The Role of Knowledge Management and Green Innovation in Sustainable Performance

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ABSTRACT

This study investigates the function of knowledge management (KM) in fostering sustainable performance through green innovation actions and strategies. Data were gathered for the study from managers at several organizations in services and manufacturing industry. In order to examine how knowledge management processes, which include knowledge creation, acquisition, sharing, and application, affect the advancement of green innovation actions and green innovation strategies, and sustainable performance using structural equation modeling (SEM) was used. The findings indicate that knowledge management has a substantial and positive impact on both green innovation and sustainable performance. A sub-dimensional investigation further revealed that, with the exception of knowledge acquisition, which demonstrated insignificant effects on sustainable, all other paths showed statistically significant outcomes. Furthermore, the study underscores the universal significance of KM for firms.

1.   Introduction

Organizations encounter dynamic problems in the ever-changing business environment as a result of sociological, technical, and environmental developments (Yousaf, 2021). Particularly since the internet came into existence, which has removed geographic restrictions and promoted globalization, businesses now work very differently. Customers can now seek out alternatives that fit their needs at a lesser cost thanks to easy access to suppliers worldwide, providing a substantial challenge for businesses looking to keep a competitive edge (Yousaf, 2021).

To fix these problems and reach long-term performance goals, businesses have used methods such as Total Quality Management (TQM) and Knowledge Management (KM). A business can't do well without knowledge, which is often thought of as an intangible good. Dynamic businesses use knowledge to make customers happier and fight better in the market (Bukari et al., 2023). A lot of attention has been paid to KM over the last 20 years because it is so important for managing business processes, coming up with new products and services, and making strategies. At the same time, companies are under pressure to stop using environmentally harmful methods and adopt sustainable performance due to growing environmental concerns and resource depletion. Green innovation is one strategy that is gaining popularity for achieving long-term performance targets. This concept aims to persuade businesses to produce environmentally friendly goods (Shah et al., 2021).

One strategy that has gained prominence in achieving sustainable performance goals is green innovation. This concept aims to encourage firms to develop environmentally friendly products. To achieve this, firms need to consider not only actions but also administrative strategies. Green innovation encompasses green actions and green strategy (GS). Green actions integrate environmental knowledge with green strategy to develop products and processes that save resources and promote harmony between the environment, economy, and production processes. GI involves restructuring or adopting new management systems to improve processes, reduce negative environmental impacts, and enhance sustainability (Roh et al., 2022).

While many facets of KM and sustainable performance have been researched, less attention has been paid to the role of KM in attaining sustainable performance through green innovation (Shahzad et al., 2020). Particularly in KSA's manufacturing and service industries, little research has examined the causal links between these factors using multivariate statistical methods and structural equation modeling (SEM). This study investigates the multifaceted interaction between KM, green innovation, and business sustainable performance in an effort to close this gap. It also looks into how KM practices affect initiatives for sustainable performance and green innovation (Sahoo et al., 2023). The study takes organizational size and industry category into consideration as control variables since it recognizes the significance of contextual factors.

This study clarifies the important roles that knowledge management and green innovation play in promoting business sustainability. Organizations can better understand how to overcome the difficulties presented by the changing business landscape and contribute to a more sustainable future by examining how these elements interact.

The current study considerably adds to the body of literature by answering the research phenomena under study. First, it fills a research gap by investigating the connection between Sustainability Performance (SP) and Knowledge Management (KM) utilizing advanced multivariate analysis via structural equation modeling (SEM). The results of this study also enable professionals and managers to improve Green Innovation within their organizations by integrating KM practices (GI). Second, this research illuminates the hitherto untapped idea of the synergy between organizational actions towards green innovation and green innovation strategy in enhancing corporate sustainability performance (CSP). This part of the study offers insightful information in a field that hasn't gotten much attention. Considering the significance of CSP, encompassing environmental, economic, and social sustainability practices (Moslehpour, 2022), there is a compelling rationale for exploring the impact of KMP, GI, and OA within organizational settings.

