practice and sustainability (Heredia et al., 2022; Trapp & Kanbach, 2021). Green entrepreneurial behaviour also helps manufacturers minimize costs by enhancing resource efficiency, lowering energy consumption, and reducing waste. This helps firms enhance their bottom line and stay competitive.

On the other hand, KMP helps firms develop, share, utilize, and manage information and knowledge within the organization. It plays a significant role in integrating green behaviour by helping companies identify and utilize environmental knowledge and sustainable practice. Hence, the association of KMP with green entrepreneurial behaviour can be explained through a theoretical lens and empirical evidence (Alkathiri et al., 2024). From a theoretical perspective, KMP is a necessary mechanism for firms to promote innovation and sustainable behaviour. Scholars argue that, with effective KMP, it becomes easier to capture and disseminate the knowledge which is crucial for building GEB and exploiting entrepreneurial opportunities (Kusa et al., 2023). Dynamic capability theory holds that KMP improves the ability of firms to embrace innovative practice in response to environmental challenges, and is pivotal to GEB (Makhloufi et al., 2022; Yu et al., 2022). Abbas & Sağsan (2019) highlight KMP's significance in green entrepreneurial firms. KMP supports entrepreneurial firms in developing and integrating green practices and strategies by facilitating knowledge and information sharing relating to environmental sustainability practice. Moreover, KMP encourages and promotes green innovation and creativity, leading to a culture of continuous experimentation, learning, and exploring new ideas to address the environmental crisis, having a positive impact on GEB. KMP also helps organizations, especially entrepreneurial firms, gather information and analyse market trends to stay competitive through strategic planning of green practice. This shows that KMP plays a significant role in promoting green behaviour in employees and industries, leading organizations to meet sustainability goals (Shehzad et al., 2023).

Empirical studies suggest that KMP affects GEB in a positive manner. However, this direct association is only possible, when firms' innovative and absorptive capacities are enabled (Chu et al., 2021; Sulphey et al., 2023). Shahzad et al. (2020) reveal that organizations which have robust knowledge management practices have an edge to position themselves effectively. This is because they are capable of grasping the essence of new environmental technologies which help stimulate green behaviour. KMP tends to support green entrepreneurs and individuals capable of making decisions and devising superior strategies linked to sustainable goals. KMP promotes best sharing practices among entrepreneurs who stimulate green behaviour. It also builds a knowledge base among individuals that leads to sustainable behaviour (Ha et al., 2021). Studies assert that knowledge management helps firms establish a culture of continuous learning which is, again, beneficial for green behaviour and sustainable competitive advantage. To conclude, both the theoretical and practical perspectives accentuate the role of KMP in vivifying green entrepreneurial behaviour. Inducing KMP in firms' operations can optimize the innovative capabilities of green entrepreneurs, unlocking their potential to make informed decisions and build resilient and sustainable value.

H1. *The knowledge management process has a positive effect on green entrepreneurial behaviour.*

Green entrepreneurial intention and green entrepreneurial behaviour

GEI and GEB are significant drivers of economic growth and development. GEI indicates the commitment and willingness of an organization to engage in sustainable or green entrepreneurial activities (Muangmee et al., 2021; Streimikiene, 2023). In green entrepreneurship literature, green intention is the most discrete predictor of green

behaviour. Because, in a planned behavioural model, intention and action are both notable predictors. In an intention-based model, entrepreneurial paradox is explicitly explained by scholars with confined evidence illustrating why individuals tend to adopt entrepreneurial behaviour (Mishra et al., 2024). Among several, the theory of planned behaviour stands out, and a plethora of research supports a robust link between entrepreneurial intention and entrepreneurial behaviour. The explanation is that intentions have a pronounced effect on behaviour, and that a strong entrepreneurial impulse leads to entrepreneurial action (Amankwah & Sesen, 2021; Bae et al., 2014). In the context of sustainability, plenty of empirical literature reinforces the idea that when individuals possess high levels of green entrepreneurial intention they are inclined to adopt sustainable business practices. For example, Yi (2021) suggests that green entrepreneurial orientation effectively develops green innovation within organizations. The effective role of knowledge management in promoting entrepreneurial behaviour recognizes the significance of intentions because it expediates green knowledge, fortifying the strong link between intention and behaviour. Li et al. (2023) demonstrate that, with strong green intentions in an entrepreneurial context, individuals are provoked by attitudes and social norms that collectively shape their green behaviour. According to Amankwah (2021), when green entrepreneurial intentions are high, individuals perform actions that support a sustainable agenda. Moreover, intentions can transform into impactful behaviours when individuals have sound educational backgrounds and enough social support, because these factors equip green entrepreneurs with resources and knowledge.

It is argued that the impact of GEI on GEB is important, because it provides indications of future actions. Yi (2021) shows the significance of GEI in promoting sustainability. When organizations are committed to and engaged in environmentally sustainable activities, they focus on achieving those goals, such that entrepreneurial firms which have a strong intention to create and develop green services and products are more interested in investing resources and time to develop, research, and bring them to the market. Hussain et al. (2021b) determine that GEI is impacted by factors such as environmental awareness and personal experience, thus shaping the green intentions of organizations. Firms committed to environmental sustainability have strong intentions to eradicate their negative influence on the environment. Therefore, entrepreneurial organizations, with various training, support, and incentives, can encourage employees to enhance their sustainability (Zhang et al., 2023). Thus, taking direction from prior evidence, the study hypothesizes that green entrepreneurial intention effectively predicts green entrepreneurial behaviour.

H2. Green entrepreneurial intentions have a positive effect on green entrepreneurial behaviour.

Transformative innovation and green entrepreneurial behaviour

Transformative innovation creates an innovative and new paradigm, transforming the whole process of business operations. Green entrepreneurial behaviour is significantly influenced by transformative innovation as it promotes sustainable practice and clean technologies (Dat et al., 2022). From a theoretical point of view, transformative innovation represents the amalgamation of disruptive innovation and sustainable development, aiming at fundamental change in organizational operations to acknowledge environmental challenges (Polas et al., 2023).

Empirical literature validates this argument by revealing that transformation innovation shapes green behaviour. When organizations are involved in transformation innovations, the occurrence of green initiatives is doubled, however, this is only possible when the workforce is inclined towards sustainable practice and adopts green behaviour to achieve the collective goal (Neumann, 2022). Transforming the green behaviour of entrepreneurs, though a transformative lens, fills the void between economic and environmental goals, nurturing a sustainable culture (Karikari Appiah et al., 2023). Since, green innovation performance is driven by green entrepreneurship orientation, it can be argued that transformative innovation not only shapes green entrepreneurial behaviour but also encourages its fusion deep into business strategies, resulting in economic and environmental gains.

