TAF
Journal of Administrative and Business Studies
JABS
2025, **11**(1): 14-26

PRIMARY RESEARCH

The role of knowledge management in driving environmental sustainability: A mediating perspective of awareness and innovation

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Keywords

KM process
Green innovation
Environmental awareness
Environmental sustainability

Received: 24 September 2024
Accepted: 20 December 2024
Published: 11 February 2025

Abstract

This study is intended to assess the relationship of knowledge management dimensions (knowledge acquisition, knowledge diffusion and knowledge application) to environmental sustainability. It also aims to test the mediating relationships of these knowledge management dimensions and green innovation by environmental awareness in the green-innovation SMEs context of India. Snowball sampling was used, and data were collected from a sample of SMEs (N=278 top and middle managers) in India and data were analyzed by SmartPLS, which adopts a quantitative approach. The study findings showed a significant and positive relationship between the various KM process and environmental sustainability. The study findings also showed a significant and negative relationship between the KM process and environmental awareness. The study findings showed a significant and positive relationship between the KM process and green innovation. Furthermore, the study analysis showed that both environmental awareness and green innovation mediated the relationship between KM processes and environmental sustainability. Learning how to effectively manage knowledge is one of the key elements of green innovations, however there has been limited research to date that showcases the relationship with knowledge management to organizational success in the long run. This study is among the few to examine the impact of KM process on their relative contribution to environmental sustainability in indian SMEs.

INTRODUCTION

For businesses adopting green innovation, knowledge management is crucial for generating a competitive edge and significant strategic potential. In recent years, business decision-makers have come to recognize the importance of innovation for environmental sustainability. Green innovation received special attention from researchers in the fields of marketing, environmental studies, business, and ethics (Polas, Tabash, Bhattacharjee, & Dávila, 2023). The creation of green innovations can help businesses gain a competitive edge and enhance environmental sustainability. However, despite the benefits and potential of green innovation, producers' engagement in this area has fallen short of expectations because of specific concern and challenges (Liu & Cao, 2025). Given the dedication to sustainable development to meet the needs of all socioeconomic sectors, partnerships with a broader range of stakeholders are expected to be required for the creation and sharing of information on sustainability (Massoudi & Birdawod, 2023). Businesses that rely heavily on technology must contend with challenges such as shifting markets, fierce competition, an uncertain environment, and instability.

In terms of implementing sustainable business practices, Small and Medium-Sized Enterprises (SMEs) have received less attention in the literature than major corporations (Alam, Zhang, Khan, & Ali, 2023). Due to their size and scope

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of operations, SMEs have received less attention than major corporations. Many SMEs have lower adoption rates for environmental practices and are unaware of how their operations affect the environment. Individually, a small business has less of an impact on the environment and society than a giant corporation. However, when combined, SMEs' effects on the environment and society are far more significant than those of large corporations for a nation. According to Alam et al. (2023), SMEs are responsible for 70% of global pollution. One of the most critical factors influencing SMEs to adopt green technologies is the KM process. The study investigates how green innovation impacts environmental sustainability. One challenge is that companies green innovation practices are rated and ranked, and some organizations do not understand what green innovation projects involve. The KM characteristics that influence green innovation in businesses have not been well studied (Elshaer, Azazz, Hassan, & Fayyad, 2023; Mukherjee et al., 2023).

As stated by Polas et al. (2023), companies can successfully transform their environments by producing new information, disseminating new information, and taking new information into their operations, they would become more creative. Companies are facing mounting pressure to strike a balance between profitability and environmental sustainability. It is true that combining innovative company ideas with knowledge management can contribute to sustainability and financial success. This research will investigate how innovation and KPC—such as KA, KD, and KP—cooperate to support environmental sustainability. Promoting knowledge-seeking, absorption, and sharing has been essential to achieving organizational objectives (Tan & Zhu, 2022). Small, medium, enterprises view knowledge management as a crucial strategic advantage. It is critical to remember that evidence is often fragmented, and, therefore,, difficult to comprehend, convey, and integrate across a company's various departments. The KPC communication within the sustainability framework is related to the KM concept used in this study. Since KM can easily distribute information from different places and times, it is likely to make information sharing easier, which supports the idea that global knowledge sharing is important for the sustainability of sustainable expansion (Makhloufi, Laghouag, Meirun, & Belaid, 2022).