2. Literature Review
2.1. Knowledge Management (KM)

Many organizations throughout the world perceive knowledge management (KM) as a crucial element to gaining a competitive advantage by creating value in the business operation or product and services (Anshari & Hamdan, 2022). Many authors in the business and government sectors emphasize how crucial knowledge management is to an organization's overall performance (Rezaei, 2020). Even though KM is known to be important, many businesses have trouble putting it into practice, usually because of cultural differences. KM has become an important area of study for both researchers and people who work in the field of modern leadership and management. All researchers agree that KM is an integrated and collaborative method that helps businesses create, capture, organize, access, and use their intellectual assets and resources for long-term success and strategic advantage. KM's popularity around the world shows how its principles and practices are being used more and more in businesses. There are three steps to KM activities, setting up a space for learning and creating knowledge, creating an organization's knowledge design that lets new ideas and flexibility work, and coming up with a way to make money from knowledge and creating value. It is the link between knowledge management and sustainability that this study is based on. This shows how important knowledge management is for promoting sustainable growth around the world. KM's ability to make it easier for people from different places and times to share information is especially useful in this situation (DELIU, 2020). As the need for environmentally friendly features grows, we

really need ways to improve knowledge management (KM) by looking at how they affect people's mental health, the economy, and the environment.

2.1.1.Knowledge Creation

Green knowledge creation means coming up with new information, thoughts, or ideas that have to do with the environment (Abbas & Khan, 2023). It comes from how implicit and explicit knowledge interact with each other in the capacities of a person, a group, or an organization. Companies that are on the cutting edge actively urge their workers to share what they know, which creates an environment that is good for creating new knowledge. Sufficient resources, including infrastructure and facilities, are essential in facilitating individuals' acquisition of new knowledge and skills, thereby promoting the progress of environmentally conscious economic growth and sustainable development. The phenomenon of knowledge generation arises from the dynamic interplay between pre-existing knowledge and the acquisition of novel information. This acquisition occurs through diverse modalities, including active engagement in actions, acquiring practical experience, and engaging in interpersonal interactions (Peña-Torres & Reina-Rozo, 2022). Allocating enough resources to support the creation of new knowledge is crucial for businesses because it greatly improves their ability to innovate and develop cutting-edge technologies (Malik et al., 2023). Consequently, these advancements have the potential to ultimately result in enhanced sustainability for these enterprises. Bleeker et al., (2023) argues that dynamic organizations proactively foster a conducive atmosphere that facilitates the generation of knowledge by incentivizing their workforce to openly exchange their specialized knowledge. They create systems that encompass infrastructure and mechanisms for sharing information, which effectively support the process of generating innovative knowledge. Furthermore, it is acknowledged by these organizations that the utilization of both monetary and non-monetary rewards is essential in incentivizing employees who actively contribute novel ideas or innovative solutions (Tasoulis et al., 2023).

2.1.2.Knowledge Acquisition

The ways that businesses collect, use, and arrange information about protecting the environment are called "green knowledge acquisition." There are details in this report about tools and services that can help protect the environment. People can learn a lot of different environmental problems from both inside and outside sources. However, remember that people might often forget the lessons they have learned. It is crucial that businesses develop effective methods to maintain data organization because of this. It is important for green information Management (GKM) that this information base is well organized. This is also called organizational memory (Abbas & Khan, 2023). An active GKM system makes it easy for eco-knowledge that has been learned or stored to move smoothly. Sharing green knowledge means giving environmental information to suppliers, competitors, coworkers, or other key figures in the company. The purpose of this sharing is to stimulate ideas for new tools, technologies, approaches, and strategies that businesses may use to reduce or completely eliminate their environmental effect. This information-sharing trend can be altered by a variety of factors, including infrastructure, technology, corporate culture, and incentive and recognition programs. Information sharing is essential to improving things, thus it's critical to foster an environment that supports it. The concept of knowledge acquisition pertains to the various activities undertaken by organizations in order to obtain, extract, and organize knowledge from diverse sources (Cross et al., 2001). A considerable portion of employees acquire knowledge through internal channels, such as engaging in interactions with their team members and colleagues. This observation implies that there exists a positive association between the level of interpersonal acquaintance among employees and the probability of experiencing enhanced productivity. The process of acquiring knowledge from external sources encompasses the gathering of information derived from various entities, such as customers, competitors, suppliers, partners, and experts (Abbas & Khan, 2023). The primary goal of knowledge acquisition is to obtain a thorough comprehension of customers' needs and their interactions with the products and services provided by the organization. Organizations adopt strategic modifications with the aim of achieving customer satisfaction, thereby promoting enhanced economic sustainability (Rao & Holt, 2005). Assert that the financial performance of an organization is positively influenced by its capacity to acquire and assimilate knowledge. In a similar vein, posited

that in order to effectively pursue sustainable development objectives, organizations must effectively incorporate acquired knowledge into their operational processes.