To discuss the argument further, Galindo-Martín et al. (2020) indicate that transformative innovation creates demand and opens up new and innovative markets for sustainable services and products. Transformative innovation motivates entrepreneurs to engage in entrepreneurial activities. Molas-Gallart et al. (2021) postulate that transformative innovation creates a sense of responsibility and urgency among entrepreneurs, encouraging them to address environmental challenges. Transformative innovation also provides entrepreneurs with new resources and tools to support sustainable entrepreneurship. Transformative innovation creates a supportive environment by encouraging investors, policymakers, and stakeholders in green entrepreneurship. This transformation can demonstrate the benefits for entrepreneurial firms and grant them a competitive edge. Green innovation leads to the development and creation of innovative technologies which eradicate the negative impact of the manufacturing sector on nature and the environment. As the business world is changing rapidly, there is a dire need for firms, especially entrepreneurial firms, to be up to date with their policies, strategies, and innovative technologies in order to meet sustainable goals (Lewandowska et al., 2023). This discussion indicates that organizations having innovative business aspects leads to green entrepreneurial behaviour.

H3. Transformative innovation has a positive effect on green entrepreneurial behaviour.

The mediating role of transformative innovation

Scholars emphasize the potential role of transformative innovation as a mediator among entrepreneurial outcomes. Since the fundamental concept of transformative innovation signifies a disruptive shift in business dynamics, it often results in radical changes and competitive advantages (Arif & Akram, 2018). According to Adomako et al. (2024), entrepreneurial orientation can be optimized when embracing transformative innovation. Such innovative practices prepare firms to experience disruption while managing operational continuity. The curious nature of entrepreneurs makes them look for opportunities associated with organizational innovation. This innovation, acting as a bridge, transforms green behaviours and attitudes, leading to exceptional firm performance (Zafar & Mehmood, 2019). Hussain et al. (2021a) emphasize the mediating role transformative innovation plays between market-oriented strategies and entrepreneurial outcomes, highlighting that organizational understanding of market needs can lead to maximum benefit from innovation and superior performance.

Transformative innovation can act as a potential mediator between KMP and GEB. Since KMP is vital for creating an innovative environment, firms which actively indulge in such processes can successfully build a substantial base for transformative innovation. Such innovation, which revolves around disruptive technologies and business models, further shapes sustainable behaviour and causes shifts in market dynamics by promoting green advocacy. Borrás et al. (2024) reveal that firms with advanced knowledge management systems experience more green entrepreneurial activity and are prone to address environmental issues. This symbiotic link underscores the significance of knowledge management systems which shape the innovative mindset leading to positive entrepreneurial outcomes.

Transformative innovation also acts as a mediator, converting entrepreneurial intention into ethereal action. Wang et al. (2020) reveal that entrepreneurs with green intention are more inclined to adopt green behaviour while dynamically involved in transformative innovation. Green entrepreneurial intentions are influenced by factors such as attitude, social pressure and behavioural control. Therefore, with transformative innovation, individuals become more capable of overcoming hurdles and exploiting prospects to ensure the success of green ventures. Transformative innovation as a mediator is quite evident in the behavioural literature, as it offers valuable tools to execute green business models. This mediating relationship is strengthened by the support of individuals who absorb pragmatic knowledge and have the resources crucial for transformative innovation, thus nourishing the relationship between entrepreneurial intention and green intention (Ordóñez-Matamoros et al., 2021; Ul Hassan & Iqbal, 2020).

In general, the entrepreneurship literature outlines the essentiality of transformative innovation as a mediating factor, because it effectively establishes the link between knowledge management and green entrepreneurial behaviour. Meanwhile, it ensures the effective transformation of green entrepreneurial intention into entrepreneurial activity. Hence, the proposition demonstrates that the mediating role of transformative innovation helps individuals navigate the difficulties experienced as a green entrepreneur in order to gain sustainable outcomes.

H4. Transformative innovation mediates the relationship between the knowledge management process and green entrepreneurial behaviour.

H5. Transformative innovation mediates the relationship between green entrepreneurial intention and green entrepreneurial behaviour.

Research methods

This research scrutinizes the effect of KMP and GEI on GEB, and the mediating role of transformative innovation on KMP, GEI, and GEB in the manufacturing industry in China. The items and questions are adopted from previously published articles. The KMP variable is measured through a questionnaire adapted from Cooper et al. (2016), consisting of 4 items. Yi's (2021) questionnaire is used to measure GEI, based on 5 items. The same questionnaire is used to measure GEB based on 5 items. Finally, a 6 items survey questionnaire adopted from Alrowwad et al. (2020) is used to measure transformative innovation.

There are currently two major concerns of the Chinese government, sustainable growth and the livelihoods of the people. The economic mode of China sees high levels of growth, consumption, and pollution, exerting great pressure on energy and the environment. The industrialization of China has accelerated, especially the manufacturing sector, which makes up a big proportion of China's economy. However, the sector also brings destruction for the environment (Shan & Wang, 2019). Therefore, focusing on environmental issues is now considered a major factor in social and economic development. Hence, the selection of this sector for study. The researchers select entrepreneurs from the manufacturing industry on the basis of random sampling. A total of 528 questionnaires were sent to the selected entrepreneurs by mail, and 294 valid responses were received and used for the data analysis. The study model is assessed using SPSS and AMOS, which is an appropriate methodology for the analysis of primary data and deals significantly with large datasets and complex frameworks. The researchers perform various tests to draw results and determine the status of the formulated hypotheses. The researchers first perform descriptive statistics to assess the overall characteristics of the data. Data normality, outliers, mean, minimum, and maximum values are determined (Nick, 2007). The researchers then perform the sample adequacy test to assess the sample sufficiency, and the factor loadings test to check for double loading or cross-loading issues. A rotated component matrix is formulated to assure the non-existence of cross-loadings, duplication etc. The convergent and discriminant validity of the constructs is tested (Barrett, 2007; Zaiţ & Bertea, 2011). Based on the resulting values of average variance extracted and composite reliability, the researchers assess the convergent validity of the data. The heterotrait-monotrait (HTMT) discriminant validity test is performed to check that the variables which are theoretically unrelated are in fact unrelated. To assess the model fitness, confirmatory factor analysis is performed. The results of this analysis indicate that the structural equation modelling yields significant results.