In this way, effective information management has measurable advantages for enhancing innovation and environmental sustainability (Rawashdeh, Abdallah, Alfawaeer, Al Dweiri, & Al-Jaghbeer, 2024). In the Indian IT industry, innovation and information management play a significant role in advancing environmental sustainability. The goal of the study is to investigate how knowledge management aspects affect green innovation in Indian IT SMEs. The impact of KM on organizational innovation has been the subject of numerous studies (Li, Li, Ozturk, & Ullah, 2023). In India, there have been few studies on knowledge management, and those that have been done have used data from big businesses (Evode, Qamar, Bilal, Barceló, & Iqbal, 2021). KMP's significance is well known, and prior research has deemed it an important consideration when researching green innovation. Only a few studies have investigated at the connection between the KMP and green innovation, despite a lot of industry discussion. KMP and the adoption of green innovation have been linked in recent studies (Rustam, Wang, & Zameer, 2020; Shibin et al., 2020). Green innovation has also been found to positively effect on environmental sustainability (Shahzad, Qu, Zafar, & Appolloni, 2021). To accomplish corporate sustainability goals, Knowledge Management (KM) is crucial, according to Oláh et al. (2020). Furthermore, Polas et al. (2023) emphasized the importance of adding to the corpus of existing information regarding KMP, environmental consciousness, and green innovation.

By providing answers to the previously specified research issues, the current study adds to the existing body of knowledge. This study first fills a research gap by employing Structural Equation Modelling (SEM) analysis to investigate the relationship between KMP and green innovation. To enhance green innovation, experts and managers today possess the knowledge and abilities needed to integrate Knowledge Management (KM) ideas into day-to-day operations. Second, this paper discusses a significant but underexplored component of green innovation and KMP, both of which support environmental sustainability. Third, India is the subject of this study; it is a highly industrialized nation that has not received much attention in the literature. Researching how the KMP, environmental awareness, and green innovation affect a company is highly encouraged (Liu & Cao, 2025). According to the Resource-Based View (RBV) theory, a company can gain a competitive advantage by recognizing and utilizing its unique and valuable assets and capabilities.

THEORETICAL UNDERPINNINGS AND HYPOTHESIS DEVELOPMENT

Resource Based-View Theory

According to the firm's Resource-Based View (RBV), a company's internal resources and competencies that are Valuable, Rare, Inimitable, and Non-Substitutable (VRIN) are the source of its long-term competitive advantage. Knowledge

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

is regarded as a vital strategic asset in this paradigm (Zahra, 2021). The organizational capacity that enables a company to efficiently utilize this resource is the Knowledge Management (KM) process, which includes knowledge acquisition, diffusion, and application. Thus, a company can create distinctive advantages, such as those pertaining to sustainability and environmental performance, by efficiently managing knowledge. The RBV states that a company's environmental sustainability is directly impacted by its capacity to gather, disseminate, and utilize knowledge. For instance, a business may obtain specialized technical knowledge regarding more effective production methods, disseminate this knowledge throughout its operations, and use it to cut waste and energy consumption (Shah et al., 2024; Varadarajan, 2020). Because it is ingrained in the business's distinct culture, daily operations, and network of knowledgeable workers, this knowledge-based competency is frequently challenging for rivals to copy. Acquiring knowledge entails looking for information about environmental risks, laws, and best practices. This information is disseminated across the organization at all levels, from frontline staff to upper management, thanks to knowledge diffusion (Jam, Donia, Raja, & Ling, 2017; Makhloufi et al., 2022). This procedure fosters a shared awareness of the company's environmental impact and the significance of mitigating it. This common environmental consciousness becomes a valuable, company-specific asset. Because not all businesses prioritize or are successful in establishing such a culture, it is uncommon. According to RBV, a company's ability to innovate in a green way is a strategic competence driven by its knowledge assets. Acquiring knowledge introduces fresh concepts and technological advancements from other sources. The RBV explains this link by demonstrating that information alone does not immediately trigger a firm's environmental sustainability measures. Rather, the information must first be absorbed and comprehended. Nevertheless, it also depends on important and relevant organizational resources(Shibin et al., 2020). The resources of manufacturing companies, such as environmental investments and top management commitment, are essential to the green innovation process. According to Varadarajan (2020), industry managers have also made extensive use of the RBV as a useful tool for determining the connection between a firm's performance and its resources.