2.1.3. Knowledge Sharing

Sharing knowledge is thought to be the most important part of making KM work. Workers converse with one another about their experiences, abilities, and knowledge as they exchange information. It guarantees that workers have access to firm information whenever they need it. It helps protect intellectual property and boosts work, among other things. People who are willing to share their knowledge, information technology (IT), and staff motivation have all been shown to have a big impact on knowledge sharing (Nguyen et al., 2019).The information that peoples have is useless until it is used and shared by people who work for the same company. knowledge is created invisibly in the human brain and only the right organizational climate can persuade people to create, reveal, share and use it (Al-Kurdi et al., 2020). Companies and their leaders can create a relaxed and friendly atmosphere that might make workers more likely to share their thoughts and information. Being able to use technology is a must for sharing information. The act of knowledge sharing involves the transmission of either explicit or tacit knowledge to an individual or a collective entity (Wong, 2013). Social interaction within organizations is widely recognized as a prominent method for fostering creative problem-solving among employees (Al-Kurdi et al., 2020). Additionally, it has been acknowledged for its significant contributions in facilitating the development of effective strategies, decision-making processes, and the establishment of a conducive learning environment (Sheate & Partidário, 2010). The act of sharing knowledge among workers has been found to have a significant impact on the enhancement of both explicit and tacit knowledge. This, in turn, leads to a reduction in errors and mistakes, as well as an improvement in operational and economic sustainability (Ali et al., 2022).Dynamic firms perceive knowledge sharing as a social responsibility and actively engage in social awareness programs. In order to foster collaborative innovation and cultivate a culture of mutual benefit, educational institutions disseminate their experimental findings to the public, enabling other organizations to utilize this information for innovative endeavors. Several organizations disclose the specifics of their manufacturing procedures in order to promote transparency in their operations and establish trust with their customers.

2.1.4.Knowledge Application

Integrating new or saved environmental knowledge into decision-making and the creation or delivery of eco-friendly goods and services is what "green knowledge application" means (Yu et al., 2022). Businesses try to employ environmentally friendly tools and procedures when performing their tasks. They can eliminate it or significantly lessen the harm they inflict in this way. Businesses get an advantage over their competitors by experimenting with new concepts, instruments, and techniques in this fashion. According to Nonaka, businesses must exchange and apply information in order to grow their core competencies and learn new things. Sharing information and using it are both important parts of the process of creating knowledge. The process of knowledge application entails the practical implementation of knowledge that has been acquired, with the aim of creating and delivering products and services within an organization (D. Wang et al., 2014). Furthermore, it includes the capacity of an organization to promptly adapt to operational changes through the utilization of technology and strategic approaches, as well as to capitalize on these changes in the creation of novel products and services (H. Wang et al., 2022). The application of knowledge plays a crucial role in the development of new core competencies within organizations and in improving their economic performance.

By effectively applying knowledge, businesses have the opportunity to uncover novel processes that possess the capacity to greatly augment their overall performance. Dynamic organizations prioritize the incorporation of eco-friendly practices and the integration of both established and new knowledge into their research and development endeavors in order to introduce inventive processes and technologies, thereby aligning with the interests of stakeholders. According to Argyropoulos et al., (2017), this particular approach enables organizations to produce products of superior quality while simultaneously reducing resource consumption. As a result, both the environment and the organization itself stand to gain significant benefits.

2.2. Sustainable Performance

The concept of sustainable performance emerged some thirty years ago in response to global environmental issues, particularly those pertaining to natural resources and energy. The most significant occasion was the 1972 Stockholm Conference on the Human Environment, where it was decided that human activity was endangering the environment and the next generation. An organization's sustainable performance shows how well it can meet the long-term goals and expectations of customers and other important people. This success is due to smart management, knowledgeable employees, a dedication to ongoing learning, and a willingness to make the right changes and improvements (Alraja et al., 2022). This is why it's very important to look for chances that can help an organization keep doing well while incorporating models of quality management systems. Organizations that want to keep up their performance need to be aware of their duties to different groups of people and keep changing their activities, methods, and tools to keep improving performance.