The results of the structural equation modelling determine the status of the hypothesized relationships (Barrett, 2007). Based on the probability values, the status of the hypotheses are reported, and those direct and indirect effects for which the probability value is greater than 0.05 are rejected. Relationships having a threshold probability value less than 0.05 are declared significant and accepted. The researchers use two predictor variables, knowledge management process (KMP) and green entrepreneurial intention (GEI), the mediating variable transformative innovation (TIN), and one dependent variable, green entrepreneurial behaviour (GEB).

Research findings

Table 1 presents the discriminant validity results. The number of cases against each variable is 250, showing that there are no values missing from the data. Similarly, the minimum and maximum values show no outliers in the data. Skewness values falls between -1 and +1, showing normality in the data. Therefore, the overall characteristics of the data indicate that there are no issues of missing values or outliers, and further analysis can be performed.

Table 2 indicates that the KMO value is 0.933 which is greater than 0.7 indicating sample adequacy. The Bartlet test significance value is .000, further indicating that the sample is adequate.

The results of the rotated component matrix given in Table 3 show that the item for each variable is loaded in its own column. So, there are no issues of cross-loadings or duplication of loadings. Furthermore, no identity matrix is observed. Therefore, the rotated component matrix results are significant.

Convergent validity is used to measure how closely a variable is associated with another variable which measures a similar construct. The average variance extracted (AVE) and composite reliability (CR) results show that convergent validity is established in the measurement model. The threshold values for AVE and CR are 0.7 and 0.5, respectively. The results in Table 4 show that each value corresponds with the threshold value and is significant. Therefore, convergent validity is established in the measurement model.

Discriminant validity is measured by the HTMT ratio. The black diagonal formulation indicates that the variables which are theoretically unrelated are in fact unrelated (Table 5).

Confirmatory factor analysis is performed to assess the model fitness of the data. Table 6 demonstrates that the observed values fall within threshold criteria and therefore the model is fit. As the model fitness is observed the structural equation modelling can be performed and will yield significant results.

Table 7 and Fig. 1 show the results for the direct associations among the variables, which indicate that, for all three direct hypotheses, the p-values fall within the threshold criteria and are equal to or smaller than 0.05. Therefore, the direct hypotheses are significant and accepted. So, green entrepreneurial intention, knowledge management process and transformative innovation have significant and positive impacts on green entrepreneurial behaviour.

The indirect effects are shown to be significant and positive. Table 8 and Fig. 2 indicate the results of the mediating hypotheses,

Table 1
Descriptive statistics

	N	Min	Max	Mean	Std. Deviation	Skewness	
						Statistic	Std. Error
KMP	250	1.00	5.00	3.6700	1.00231	-.906	.154
GEB	250	1.00	5.00	3.6608	1.02176	-.884	.154
GEI	250	1.00	5.00	3.6152	.92128	-.715	.154
TIN	250	1.00	5.00	3.2993	.99623	-.293	.154
Valid N (listwise)	250						

(Source: Authors' estimation)

Table 2
KMO & Bartlet Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.933
Bartlett's Test of Sphericity	Approx. Chi-Square	3280.405
	Df	190
	Sig.	.000

(Source: Authors' estimation)

Table 3
Factor loadings

	Component			
	1	2	3	4
KMP1		.754		
KMP2		.799		
KMP3		.817		
KMP4		.805		
GEB1			.727	
GEB2			.698	
GEB3			.644	
GEB4			.683	
GEB5			.668	
GEI1				.708
GEI2				.814
GEI3				.754
GEI4				.491
GEI5				.507
TIN1	.567			
TIN2	.725			
TIN3	.722			
TIN4	.799			
TIN5	.823			
TIN6	.794			

(Source: Authors' estimation)

Table 4
Convergent validity

	CR	AVE	MSV	MaxR(H)	TRIN	KMP	GREB	GREI
TRIN	0.868	0.549	0.513	0.922	0.741			
KMP	0.916	0.732	0.507	0.923	0.604**	0.856		
GREB	0.903	0.650	0.513	0.905	0.716**	0.712***	0.806	
GREI	0.814	0.467	0.505	0.816	0.706**	0.700***	0.711***	0.683

(Source: Authors' estimation)

Table 5
Discriminant validity HTMT

	TRIN	KMP	GREB	GREI
TRIN				
KMP	0.661			
GREB	0.789	0.718		
GREI	0.753	0.700	0.705	

(Source: Authors' estimation)

Table 6
Model fitness

Index	Observed Value
CMIN/df	2.025
GFI	.879
IFI	.948
CFI	.947
RMSEA	.064

(Source: Authors' estimation)

Table 7
Direct effects structural equation modelling

Parameter			Estimate	Lower	Upper	P
GEB	<—	GEI	.157	.015	.285	.059
GEB	<—	KMP	.321	.198	.478	.007
GEB	<—	TIN	.405	.287	.543	.005

(Source: Authors' estimation)

and show transformative innovation is a significant mediator between green entrepreneurial intention, knowledge management process and green entrepreneurial behaviour. The p-values against these hypotheses are 0.000 indicating perfectly significant mediation of transformative innovation.

Discussion

The results reveal that KMP enhances GEB, showing consistency with previous studies. Abbas & Sağsan (2019) support this hypothesis, finding that KMP plays a significant role in enhancing the sustainability of organizations. KMP helps entrepreneurs enhance their sustainability performance by measuring the impact on the environment, monitoring progress, and setting sustainability goals. By using and sharing data regarding sustainable performance, entrepreneurs can highlight areas which need improvement and apply proper resource allocation. Shahzad et al. (2020) argue that KMP encourages organizations to focus on green practice, as it stimulates creativity and innovation in green entrepreneurship by sharing ideas and knowledge and encouraging experimentation and collaboration. KMP creates a culture of learning and sharing knowledge, which leads entrepreneurs to develop innovative approaches to sustainability. Our analysis shows that KMP has a significant impact on GEB, as it leads to the creation, sharing, and utilizing of knowledge and information within the manufacturing industry to create sustainability, leading to green entrepreneurial behaviour.