KM Process and Environmental Sustainability

According to Ode and Ayavoo (2020), knowledge is a crucial resource for boosting a company's innovativeness, a key characteristic of firms seeking to thrive in today's markets. Knowledge must be managed to maximize its contribution. Since KM comprises a holistic approach to risk management, it includes methods in practically every management sector (Liu & Cao, 2025; Shahzad et al., 2021). The degree of expertise that businesses apply to their business processes determines their competitiveness in a competitive market, and Knowledge Management (KM) consistently leverages the acquired expertise to meet both present and emerging challenges (Jam, Akhtar, Haq, Ahmad-U-Rehman, & Hijazi, 2010; Sahibzada, Cai, Latif, & Sahibzada, 2020). It addresses issues of maturity, adaptability, and organizational sustainability in a world that is becoming more and more strange (Alam et al., 2023). Since the value gained from Knowledge Management (KM) increases with competition, it has emerged as a key competency in businesses. Firms must prioritize Knowledge Management (KM) in addition to business-driven demands that center on consumer demands and external competitiveness (Massoudi & Birdawod, 2023). Consumer demands have grown more sophisticated in the modern day as consumers look for products that best suit their wants. Both individual consumers and manufacturing companies need goods and services to be profitable and to provide them with the greatest possible advantages (Shahzad et al., 2021). KM methods have proven to be an effective strategy for these businesses to thrive in a highly competitive and dynamic environment. To assist organizations, achieve sustainable business outcomes, knowledge management is crucial (Shahzad et al., 2021). Any company's ability to develop sustainably is built on its foundation of fundamental knowledge assets and capabilities (Sahibzada et al., 2020). Knowledge management is essential for gaining a competitive edge and presents a large revenue opportunity for businesses that focus on cause-related marketing. The role that knowledge organizations play in advancing environmental sustainability cannot be overstated. Considering this, the following hypotheses are proposed:

H1: KM process (knowledge acquisition, knowledge diffusion, knowledge application) has direct impact on environmental sustainability.

KM Process and Environmental Awareness

Bülbül, Büyükkeklik, Topal, and Özoğlu (2020) state that individuals who are environmentally aware, demonstrate awareness of the risks of environmental contamination, tend to collaborate to find ways to minimize or eliminate the problem and are often willing to assist in developing solutions. KM practices are essential in this context. For

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

green innovation to be taken seriously, appropriate information is required (Galli et al., 2020). For example, individual's emotional response towards such situations, their environmental knowledge, and their readiness to adopt green innovations contribute to environmental awareness. In past literature concerning eco-SMEs has typically looked at eco-friendly behavior in many ways due to its multifaceted nature. Therefore, previously accepted practices concerning prior literature were implemented to gain a statistically validated uptake of green innovations (Rustam et al., 2020). An individual's environmental awareness is fundamental, evident from the long history of environmental research. It is a sufficient predictor of environmentally friendly behavior (e.g. recycling behaviors, or green innovation), and reflects a person's overall stance towards the environment, and their relative concern for the environmental issues that drive these behavior commitments towards green innovation (Thor & Karlsudd, 2020). Generally, higher environmental awareness would likely lead to individuals purchasing products based on their social responsibility or green claims. Environmental concern was found to have a stronger correlation to the consequential adoption behavior towards green innovation than awareness. To encapsulate this point, environmental awareness speaks to an individual's core values or beliefs and values of environmental ethics. Moreover, altruistically valued consequences positively improve environmental awareness, whereas egoistically valued consequences are negatively related to environmental awareness (Darvishmotevali & Altinay, 2022).

Tan and Zhu (2022) discovered that top management plays a crucial role in strategic decision-making in their strategic selection theory. Businesses can leverage the characteristics of senior management practices and attitudes to pursue a spectrum of environmental awareness within the same political and economic setting (Polas et al., 2023). According to Liu and Cao (2025), top management's environmental consciousness influences green innovation policy through the aspects of knowledge management. This is because the company's environmental policies are influenced by how top management supports the application of knowledge management (Sahibzada et al., 2020). On the one hand, senior management in SMEs who are highly conscious of environmental issues are more inclined to think about the possible advantages of government incentive programs. According to Alam et al. (2023) and Mohan (2024), top management of SMEs with a greater level of environmental awareness may also finds it challenging to consider the potential opportunities and commercial prospects of green technologies. Businesses are actively searching for market conditions to cover the costs of renewable engineering instead of being restricted to the minimum required environmental regulation standards (Polas et al., 2023). In addition to helping companies find external growth prospects, environmental awareness at the management level can streamline internal resources to pursue green innovation during strategic phases, improving environmental sustainability. Qadeer and Rafi (2025) examined the business-strategic choice mechanism considering the managers' identified opportunities and risks. Accordingly, the following hypothesis are proposed:

H2: KM process (knowledge acquisition, knowledge diffusion, knowledge application) has direct impact on environmental awareness.