The first hypothesis is concerned with the relationship between knowledge management and sustainable performance.

H1: Knowledge management positively impacts an organization's sustainable performance through knowledge creation, acquisition, sharing, and application.

2.3. Green Innovation

Fussler and James (1996) are credited with introducing the term "green innovation." This term refers to new products and processes that help businesses and customers while having little negative effect on the environment. Abbas & Khan, (2023) gives another definition of "green innovation" as changes that are made to organizational technologies, management systems, products, and processes that are meant to protect nature by reducing waste and pollution. These innovations include new ways of managing, new products, and new service (H. Wang et al., 2022).

Innovative ideas give businesses a competitive edge in addition to helping society and the environment. There is a wide range of terminology used when discussing business innovation. Green innovation (GI), environmental innovation, sustainable innovation, and eco-innovation are a few of these. It is very important to tell these terms apart based on their differences. Research from the past shows that words like GI, eco-innovation, ecological innovation, and environmental innovation are often used to talk about the same thing. Sustainable innovation considers social and environmental factors in its innovation process (J. Wang et al., 2023). Eco-innovation typically focuses on both the environment and business. One thing that sets sustainable ideas apart from innovative ones is that they consider social and moral problems along with business and competition goals.

When Saleh & Brem, (2023) talk about "green innovation," they mean both hardware and software changes that make products or processes greener. Energy-saving, environmentally friendly product development, pollution reduction, and environmental management in business are all made possible by new technology. Protecting the environment, gaining a sizable share of the market, making money, and learning new things while creating innovative ideas are the goals of green innovation. Green innovation seeks to safeguard the environment, advance technology, lessen pollution, and produce eco-friendly goods. To boost overall performance, keep ahead of the competition, and turn a profit, businesses must innovate in a sustainable way (Yadegaridehkordi et al., 2023). This is a crucial part of sustainable development since it involves creating new goods, services, ideas, operating procedures, or perspectives on environmental issues. A number of important factors that impact green innovation have been found. Some of these are market and customer needs, company ethics, pressure from stakeholders, and the chance to learn about the environment. People think that evaluating green innovation and its parts is important for making businesses more environmentally friendly. Eco-friendly technologies are now essential if you want to stay in business, not just a method to outperform the competition (Jiakui et al., 2023). Innovation is the application of novel goods, processes, services, and organizational schemes to improve the state of affairs . This is meant to help

companies do better in the market. "Green innovation" means new ideas that are good for the earth.

Green innovations in term of green actions and green strategies. When taken as a whole, these elements motivate businesses to take environmentally friendly and long-term growth-promoting actions. Organizations that practice "Green Actions" take practical, on-the-ground measures to lessen their environmental effect. It involves creating goods and practices that are more environmentally friendly. Green activities can include anything from using cleaner ways to make things and adding technologies that use less energy to creating packaging and materials that are better for the environment (Awais et al., 2023). The main goal is to use fewer resources, make less trash, and release fewer harmful chemicals into the air. Green actions show a dedication to operational success that is in line with protecting the environment. The second part is green strategy, which is the idea and management side of encouraging eco-friendly behaviors. Creating and using new management systems and strategies with a strong focus on protecting the environment is part of it (Marcon et al., 2022). These strategies are meant to improve how organizations work, lessen their bad effects on the environment, and encourage sustainability. A green strategy is necessary to figure out how to include environmental issues in an organization's purpose and values in a complete way. It tells organizations how to run and engage with the economy, society, and the environment. It also sets the overall standards for green actions.

In real life, green deeds and green strategies go hand in hand. The big representation and direction of a green strategy are set by green actions, which are the specific steps and actions that are taken to make that strategy real. All of these factors work together to encourage new ideas and make progress toward sustainable development goals while minimizing damage to the natural environment.