GEI is shown to be an effective indicator of GEB, supported by Yi (2021), who indicates that GEI can influence the strategies and policies that prioritize environmental responsibility and sustainability. It fosters creativity and innovation in developing new solutions for environmental challenges, creating a commitment to sustainability. Amankwah and Sesen (2021) also show the significance of GEI in enhancing green entrepreneurship. Entrepreneurs with GEI

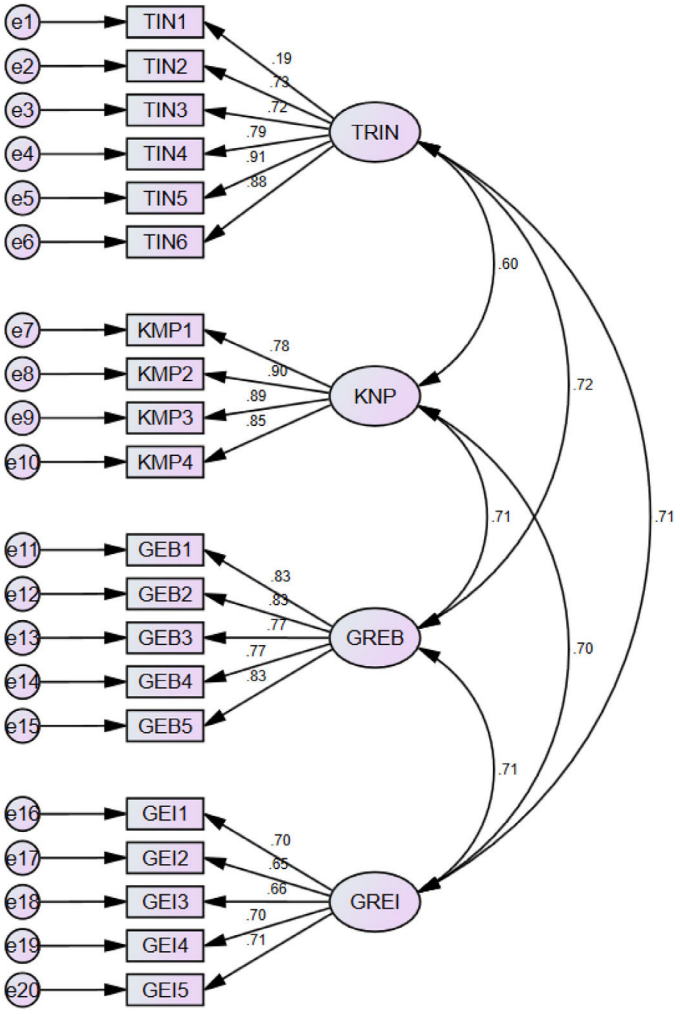

Fig. 1. Measurement assessment model(Source: Authors' estimation)

encourage and promote collaboration and commitment to sustainability. Firms with GEI enhance their brand images and reputations, as it integrates green activities into business operations which, in return, increase green entrepreneurial behaviour. Organizations with

Table 8
Indirect effects structural equation modelling

Indirect Path	Standardized Estimate	Lower	Upper	P-Value
GEI –> TIN –> GEB	0.175***	0.119	0.293	0.000
KMP –> TIN –> GEB	0.129***	0.082	0.199	0.000

(Source: Authors' estimation)

GEI are key drivers of GEB. Entrepreneurs with a strong commitment to environmental sustainability are more interested in creating business ventures that have a positive impact on the environment and foster innovation.

Transformative innovation has a positive effect on GEB. Galindo-Martín et al. (2020) support this hypothesis, claiming that transformative innovation plays a significant role in enhancing GEB, as it helps create new processes, business models, and sustainable products. Transformative innovation helps organizations identify new opportunities, overcome barriers which hinder the adoption of green and innovative practices, and encourage sustainable strategies and policies. By developing innovative and green practices, green entrepreneurs differentiate themselves in the market from their competitors. Therefore, transformative innovation plays a significant role in enhancing the GEB in the manufacturing industry by addressing environmental challenges. Transformative innovation is also shown to be an effective mediator. According to our analysis, transformative innovation plays a significant and positive role in enhancing green entrepreneurship. In the current era, the world faces huge environmental challenges due to business activities causing natural resources depletion, and the emission of greenhouse gasses, waste, and air pollution. To tackle these issues governments, focus on creating a green and sustainable environment. For that purpose, there are several factors which enhance the implementation of green activities. Transformative innovation refers to innovative, new, and creative solutions and business models. Transformative innovation encourages the process of knowledge management which determines the creation, utilization, and sharing of information and knowledge. This process helps organizations create sustainable and environmentally friendly solutions. The process promotes and encourages the integration of green activities in the manufacturing process and business activities, thus increasing GEB.

The results show the mediating role of transformative innovation between GEI and GEB in the manufacturing industry of China. In the past, no study has been done to support this hypothesis. Our results show that organizations having strong transformative innovation

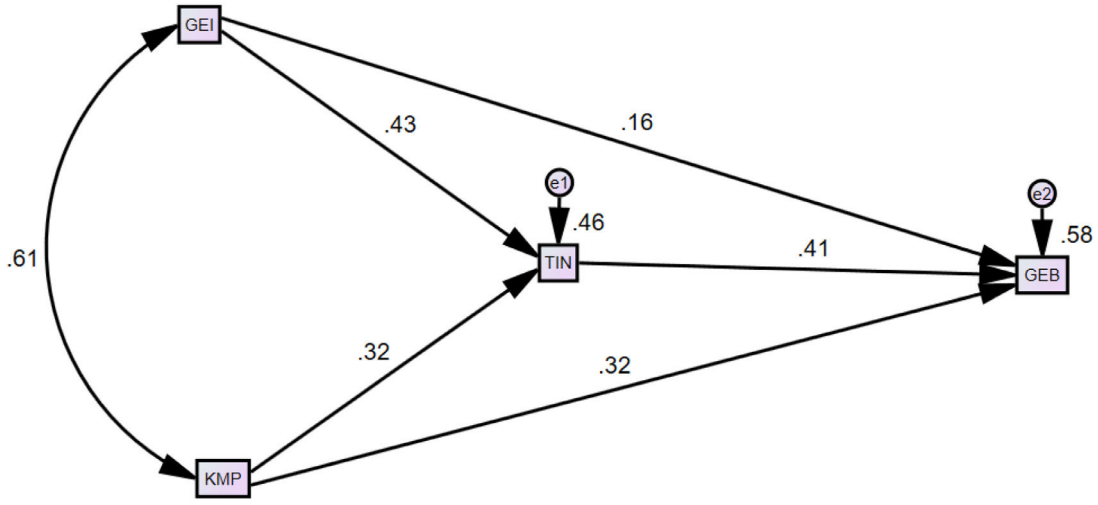

Fig. 2. Structural assessment model(Source: Authors' estimation)

encourage GEI. To remain competitive, firms must transform their processes, strategies, and activities according to trends in the market. As customers, stakeholders, and investors are interested in green products, firms need to integrate sustainable business operations. This can be done through GEI, which refers to the commitment of an organization to sustainability (Hussain et al., 2021b). Transformative innovation increases the behavioural intention to make organizations more environmentally friendly. Organizations having transformative innovation leads to a strong relationship between GEI and GEB. Entrepreneurial firms inclined towards innovative transformation are always ready to embrace change and, in the current era, all traditional business models are transforming into green and innovative ventures, leading to the development of GEB.