H4: Environmental awareness has mediating impact between KM process (knowledge acquisition, knowledge diffusion, knowledge application) and environmental sustainability.

KM Process and Green Innovation

Innovation guarantees social and environmental advantages in addition to a competitive edge (Ode & Ayavoo, 2020). Related terms for innovation, such as eco-innovation, green innovation, sustainable innovation, and environmental innovation, have been established and assigned to different business divisions (Shahzad et al., 2021). Knowing the differences between these terminologies is essential. Furthermore, industrial and environmental experts view green innovation as one of the key advantages of corporate activity that boosts market demand and helps businesses succeed. Green innovation is the willingness of a business to adopt innovations in products or procedures that allow it to preserve a high level of environmental sustainability. According to Polas et al. (2023), green product innovation is the process of developing new products that have fewer negative effects on the environment over the course of their life cycles. These products should be toxin-free, recyclable, long-lasting, low in emissions, and energy-efficient.

Knowledge Management (KM) is the collection of procedures that companies use to gather, share, and use knowledge in a timely and responsive manner (Li et al., 2023; Kahil, 2025; Kanagaraj, Devi, Babu, & Ananth, 2025). The primary goal of Knowledge Management (KM) is to acquire new information while applying current knowledge to innovate and provide better outcomes (Tan & Zhu, 2022). acquisition typically refers to the process of establishing the ontologies and rules necessary for a knowledge-based sys-

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

tem. It also involves the process of gathering, organizing, and structuring information from a single source typically human specialists (Sahibzada et al., 2020). Furthermore, the participatory process of imparting knowledge to certain audiences to bring about change is known as knowledge application. Knowledge diffusion can be achieved by applying existing organizational knowledge, and it involves applying extant knowledge and information to create new, rapid solutions (Massoudi & Birdawod, 2023). Developments involving new products, systems, services, and markets all require new competences and skills, which improves already-existing knowledge and abilities (Polas et al., 2023; Sahibzada et al., 2020). Innovation has strategic benefits, can improve outcomes, and provide value for businesses. Performance and innovation can be improved with the help of an effective knowledge management system (Alam et al., 2023; Shamsuddin & Raza, 2025; Bavardi, 2024). Businesses must gather a range of knowledge regarding internal and external forces to innovate. In essence, awareness is raised when knowledge workers' ability to manage knowledge characteristics improves. Employees organizing and collaborating to gain access to knowledge strengthens organizational learning capacity. To produce new ideas, or progressive innovations, businesses need new capabilities, such as small businesses or scientific knowledge paired with knowledge management skills in a company. According to Liu and Cao (2025), businesses that are driven by innovation are expected to thrive, produce large profits, and increase their competitiveness in the market. Therefore, the following hypothesis is proposed:

H3: KM process (knowledge acquisition, knowledge diffusion, knowledge application) has direct impact on green innovation.

H5: Green innovation has mediating impact between KM process (knowledge acquisition, knowledge diffusion, knowledge application) and environmental sustainability.

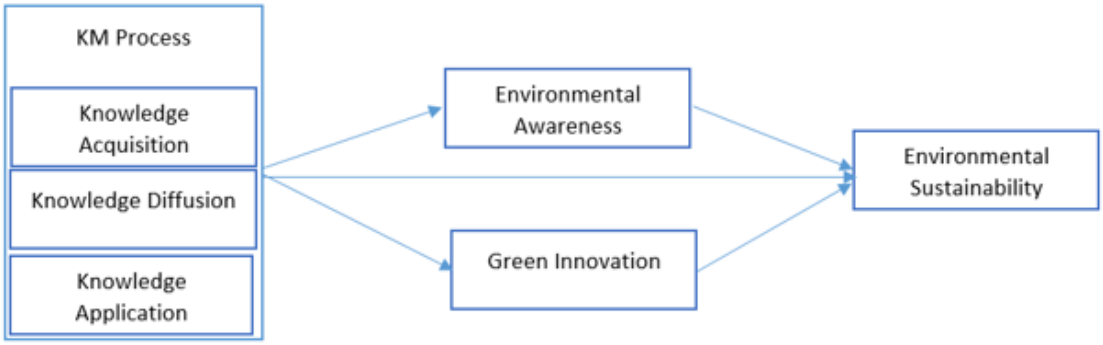

FIGURE 1. Conceptual framework

METHODOLOGY

Population

Because it facilitates the discovery of scientific knowledge through a hypothetical statistical deductive procedure, this study adopted a positivist and explanatory research methodology (Hair, Sharma, Sarstedt, Ringle, & Liengaard, 2024). A thorough set of research techniques and particular assumptions are also included in the paper. Since top and middle management of IT-related SMEs have put in place several sustainability policies and established a range of training programs to encourage involvement, Indian enterprises were ideal for this study.