2.4. Green Knowledge Management and Green Innovation

More people are worried about the environment, mostly because of how quickly businesses use up natural resources. This makes it very hard for leaders of organizations to make choices. To protect the earth, people and the government are telling companies that they need to change how they do business. People now want to buy and use services and goods that are good for the world. Businesses are using green production capabilities to make their products and services better for the earth because people are becoming more concerned about it (Serrano-García et al., 2023). Sustainable development aims to create eco-friendly products and processes, and one important method that firms can do is through green innovation. Green innovation, according to an earlier study Li et al., (2022), refers to the introduction of notably improved technologies or management systems that consume a great deal fewer natural resource, generate a great deal less pollution, and have a negative impact on the environment. There are two categories of green innovation: managerial and technological. Green technological innovation is the process of improving existing goods or processes or developing new ones that consume less energy and resources by utilizing technology and environmental understanding. Green product and process innovations fall within this category. The focus of green product innovation is on making materials and packages that save energy, cut down on or get rid of toxic gases, protect the environment, and stop pollution (Nayak et al., 2022). Using materials that break down naturally, save energy, and harm the earth as little as possible are the major goals. Also needed are long-lasting, reusable items made from non-toxic or eco-friendly materials. Conversely, green process innovation modifies industrial tasks such as operations and assemblies to promote environmentally conscious behavior both within and beyond the organization. Its objectives are to reduce energy consumption, develop new processes, and enhance current ones in order to increase production, recycle resources, and make them more energy-efficient. Yusliza et al., (2019) say that green management innovation means using new management systems or changing the way old ones work to make production and management better. Ultimately, this eliminates or lessens environmental risks and might even be good for the environment. As this study shows, Green Knowledge Management (GKM) systems are very important for encouraging green innovation at both the individual and organizational levels. KM increases organizational concern and information about environmental issues, which aids in the development of fresh knowledge, concepts, and practical solutions by enterprises to aid in environmental restoration (Cheng

et al., 2023). The importance of many types of knowledge, including supply chain and technological knowledge, in innovation has been examined in a number of recent studies. But there is still much to learn about GKM's contribution to accomplishing green innovation objectives.

The second hypothesis investigates the relationship of the impact of green innovation on sustainable performance

H2: Green innovation through green innovation actions and strategies mediates the relationship between knowledge management and sustainable performance.

Based on the above discussion this study proposed the following research model presented in Figure 1 below. Knowledge management which is an independent variable, is measured through four dimensions: knowledge creation, knowledge acquisition, knowledge sharing, and knowledge application. Similarly, the dependent variable is mentioned as sustainable performance. While mediating variable "green innovation" as been identified by two dimensions i.e. green innovation actions and strategies.
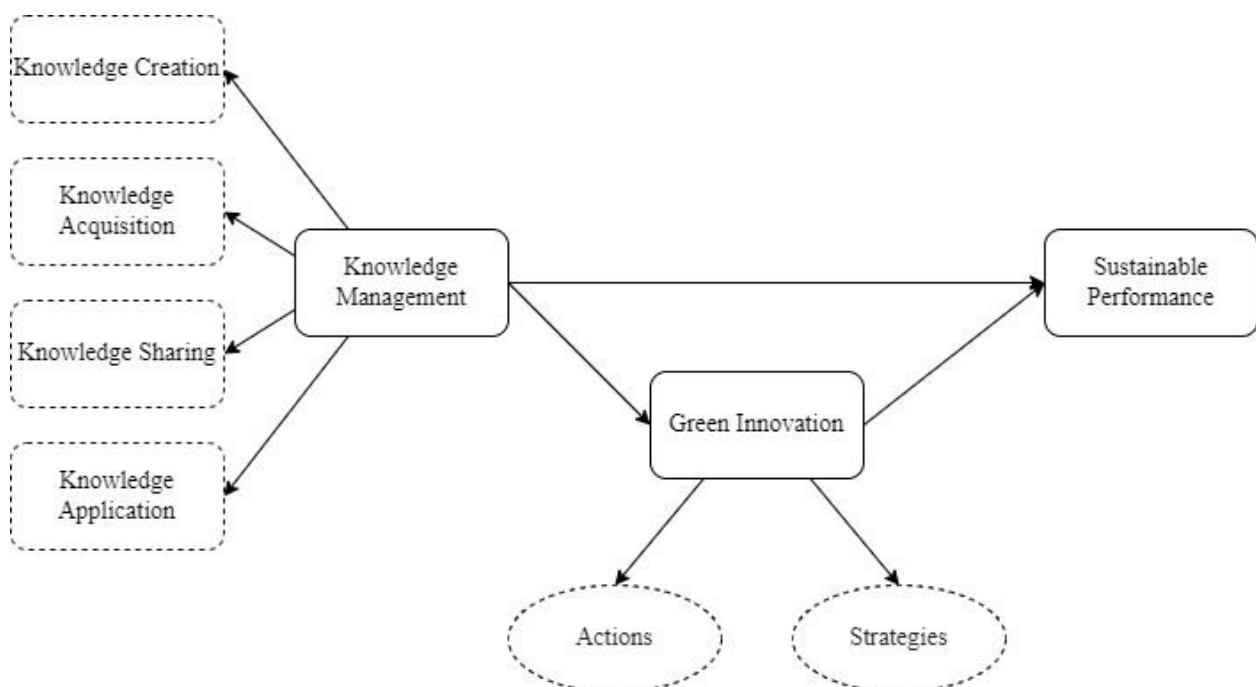