This paper makes a significant contribution to the literature. Green entrepreneurship has attracted huge attention in the manufacturing sector of China. The manufacturing industry is one of the biggest industries in China, contributing greatly to the economic development of the country, but, at the same time, damaging the environment. To tackle the environmental crisis, green firms are gaining significance. With growing concern and awareness of climate change and the environment, customers are demanding eco-friendly and sustainable products, creating opportunities for green entrepreneurs to implement and introduce green initiatives to the business world. The Chinese government is focusing on green initiatives by providing tax incentives, financial support, and subsidies. The manufacturing industry in China is trying to transform its business practices into sustainable and green practices but faces various challenges which need to be overcome to strengthen green activity in the market. This paper concludes that KMP, GEI and transformative innovation have a direct and positive impact on GEB, which leads to the successful implementation of green initiatives in the market. The paper also highlights the mediating role of transformative innovation between KMP, GEI, and GEB. In the past, no study has analysed the mediating role of transformative innovation. This paper highlights the impact and importance of transformative innovation between these variables and the role of transformative innovation in supporting green activities in the market.

Conclusion

The manufacturing sector in China is one of the biggest industries not only in the country but in the world, producing high economic output. The manufacturing sector of China is still growing rapidly, contributing to the environmental crisis. This development of the manufacturing industry in China leads to the destruction of the environment and the consumption of natural resources. 36% of CO2 emissions and one-third of consumption of global energy are caused by the manufacturing sector. In short, mankind, in an era of development and industrialization, has made great achievements but created severe environmental issues, pollution, and an energy crisis. The world has now realized that economic profit is crucial, but also must pay attention to the sustainability of industries, because the rapid use of natural resources, depletion of the ozone layer, and emissions of greenhouse gasses have created serious threats to the environment of the planet and for future generations. To tackle these issues governments, regulatory bodies, policymakers, and non-governmental organizations pay attention to minimizing negative environmental impacts. This paper helps organizations and entrepreneurial firms by highlighting the importance of GEB and the impact of KMP, transformative innovation, and GEI on GEB. This paper concludes that KMP has a positive impact on GEB.

KMP helps entrepreneurial firms create, share, utilize, and store information and knowledge within the organization. This process encourages employees and firms to share and transfer creative and innovative ideas which leads to the formulation of solutions to deal with the environmental crisis. When employees feel empowered and are allowed to share their thoughts and ideas, they create distinctive processes which help the organizations integrate sustainable and green practice in their business ventures. Green entrepreneurship requires innovative ideas and solutions which address environmental challenges, and KMP plays a significant role.

GEI also plays a significant role in GEB. GEI refers to the willingness of employees and organizations to focus on their commitment and engagement in environmental sustainability. Organizations with GEI are more willing to invest their business activities in the well-being of the environment, having a positive impact on GEB. Business is changing rapidly and with the passage of each day firms need to keep their business processes up to date to gain a competitive edge. Transformative innovation plays a significant role. Transformative innovation helps change processes, activities, and ideas to sustain a business in the market. Entrepreneurial firms with transformative innovation play a significant role in GEB by transforming traditional methods into innovative sustainable processes. Transformative innovation plays a mediating role between KMP, GEI, and GEB, which means that transformative innovation strengthens the relationship between these variables by motivating and encouraging entrepreneurial firms to embrace sustainable products, services, and processes. Hence, market demand, government support, international pressure, and competitive advantage all lead to the integration of sustainable activities, but entrepreneurial firms in the manufacturing industry of China require other factors, such as KMP, GEI, transformative innovation, and GEB, to make businesses environmentally friendly.

Since the Chinese market is the focus of this study, and due to its distinct cultural and institutional norms, valid concerns can be raised regarding the generalizability of the findings. The country's well-marked placement on Hofstede's dimension of power distance, may influence the process of knowledge management. Due to its ingrained hierarchical structure, the inclination of employees towards knowledge can pose a barrier, and thus may limit the knowledge flow in other sectors. Market mechanisms, along with the control of the state, differentiate the country's institutional setup from the liberal markets of other economies. Although, the present findings provide valuable insight into KMP and its links to other variables in the Chinese context, implementing these findings within the bigger picture would be to fail to consider the cultural and institutional differences that play major a role in organizational behaviour. In order to address this issue, there is a need for future studies to consider these limitations, acknowledging the contextual constraints of the present study, replicating the framework in broader, culturally diverse contexts. Other than this limitation, the study captures the relationship, in the presence of the mediating role of transformative innovation, between KMP, GEI, and GEB. Future research could study the mediating role of green technology between these variables.

CRediT authorship contribution statement

Yanhui Wang: Formal analysis, Data curation, Conceptualization. **Qin Wang:** Resources, Methodology, Investigation. **Xuen Pan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software. **Mário Nuno Mata:** Writing – review & editing, Validation, Supervision, Project administration.

Appendix

Variable	Statement	items
Knowledge management Process	• My organization has processes for integrating different sources and types of knowledge. • My organization has processes for converting competitive intelligence into plans of action.	4

(*continued*)

(*Continued*)

Variable	Statement	items
	• My organization has processes for taking advantage of new knowledge. • My organization has processes for acquiring and exchanging knowledge about organizational partners.	
Green Entrepreneurial Intention	• I wished to start a green enterprise that assists in alleviating environmental issues. • I had a preliminary idea for a green enterprise to implement in the future. • My professional goal was to become a green entrepreneur. • I was willing to do anything to become a green entrepreneur. • I would act as a professional manager and get involved in the management of a social enterprise.	5
Green Entrepreneurial Behaviour	• Written a green business plan. • Started green product/service development. • Attempted to obtain external funding. • Purchased material, equipment or machinery for the green business. • Registered the green company.	5
Transformative Innovation	Radical innovation • Our company has introduced new product generations. • Our company has used new distribution channels. • Our company has opened new markets. Incremental innovation • Our company has the capability of innovations that make the prevailing product/service lines obsolete. • Our company has the capability of innovations that fundamentally change the prevailing products/services. • Our company has the capability of innovations that make the existing expertise in prevailing products/services obsolete.	6

References

Abbas, J., & Sağsan, M. (2019). Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2019.05.024.

Abubakar, A. M., Elrehail, H., Alatailat, M. A., & Elçi, A. (2019). Knowledge management, decision-making style and organizational performance. *Journal of Innovation & Knowledge*, *4*(2), 104–114.