Measures

The study parameters have been measured using validated scales in order to ensure consistency and reliability across constructs. The five-point Likert scale, which goes from (1) "strongly disagree" to (5) "strongly agree," is used to measure all the variables. According to Hair et al. (2024), a 32-item questionnaire was created, and it meets the minimal requirements for a comprehensive questionnaire. There are six variables in the measurement model. The dimensions of KM process are knowledge acquisition, a five-item scale was developed by Ode and Ayavoo (2020), knowledge diffusion 4-item scale measured by Ode and Ayavoo (2020) and knowledge application 6-item scale was measured by Ode and Ayavoo (2020). The mediating variable of environmental awareness was measured using a six-item scale was developed by Polas et al. (2023) and green innovation has 6-item scale was developed by Polas et al. (2023). Lastly, environmental sustainability was measured using a five-item scale by Elshaer et al. (2023).

Data Collection, Sampling Technique and Sample Size

Information was gathered from middle managers and top managers of IT-related SMEs in India. In this cross-sectional

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

study, snowball sampling was employed. Researchers and their assistants with local training collected the data. The twofold back-translation approach was used to translate the questionnaire from English into the native language. Eight CEOs reviewed the questionnaire to make sure the questions were clear. Top and middle managers working in SMEs served as the unit analysis for this study. By the end of 2024, 350 respondents had completed the questionnaires. Ultimately, 278 respondents (79.42% of the total) provided complete and accessible responses.

Data Analysis

Additionally, SEM is employed for relationship assessment and mediation analysis (Hair et al., 2024). The software SmartPLS 3.0 aided the analysis. One important factor in SEM is sample size, and the recommended minimum sample size requirements based on the R-squared methods have been satisfied (Hair et al., 2024). The data was analyzed using IBM SPSS and SmartPLS. This study employed PLS-SEM, a technique that works well when the goal is to predict and analyze the dependent variables to account for as much variance as possible. PLS-SEM is therefore an appropriate technique for forecasting. It can manage both the structural and measurement models simultaneously. Additionally, it is an effective technique for assessing complex path models (Hair et al., 2024). Lastly, PLS-SEM can produce reliable results even with smaller sample sizes. Therefore, PLS-SEM seems like a suitable approach for this study.

ANALYSIS AND RESULTS

Demographic Characteristics

Indian SMEs have a complex past period, having flourished in handicrafts and cottage businesses before to independence. These modest businesses made major contributions to local economies and were essential to rural self-sufficiency. SMEs have been essential to India's economic growth since independence, especially in creating jobs and minimizing regional inequalities. A cross-section of the firms is represented among the survey respondents. In this context, the study model and results were validated using data from 278 personnel (managers and senior executives) of SMEs in India using Smart PLS 3.0 (SEM). A specific data collection method was employed in this investigation. The participants' demographic information is shown in Table 1. Table 1 indicates that 71.9% of respondents were men, 28.1% were between the ages of 28 and 38, 51.2% were married, 48.9% had a master's degree, and 46.9% had five to ten years of work experience.

TABLE 1. Demographic characteristics

Characteristics	Categories	Percentage (%)
Gender	Male	71.9%
	Female	28.1%
Age	18-28 Years	22.7%
	28-38 Years	44.1%
	38-48 Years	13.3%
	More than 48 Years	19.9%
Qualification Level	Bachelors	22.7%
	Masters	48.9%
	Diploma	28.4%
Experience of Employees	4-5 Years	33.4%
	5-10 Years	46.9%
	More than 10 Years	19.7%
Marital Status	Married	51.2%
	Unmarried	35.3%
	Separated	13.5%

Measurement Model

Validity, Reliability and AVE values

Additionally, the measurement model is the first step in SEM. The validity and reliability of latent variables is assessed in the dimension model. The outer loadings of every variable that was observed are displayed in Table 1. According to Hair et al. (2024), the outer loading values are higher than the 0.70 threshold value. Cronbach alpha and composite reliability are examined for internal consistency. According to Hair et al. (2024), the resulting Cronbach alpha and compos-

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

ite reliability values are over the thresold value, or 0.70, indicating that all latent variables have enough reliability. Additionally, (AVE) is measured to verify the convergent validity. According to Hair et al. (2024), the AVE values are higher than the threshold value, or 0.50. The model fit is acceptable, as evidenced by the SRMR value of 0.086.