Figure 1: Conceptual Model

3. Research Methodology
3.1. Research Design and Sampling

The various interactions between Knowledge Management (KM), Green Innovation (GI), and Sustainable Performance (SP) were examined using a quantitative research methodology. The study design includes the gathering of cross-sectional data, hypothesis testing, and structural equation modeling (SEM). This study employed a convenience sampling technique (Andrade, 2021) to choose respondents in organizations operating in the manufacturing and service sectors in the Kingdom of Saudi Arabia (KSA). Structured surveys have been sent to employees at different levels from top to lower in the chosen organizations to gather data. Additionally, data regarding an organization's performance over time will be collected through publicly accessible reports or its own records. The groups that make up this study's people are businesses in the production and service sectors of the Kingdom of Saudi Arabia (KSA). These areas are especially interesting because they might have an effect on the environment and are connected to sustainable growth. The sample size was checked and followed the guidelines of Hoelter (1983) who said that factor analysis needed a sample size of at least 200. The current study had 320 respondents and 307 responses were selected for analysis, so this requirement was met. The demographic information of respondents is given in Table 1. Descriptive statistical

analysis is used, like means, standard deviations, rates, and percentages to summarize and show the data. This analysis gave a quick look at the sample and the important factors.

Table 1
Demographic Results

Demographics	Description	Statistic	Percentage
Gender	Male	215	69.80%
	Female	93	30.20%
Position	Top Management	50	16.23%
	Middle Management	101	32.79%
	Lower Management	157	50.97%

3.2. Analysis of Measurement Model

There were four separate parts of the study instrument. In the first part, the respondents were asked to give demographic information. The second part had 22 questions that measured the four aspects of knowledge management (KM): creating knowledge (CR), acquiring knowledge (AC), sharing knowledge (SH), and applying knowledge (AP). Questionnaires were used in this part to test each of these characteristics. The amount of knowledge people shared was measured by seven items, the amount of knowledge people used was measured by six items. The amount of knowledge people wrote down and learned was measured by five items. These questions come from the work of Darroch, (2005), Chowdhury et al., (2022), and Papa et al., (2020). In the third part, there were eight items that had to do with sustainable performance (SP) which were taken from Sharma et al., (2021). The fourth part had eight things that were about green innovation. These were made up of green innovation actions (GIA) and green innovation strategies (GIS). These items were adapted from a study of (Wong, 2013).

A pilot test was done to make sure that the adapted questionnaire would work well, be reliable, and be valid in the context of KSA. For this pilot test, 21 answers were gathered from employees of different businesses in KSA. Based on the reliability scores of 0.81 to 0.89, this pilot test showed that the items were very similar to each other. According to Hair et al., (2020), these numbers were a lot higher than the suggested level of 0.70. So, the researcher went ahead with the next poll. Before going further, the reliability and validity of the instrument have been thoroughly checked using confirmatory factor analysis (CFA). The reliability of the instrument has been determined through Cronbach's Alpha. It is noted that Cronbach's alpha value for the instrument is 0.944 which is higher than the minimum standard value of 0.70. The validity of the instrument was assessed through convergent and discriminant validity. Factor loading has been utilized to measure convergent validity with a threshold value of 0.60 as suggested. Moreover, the average variance extracted (AVE) was also studied followed by factor loading to measure convergent validity. It is found that not all the items have factor loading above the threshold level however, AVE is higher than 0.50 for each dimension. Table 2 below presents the factor loading and AVE values.