Adomako, S., Kusi, S. Y., Ahsan, M., Cowden, B., & Nguyen, N. P. (2024). Entrepreneurial curiosity and firm innovation: Exploring the mediating role of information search in new technology ventures. *Journal of Business Research*, *182*, 114787.

Alkathiri, N. A., Said, F. B., Meyer, N., & Soliman, M. (2024). Knowledge management and sustainable entrepreneurship: a bibliometric overview and research agenda. *Journal of Innovation and Entrepreneurship*, *13*(1), 38.

Almudi, I., Fatas-Villafranca, F., Izquierdo, L. R., & Potts, J. (2017). The economics of utopia: a co-evolutionary model of ideas, citizenship and socio-political change. *Journal of Evolutionary Economics*. doi:10.1007/s00191-017-0507-7.

Alrowwad, A.a., Abualoush, S. H., & Masa'deh, R.e. (2020). Innovation and intellectual capital as intermediary variables among transformational leadership, transactional leadership, and organizational performance. *Journal of Management Development*, *39*(2), 196–222.

Amankwah, J., & Sesen, H. (2021). On the relation between green entrepreneurship intention and behaviour. *Sustainability*, *13*(13), 7474.

Ameer, F., & Khan, N. R. (2022). Green entrepreneurial orientation and corporate environmental performance: A systematic literature review. *European Management Journal*. doi:10.1016/j.emj.2022.04.003.

Arif, S., & Akram, A. (2018). Transformational leadership and organizational performance: the mediating role of organizational innovation. *SEISENSE Journal of Management*, *1*(3), 59–75.

Bae, T. J., Qian, S., Miao, C., & Fiet, J. O. (2014). The relationship between entrepreneurship education and entrepreneurial intentions: A meta–analytic review. *Entrepreneurship theory and practice*, *38*(2), 217–254.

Barrett, P. (2007). Structural equation modelling: Adjudging model fit. *Personality and Individual differences*, *42*(5), 815–824.

Borrás, S., Gerli, F., & Cenzato, R. (2024). Technology transfer offices in the diffusion of transformative innovation: Rethinking roles, resources, and capabilities. *Technological Forecasting and Social Change*, *200*, 123157.

Brazauskaite, I., Auruskeviciene, V., & Gerbutaviciene, R. J. (2022). An Examination of New Product Innovativeness and Performance: the Moderating Role of Commercial Environment. *Engineering Economics*, *33*(5), 486–495.

Berkhout, F. (2006). Normative expectations in systems innovation. *Technology Analysis & Strategic Management*, *18*(3-4), 299–311.

Berkhout, G., Hartmann, D., & Trott, P. (2010). Connecting technological capabilities with market needs using a cyclic innovation model. *R&d Management*, *40*(5), 474–490.

Biermann, F., Betsill, M. M., Gupta, J., Kanie, N., Lebel, L., Liverman, D., . . . Zondervan, R. (2010). Earth system governance: a research framework. *International Environmental Agreements: Politics, Law and Economics*, *10*, 277–298. doi:10.1007/s10784-010-9137-3.

Černevičiūtė, J., & Liebutė, L. (2022). Cultural probes method in design research: creativity in sketches. *Creativity Studies*, *15*(1), 169–181.

Chu, F., Zhang, W., & Jiang, Y. (2021). How does policy perception affect green entrepreneurship behaviour? An empirical analysis from China. *Discrete Dynamics in Nature and Society*. doi:10.1155/2021/7973046.

Cooper, A. L., Huscroft, J. R., Overstreet, R. E., & Hazen, B. T. (2016). Knowledge management for logistics service providers: the role of learning culture. *Industrial Management & Data Systems*, *116*(3), 584–602.

Daimer, S., Hufnagl, M., & Warnke, P (2012). Challenge-oriented policy-making and innovation systems theory. In K. Koschatzky (Ed.), Fraunhofer ISI (Hg.): Innovation system revisited. Experiences from *40 Years of Fraunhofer ISI Research*. Karlsruhe, Germany: Fraunhofer ISI ISBN 9783839604434.

Dat, N. M., Dai, N. Q., & Bich, P. N. (2022). The impact of corporate social responsibilities (CSR), entrepreneurship, and financial factors on the financial performance of the banks in ASEAN countries. *Contemporary Economics*, *16*(2), 227–240.

Diab, Y. (2021). The concept of knowledge sharing in organizations (Studying the personal and organizational factors and their effect on knowledge management). *Management Studies and Economic Systems*, *6*(1/2), 91–100.

Dymek, D., Grabowski, M., & Paliwoda-Pękosz, G. (2022). A proposition of an emerging technologies expectations model: An example of student attitudes towards blockchain. *Technological and Economic Development of Economy*, *28*(1), 101–130.

Fiszeder, P., & Malecka, M. (2022). Forecasting volatility during the outbreak of Russian invasion of Ukraine: Application to commodities, stock indices, currencies, and cryptocurrencies. *Available at SSRN 4109874*.

Galindo-Martín, M.-A., Castaño-Martínez, M.-S., & Méndez-Picazo, M.-T. (2020). The relationship between green innovation, social entrepreneurship, and sustainable development. *Sustainability*, *12*(11), 4467–4479.

Guaita Martínez, J. M., Martín Martín, J. M., Sol Ostos Rey, M., & de Castro Pardo, M (2021). Constructing Knowledge Economy Composite Indicators using an MCA-DEA approach. *Economic research-Ekonomska istraživanja*, *34*(1), 331–351.

Ha, S. T., Lo, M. C., Suaidi, M. K., Mohamad, A. A., & Razak, Z. B. (2021). Knowledge Management process, entrepreneurial orientation, and performance in SMEs: Evidence from an emerging economy. *Sustainability*, *13*(17), 9791.

Hameed, I., Zaman, U., Waris, I., & Shafique, O. (2021). A serial-mediation model to link entrepreneurship education and green entrepreneurial behaviour: application of resource-based view and flow theory. *International Journal of Environmental Research and Public Health*, *18*(2), 550–562.

Hermundsdottir, F., & Aspelund, A. (2021). Sustainability innovations and firm competitiveness: A review. *Journal of Cleaner Production*, *280*, 124715.

Heredia, J., Castillo-Vergara, M., Geldes, C., Gamarra, F. M. C., Flores, A., & Heredia, W. (2022). How do digital capabilities affect firm performance? The mediating role of technological capabilities in the "new normal. *Journal of Innovation & Knowledge*, *7*,(2) 100171.