TABLE 2. Validity, reliability and AVE results

Variables	Items	Loadings	Alpha	CR	AVE	SRMR
KM Process		0.920	0.931	0.575		0.086
Knowledge Acquisition	KA1	0.749				
	KA2	0.780				
	KA3	0.772				
	KA4	0.742				
	KA5	0.766				
Knowledge Diffusion	KD1	0.790				
	KD2	0.756				
	KD3	0.757				
	KD4	0.710				
Knowledge Application	KAp1	0.757				
	KAp2	0.786				
	KAp3	0.721				
	KAp4	0.798				
	KAp5	0.733				
	KAp6	0.792				
Environmental Awareness	EA1	0.793	0.897	0.921	0.660	
	EA2	0.833				
	EA3	0.793				
	EA4	0.797				
	EA5	0.824				
	EA6	0.835				
Green Innovation	GI1	0.739	0.912	0.932	0.696	
	GI2	0.835				
	GI3	0.869				
	GI4	0.842				
	GI5	0.859				
	GI6	0.855				
Environmental Sustainability	ES1	0.842	0.874	0.909	0.667	
	ES2	0.849				
	ES3	0.872				
	ES4	0.797				
	ES5	0.713				

TABLE 3. Discriminant validity result

	1	2	3	4
Environmental Awareness	0.883			
Environmental Sustainability	0.651	0.867		
Green Innovation	0.739	0.811	0.834	
KM Process	0.633	0.732	0.711	0.829

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

Discriminant Validity

To consider the discriminant validity, the Fornell-Larcker method is applied at the initial stage. The discriminant validity assessment approach focuses on the AVE square root, which must be higher than the correlation values between the constructs in the measurement model by Fornell and Larcker (1981). The discriminant validity score of the Fornell-Larcker approach is in Table 3. All variables show strong discriminant validity because the square root of AVE values are higher than the inter-construct correlations.

HTMT

It was determined that the HTMT values are significantly below 0.85. According to Hair et al. (2024), the variables' discriminant validity has been established when the HTMT value is less than 0.85, which is statistically suitable (Table 4).

TABLE 4. HTMT

	1	2	3	4
Environmental Awareness				
Environmental Sustainability	0.717			
Green Innovation	0.811	0.732		
KM Process	0.683	0.812	0.774	

Structural Model Assessment

Another crucial step in the validation process is the evaluation of structural models. T-values and R^2 values have also been assessed using the 5,000 resample bootstrapping procedure. Figure 2 displays the results of the measurement model. All indicators tended to have outside loads that were higher than permitted. All variables have strong path coefficients. Multi-collinearity is the first step in examining a structural model (Hair et al., 2024). Since every VIF value is below the threshold of 5 (Hair et al., 2024), the results demonstrate that there is no collinearity problem in the data.

Direct and Indirect Hypothesis Testing

Table 5 displays the findings of the hypothesis assessment. KM process has significant and positive effect on environmental sustainability (β = 0.270, p = 0.000). KM process has significant and negative effect on environmental awareness (β = -0.633, p = 0.000). KM process has significant and positive effect on green innovation (β = 0.711, p = 0.000). Furthermore, environmental awareness has mediating significant effect between KM process and environmental sustainability (β = 0.322, p = 0.005). Also, green innovation has mediating significant effect between KM process and environmental sustainability (β = 0.459, p = 0.000).

TABLE 5. Direct and indirect hypothesis results

Hypothesis	Relationships	β Value	t Value	p Value	R-Square
H1	KM Process → Environmental Sustainability	0.270	4.879	0.000	0.743
H2	KM Process → Environmental Awareness	-0.633	15.063	0.000	0.401
H3	KM Process → Green Innovation	0.711	22.770	0.000	0.505
H4	KM Process → Environmental Awareness → Environmental Sustainability	0.322	2.150	0.005	
H5	KM Process → Green Innovation → Environmental Sustainability	0.459	8.516	0.000	

DISCUSSION

In larger companies, Knowledge Management (KM) is an essential function. However, it was found that KM is used in SMEs as well as in large corporations. There is a relatively level playing field for the growing and development of SMEs. Nonetheless, our findings demonstrate that all KM practices knowledge application, diffusion, and acquisition have a favorable effect on SMEs' adoption of green innovation. Each KM component's positive effects on green innovation show that KM has a favorable impact on green innova-

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tion. The study aims to explore the effects of knowledge acquisition, information diffusion and knowledge application on green innovation in India, particularly IT related SMEs. The results showed that green innovation was positively impacted by the three methods. Alam et al. (2023) have shown that the three KM dimensions significantly impact innovation, and this finding is in line with their results. However, these findings are not fully justified by the results of Liu and Cao (2025), Massoudi and Birdawod (2023) and Sahibzada et al. (2020) associating KM dimensions with green innovation. These researchers contend that while KM processes are beneficial for green innovation, they are detrimental for environmental awareness. Polas et al. (2023) partially support the present results, although not entirely. The KM process significantly influences green innovation, which supports the green environment and is somewhat compatible with it, as well as consistent with the findings of Shahzad et al. (2021).