Table 2
Reliability and Validity Analysis

Construct	Items	Factor Loading Ranges	Composite Reliability	AVE
Knowledge Creation	5	0.55-0.84	0.889	0.702
Knowledge Acquisition	5	0.37-0.80	0.844	0.783
Knowledge Sharing	4	0.28-0.89	0.901	0.642
Knowledge Application	4	0.11-0.86	0.827	0.759
Sustainability Performance	7	0.67-0.943	0.916	0.615
Green Innovation Action	3	0.425-0.838	0.879	0.725
Green Innovation Strategies	5	0.782-0.817	0.834	0.719

Figure 2 below provide the graphical representation of the factor loading through AMOS output. The factor loading for item less than 0.50 were removed form the model for further analysis.
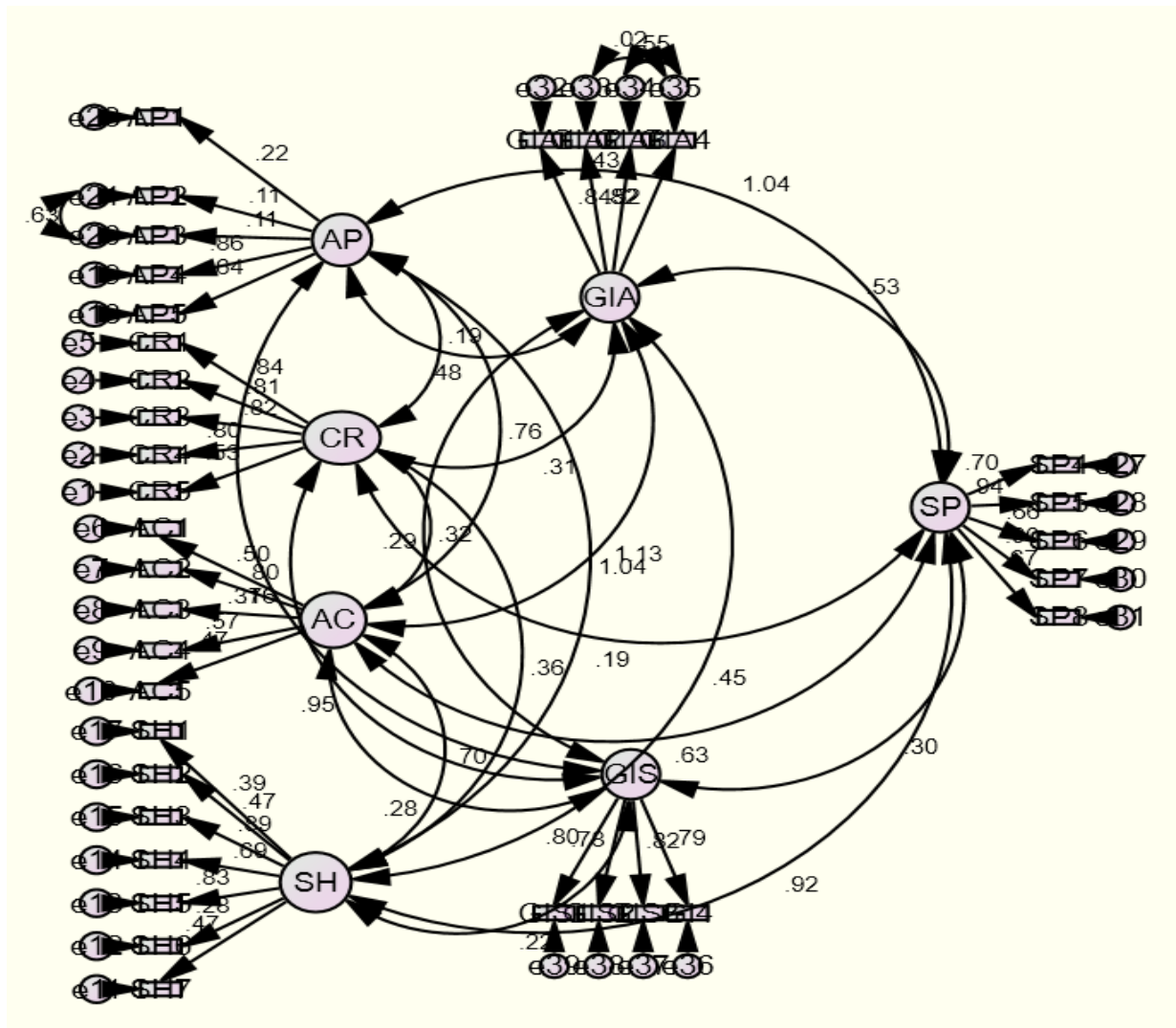
Figure 2: Factor Loading Diagram

Further, using the method outlined by Fornell & Larcker, (1981), discriminant validity was assessed. The construct's variance with its indicators ought to be higher than its variation with other constructs. Additionally, the correlation coefficients between pairs of predictor variables should be less than 0.90 (Hair et al., 2017). The results of discriminant validity are provided in Table 3.