Hudáková, M., Masár, M., Buganová, K., & Môcová, L. (2023). Fostering entrepreneurship through the assessment of business risks for SMEs in V4 countries. *Engineering Economics*, *34*(4), 384–396.

Huang, Q. (2022). *Green Manufacturing* Understanding China's Manufacturing Industry. (pp. 129–146). Springer.

Hussain, I., Nazir, M., Hashmi, S. B., Di Vaio, A., Shaheen, I., Waseem, M. A., & Arshad, A. (2021a). Green and sustainable entrepreneurial intentions: A mediation-moderation perspective. *Sustainability*, *13*(15), 8627–8640.

Hussain, I., Nazir, M., Hashmi, S. B., Shaheen, I., Akram, S., Waseem, M. A., & Arshad, A. (2021b). Linking green and sustainable entrepreneurial intentions and social networking sites; the mediating role of self-efficacy and risk propensity. *Sustainability*, *13*(13), 7050–7065.

Ju, X., Ma, Z., Chen, F., Yao, P., Liu, J., & Sriboonchitta, S. (2023). Environmental regulation, industrial agglomeration, and sustainable development in the Chinese textile industry. *Technological and Economic Development of Economy*, *29*(6), 1633–1656.

Karikari Appiah, M., Sam, A., Twum, E., & Godslove, E. (2023). Modelling the influencing of green entrepreneurship orientation on sustainable firm performance: a moderated mediation model. *Economic research-Ekonomska istraživanja*, *36*(2).

Kraus, S., Breier, M., & Dasí-Rodríguez, S. (2020). The art of crafting a systematic literature review in entrepreneurship research. *International Entrepreneurship and Management Journal*. doi:10.1007/s11365-020-00635-4.

Kusa, R., Suder, M., Duda, J., Czakon, W., & Juárez-Varón, D. (2023). Does knowledge management mediate the relationship between entrepreneurial orientation and firm performance? *Journal of Knowledge Management*, *28*(11), 33–61.

Lewandowska, A., Berniak-Woźny, J., & Ahmad, N. (2023). Competitiveness and innovation of small and medium enter-prises under Industry 4.0 and 5.0 challenges: A comprehensive bibliometric analysis. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *18*(4), 1045–1074.

Li, C., Murad, M., & Ashraf, S. F. (2023). The influence of women's green entrepreneurial intention on green entrepreneurial behavior through university and social support. *Sustainability*, *15*(13), 10123.

Li, Y., Mohd Nordin, N. R., Akhter, S., Kumar, T., & Shaheen, M. (2022). Does green entrepreneurial behaviour enhance through entrepreneurship education,