Additionally, this study demonstrates that the KM approach significantly and favorably influences green innovation. A company may be more inventive and spread knowledge more widely if it uses more intelligence or experience. The KM process leads to innovation. According to the study, KM significantly influences innovation-related activities. This result supports the assertion made by Alam et al. (2023) and Darvishmotevali and Altinay (2022), that businesses with a high level of knowledge-based activities are more likely to provide their clients with cutting-edge products and services. For this reason, knowledge from a variety of sources must be learnt, developed, and applied in business innovation. In a similar vein, companies that promote information sharing and dissemination among their staff may inspire fresh concepts for green innovation. Since KM is the result of successfully applying new information, methods of KM and innovation are frequently applied in an unchanging manner. This covers the process of finding, acquiring, sharing, or transmitting novel ideas and knowledge. Additionally, companies ought to be ready to provide innovative KM process. It suggests that increasing awareness (and even more strategically targeted awareness) just a little, positively foster the movement towards sustainable practices. This mediation pathway also reinforces the continued significance employee/stakeholder awareness has in germinating employee to move on from strategic sustainability, to behaving sustainably. This means, green innovation is a vital strategic mechanism, affirming academic suggestions from Makhloufi et al. (2022), who suggested that KM has value in sustainability, when it manifests itself in physical innovative products and processes. This contradicts slightly with a few studies (Li et al., 2023; Sahibzada et al., 2020; Shibin et al., 2020) that suggest there is a positive connection. This aspect also need more attention to understand the specific conditions and type of KM processes may lead to this situation. The significant positive association is notable, particularly when considering that KM, when targeted and executed in an efficient manner (where knowledge is shared, knowledge is created /developed and applied) as a key driver of developing 'green' products, processes and services. The findings reinforce that though a structured KM process is undeniably an excellent process for increasing green innovation, management must be mindful of their KM processes that are not only increasing green innovation but also increasing environmental awareness. The findings present a dual mediating relationship involving green innovation and awareness and reinforce that the most sustainable outcome are achieved through a holistic approach - using KM to provide innovative solutions while simultaneously increasing employees awareness.

Theoretical Implications

The results of this investigation have several theoretical implications. From a theoretical perspective, KMP is an emerging topic of study. Although the academic literature is increasingly addressing KMP, there is still a limited number of research papers that address the interrelationship area of each of the KMP constructs through green innovation and environmental awareness mediation in a holistic framework (Rustam et al., 2020). By empirically analyzing the significance of KMP and its aspects in enhancing GI and EA, this work examined a hitherto uncharted field and sought to fill a research gap, ultimately bolstering the RBV theory. According to the study's findings, KMP may facilitate the efficient use and administration of knowledge resources as well as the streamlining of processes to enhance green innovation and environmental awareness.

This brings the RBV from the most general organizational context, to a narrower and increasingly imperative, sustainability context. Here, findings indicate that a firm's capability to manage knowledge to develop green innovations, is a unique resource that is not easily imitated by competitors, likely facilitating the firm's long-term environmental sustainability. Overall, by identifying and situating the study within India, a highly industrialized but understudied context in this area, the study enhances the generalizability of these theories to a prominent developing economy. This regional context is a unique lens through which to explore

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

how global management and sustainability theories play out in diverse industrial contexts. The KMP and previously underdeveloped green innovation were found to be significantly mediated by environmental awareness in this study (Shahzad et al., 2021; Shibin et al., 2020). The examination of the mediating role of environmental awareness in the proposed model provides a novel theoretical perspective in the context of emerging economies. This study offers several insights that can guide future research investigations because there have not been many studies that look at how green innovation functions as an intervening variable in different cultures (Darvishmotevali & Altinay, 2022). According to the research, environmental awareness plays a significant role in determining green innovation and all of its facets that support SD and maintain a clean environment. Nonetheless, the environmental aspect of green innovation is greatly influenced by environmental consciousness. Consequently, this study contributes to the RBV in the context of developing nations, proving that environmental awareness remains a crucial component of green innovation. Lastly, this study offers fresh perspectives on how to raise environmental awareness to accomplish green innovation through sharing and using the knowledge gained in business operations and strategic plannings.

Practical Implications

A helpful handbook for manufacturing professionals and practitioners is created in this study. It facilitates understanding the significance of Knowledge Management (KM) in administrative measures for the transition into an environmentally, commercially, and socially sustainable and innovative organization. Top management needs to invest more time and consider workforce development through KMP as a crucial instrument for enhancing GI and EA to do that. This means that in a formalized KMP has been developed to deliver innovation, there are still challenges that require an intentional effort to ensure that all employees understand sustainability is a valuable corporate attribute, worth paying attention to. For innovators and policymakers in India or other nations with similar industrial structures, the conclusions are that firms require policy support to establish KM best practices, measure and integrate green innovation into their models (Sahibzada et al., 2020). There is potential for policies such as grant funding for technology, tax incentives for firms with strong green innovation metrics or funding a knowledge-led sector wide network to facilitate transition to sustainable economy.

To educate and assist managers in creating a long-term organization, specific programs may be implemented. Because of this, Knowledge Management (KM) plays a significant role in determining green innovation in developing nations where businesses are less inventive than those in rich nations. Additionally, it is important to recognize KM is a crucial step for Green Innovation (GI) and long-term environmental sustainability, and that it is equally critical for Indian managers. If managers are expected to cultivate a work environment that improves green innovation and performance outcomes, they will need to provide employees with platform for self-organization that enable them to connect with other employees and share respective knowledge and practices. For this reason, workshops, seminars, and socialization training for employees should be organized.

Limitations and Future Research

This study has several limitations that suggest opportunities for future research. First, SMEs in a single nation (India) were used in this study. Therefore, to generalize the findings, future studies should include data from other countries and larger multinational corporations. Second, further research is required in the research area. Anecdotal data suggests that wealthy nations' rates of green innovation are not particularly low. Third, the research design for this paper was cross-sectional since the data was gathered at a specific moment. A follow-up study that lasts three years will determine whether these factors influenced green innovation. Fourth, some researchers have shown that senior management's religious convictions can influence their environmental position; this variable may be considered in future research. Above all, it is advised that more research be done on how to achieve environmental sustainability in severely polluted developing countries.

Finally, future research can examine the role of different contextual factors in shaping the nature of the relationships among environmental sustainability, GI, EA and the KM process. For example, more exploratory studies could examine the determinants of these relationships by utilizing organizational size, industry structure, and national culture. Overall, the research provides helpful considerations in relation to how KM and GI can contribute to environmental sustainability. Despite the many limitations of the research, the findings may point to future possibilities of exploring these relationships. Moreover, exploring the implications of several effective ways to promote ecological sustainability and GI under a more comprehensive understanding based on doing contextually-appropriate KM, GI, and EA research may indicate useful avenues for future research.

DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X

CONCLUSION

The study model focuses on investigating the relationships among environmental consciousness, green innovation, and Knowledge Management Processes (KMP). The factors in this study are explained in terms of green innovation and Knowledge Management (KM). Environmental awareness acts as a mediator between Knowledge Management (KM) and environmental sustainability, the dependent variable, whereas knowledge acquisition, dissemination, and application served as independent variables. Furthermore, whereas green innovation acted as a mediator between Knowledge Management (KM) and environmental sustainability (a dependent variable), the other KM dimensions—KA, KD, and KAp served as independent factors. To evaluate the study model or validate hypotheses, a SEM technique was employed. There was a positive correlation between awareness management and green innovation. This implies that SMEs in India are more likely to engage in green innovation when they exhibit significant behaviors related to KMP. The study looked at how SMEs perceive KM dimensions and green innovation at the same time. It also looked at how a KM dimension might encourage innovation in SMEs. They will be helpful to organizations in identifying any area where they might find chances for innovation, knowledge sharing, and acquisition to improve the implementation of environmental sustainability. According to this study, companies that use Knowledge Management (KM) would encourage green innovation in Indian SMEs who are constrained by a lack of funding and other resources. The benefits are not fully recognized by SMEs when more of them are unaware of this KM procedure. This is because most businesses are unable to efficiently manage their own internal resources. Weak management structures can hinder SMEs due to the absence of a well-established internal framework capable of supporting new processes. Through this study, SMEs are encouraged to better utilize their internal resources to gain a competitive advantage.

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DOI:https://doi.org/10.20474/jabs-11.1.2
ISSN: 2414-309X