perceived-ability to use technology, and commitment to environment? Understanding the contribution of entrepreneurial motivation and university support. *Economic Research-Ekonomska Istraživanja*. doi:10.1080/1331677X.2022.2153375.
Lindner, R., Daimer, S., Beckert, B., Heyen, N., Koehler, J., Teufel, B., ... & Wydra, S. (2016). *Addressing directionality: Orientation failure and the systems of innovation heuristic. Towards reflexive governance* (No. 52). Fraunhofer ISI Discussion Papers-Innovation Systems and Policy Analysis.http://hdl.handle.net/10419/145315.
Loorbach, D., Wittmayer, J., Avelino, F., von Wirth, T., & Frantzeskaki, N. (2020). Transformative innovation and translocal diffusion. *Environmental Innovation and Societal Transitions*. https://doi.org/10.1016/j.eist.2020.01.009
Makhloufi, L., Laghouag, A. A., Meirun, T., & 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*, *31*(1), 425–444.
Mishra, M. K., Sharma, N., Kumar, S., & Shah, M. A. (2024). Catalyzing green entrepreneurial behavior: the role of intentions and selective factors. *Cogent Business & Management*, *11*,(1) 2337959.
Molas-Gallart, J., Boni, A., Giachi, S., & Schot, J. (2021). A formative approach to the evaluation of Transformative Innovation Policies. *Research Evaluation*, *30*(4), 431–442.
Muangmee, C., Dacko-Pikiewicz, Z., Meekaewkunchorn, N., Kassakorn, N., & Khalid, B. (2021). Green entrepreneurial orientation and green innovation in small and medium-sized enterprises (SMEs). *Social Sciences*, *10*(4), 136. doi:10.3390/socsci10040136.
Muo, I., & Azeez, A. A. (2019). Green Entrepreneurship: Literature review and agenda for future research. *International Journal of Entrepreneurial Knowledge*, *7*(2), 17–29.
Neumann, T. (2022). Impact of green entrepreneurship on sustainable development: An ex-post empirical analysis. *Journal of Cleaner Production*, *377*, 134317.
Nick, T. G. (2007). Descriptive statistics. *Topics in biostatistics*. doi:10.1007/978-1-59745-530-5_3.
O'Brien, K. (2012). Global environmental change II: From adaptation to deliberate transformation. *Progress in human geography*, *36*(5), 667–676.
Olanrewaju, A.-S. T., Hossain, M. A., Whiteside, N., & Mercieca, P. (2020). Social media and entrepreneurship research: A literature review. *International Journal of Information Management*. doi:10.1016/j.ijinfomgt.2019.05.011.
Ordóñez-Matamoros, G., Centeno, J. P., Andrade-Sastoque, E., & Pinzón-Camargo, M. A. (2021). Transformative innovation policy in emerging economies: what does it Entail?. *Policy and governance of science, technology, and innovation: Social inclusion and sustainable development in Latin América*, 105-146.
Parodi, O. (2015). The missing aspect of culture in sustainability concepts. In J. C. Enders, & M. Remig (Eds.), *Theories of Sustainable Development*. London, UK: Routledge ISBN 9781138796362.
Parodi, O., Banse, G., & Schaffer, A. (2010). Wechselspiele: Kultur und Nachhaltigkeit. *Annäherungen an ein Spannungsfeld. Berlin.*; ISBN 9783894045852.
Patterson, G. R., DeBaryshe, B. D., & Ramsey, E. (2017). A developmental perspective on antisocial behaviour. *Developmental and life-course criminological theories*. doi:10.4324/9781315094908.
Polas, M. R. H., Kabir, A. I., Jahanshahi, A. A., Sohel-Uz-Zaman, A. S. M., Karim, R., & Tabash, M. I. (2023). Rural entrepreneurs behaviors towards green innovation: Empirical evidence from Bangladesh. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*,(1) 100020.
Qazi, W., Qureshi, J. A., Raza, S. A., Khan, K. A., & Qureshi, M. A. (2020). Impact of personality traits and university green entrepreneurial support on students' green entrepreneurial intentions: the moderating role of environmental values. *Journal of Applied Research in Higher Education*, *13*(4), 1154–1180.
Schlaile, M. P., Urmetzer, S., Blok, V., Andersen, A. D., Timmermans, J., Mueller, M., ... Pyka, A. (2017). Innovation systems for transformations towards sustainability? *Taking the normative dimension seriously*. Sustainability, *9*(12), 2253.
Schot, J.; Daniels, C.; Torrens, J.; Bloomfield, G. Developing a Shared Understanding of Transformative Innovation Policy. Available online: http://www.transformative-innovation-policy.net/publications/developing-a-shared-understanding/ (accessed on 5 December 2017)
Shahzad, M., Qu, Y., Zafar, A. U., Rehman, S. U., & Islam, T. (2020). Exploring the influence of knowledge management process on corporate sustainable performance through green innovation. *Journal of Knowledge Management*, *24*(9), 2079–2106.
Shehzad, M. U., Zhang, J., Latif, K. F., Jamil, K., & Waseel, A. H. (2023). Do green entrepreneurial orientation and green knowledge management matter in the pursuit of ambidextrous green innovation: A moderated mediation model. *Journal of Cleaner Production*, *388*, 135971.
Shan, W., & Wang, J. (2019). The effect of environmental performance on employment: Evidence from China's manufacturing industries. *International Journal of Environmental Research and Public Health*, *16*(12), 2232.
Song, Y., Zhao, P., Chang, H. L., Razi, U., & Sorin Dinca, M. (2022). Does the COVID-19 pandemic affect the tourism industry in China? Evidence from extreme quantiles approach. *Economic research-Ekonomska istraživanja*, *35*(1), 2333–2350.
Streimikiene, D. (2023). Transformative changes towards carbon neutral society: Barriers and drivers. *Contemporary Economics*, *17*(3), 351–360.
Stirling, A. (2009). Direction, distribution and diversity! Pluralising progress in innovation, sustainability and development. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/2458
Sulphey, M. M. I., Al-Kahtani, N. S., Senan, N. A. M., & Adow, A. H. E. (2023). An examination of a few antecedents of green creativity using structural equation modeling. *Creativity Studies*, *16*(2), 509–528.
Tainter, J. A., & Taylor, T. G. (2014). Complexity, problem-solving, sustainability and resilience. *Building Research & Information*, *42*(2), 168–181.
Tiwari, S. P. (2022). Knowledge Management Strategies and Emerging Technologies −An Overview Of the Underpinning Concepts. *arXiv preprint arXiv:2205*. doi:https://doi.org/10.48550/arXiv.2205.01100
Trapp, C. T., & Kanbach, D. K. (2021). Green entrepreneurship and business models: Deriving green technology business model archetypes. *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2021.126694.
Turnheim, B., Berkhout, F., Geels, F., Hof, A., McMeekin, A., Nykvist, B., & van Vuuren, D. (2015). Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. *Global environmental change*, *35*, 239–253.
Ul Hassan, M., & Iqbal, A (2020). Open innovation and innovative performance of Pakistani SMEs: Moderated mediation of knowledge management capability and innovative climate. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *14*(4), 962–990.
Urmetzer, S., & Pyka, A. (2020). Innovation systems for sustainability. *Decent Work and Economic Growth* (pp. 600−611). Cham: Springer International Publishing.
Urmetzer, S., & Pyka, A. (2017). *Varieties of knowledge-based bioeconomies*. (pp. 57−82). Springer International Publishing. doi:10.1007/978-3-319-58374-7_4.
Vukašina, M., Kersan-Škabić, I., & Orlić, E. (2022). Impact of European structural and investment funds absorption on the regional development in the EU-12 (new member states). *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *17*(4), 857–880.
Wadhwani, R. D., Kirsch, D., Welter, F., Gartner, W. B., & Jones, G. G. (2020). Context, time, and change: Historical approaches to entrepreneurship research. *Strategic Entrepreneurship Journal*, *14*(1), 3–19.
Wang, Z., Ling, J., & Chok, J. I. (2020). Relational embeddedness and disruptive innovations: The mediating role of absorptive capacity. *Journal of Engineering and Technology Management*, *57*, 101587.
Warnke, P., Koschatzky, K., Dönitz, E., Zenker, A., Stahlecker, T., Som, O., ... Güth, S. (2016). *Opening up the innovation system framework towards new actors and institutions* (No. 49). *Fraunhofer ISI Discussion Papers-Innovation Systems and Policy Analysis. http://hdl.handle.net/10419/129191*.
Waring, T. M., Kline Ann, M., Brooks, J. S., Goff, S. H., Gowdy, J., Janssen, M. A., ... Jacquet, J. (2015). A multilevel evolutionary framework for sustainability analysis. *Ecology and Society*. *https://www.jstor.org/stable/26270218*.
WBGU. World in Transition: A Social Contract for Sustainability; Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen: Berlin, Germany, 2011002E
Xin, L., Sun, H., Xia, X., Wang, H., Xiao, H., & Yan, X. (2022). How does renewable energy technology innovation affect manufacturing carbon intensity in China? *Environmental Science and Pollution Research*, *29*(39), 59784–59801.
Xu, J., & Li, J. (2022). The interrelationship between intellectual capital and firm performance: evidence from China's manufacturing sector. *Journal of Intellectual Capital*, *23*(2), 313–341.
Yeboah, A. (2023). Knowledge sharing in organization: A systematic review. *Cogent business & management*, *10*,(1) 2195027.
Yi, G. (2021). From green entrepreneurial intentions to green entrepreneurial behaviours: the role of university entrepreneurial support and external institutional support. *International Entrepreneurship and Management Journal*, *17*(2), 963–979.
Yu, Q., Aslam, S., Murad, M., Jiatong, W., & Syed, N. (2022). The impact of knowledge management process and intellectual capital on entrepreneurial orientation and innovation. *Frontiers in psychology*, *13*, 772668.
Zafar, H., & Mehmood, K. K. (2019). Innovation as a mediator between innovative culture, transformational leadership, knowledge management, learning orientation, and performance. *JISR management and social sciences & economics*, *17*(1), 149–164.
Zaiț, A., & Bertea, P. (2011). Methods for testing discriminant validity. *Management & Marketing Journal*, *9*(2), 217–224.
Zhang, Z., Zhou, Z., Zeng, Z., & Zou, Y. (2023). How does heterogeneous green technology innovation affect air quality and economic development in Chinese cities? Spatial and nonlinear perspective analysis. *Journal of Innovation & Knowledge*, *8*,(4) 100419.