Table 3
Discriminant Validity Analysis

Construct	CR	AC	SH	AP	SP	GIA	GIS
CR	.572						
AC	.167	.599					
SH	.160	.289	.505				
AP	.118	.186	.370	.502			
SP	.063	.133	.251	.201	.548		
GIA	.083	.336	.173	.146	.105	.549	
GIS	.364	.120	.070	.049	.071	.063	.572

The hypotheses testing using SEM validated by the data shown in the Table 4. The results showed that KM has a notable impact on sustainable performance, as shown by a significant p-value of 0.000 and a coefficient of 0.65. Furthermore, with a coefficient of 0.50 and a p-value of 0.000, KM was discovered to have a significant impact on green innovation. Similarly, green innovation showed a substantial impact on sustainable performance, as shown by a p-value of 0.002 and a coefficient of 0.11.

Table 4
Direct Effect Path Coefficients

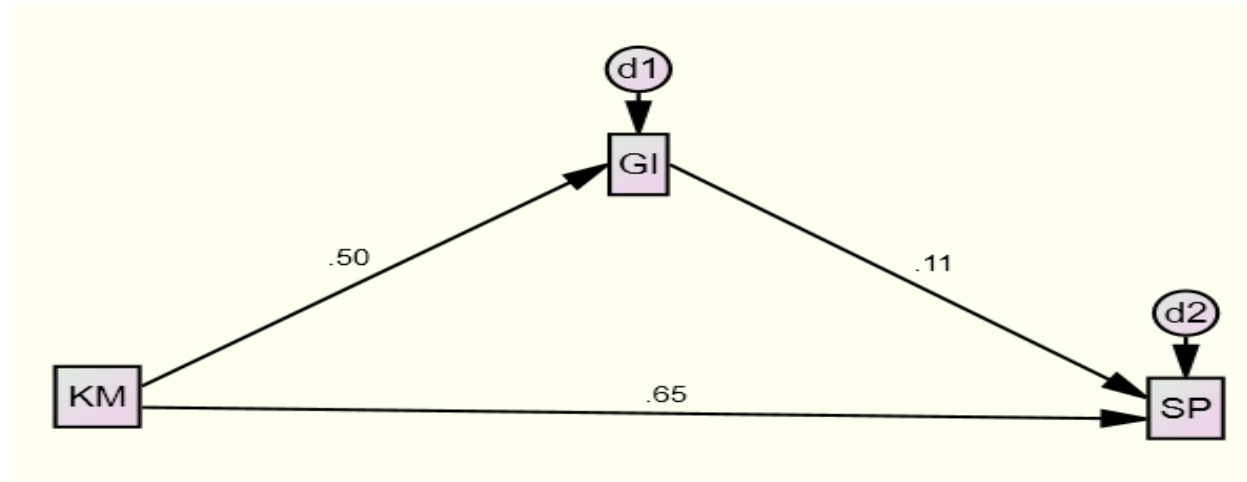|	B-value	Standard Deviation (STDEV)	T value	P value	Decision
KM> SP	0.65	0.006	10.144	0.000	Supported
KM > GI	0.50	0.023	14.126	0.000	Supported
GI > SP	0.11	0.177	3.305	0.002	Supported

Figure 3: Path Diagram

Further, the indirect effect is measured to determine the validity of mediating variables. Table 5 presents the results of mediation. It is noted that the relationship of knowledge management and sustainable performance has a mediation role in green innovation as the coefficient value drops significantly when the mediating variable (GI) is controlled. Moreover, we measure the mediation of green innovation with sub-dimensions (GIA & GIS) with four dimensions of knowledge management. The dimensional analysis shows that all the dimensions of KM are mediated by GIA and GIS except knowledge acquisition. All the dimension of knowledge management are observed with a substantial decrease in the coefficient with the induction of mediation (GIS and GIA). However, knowledge acquisition received an insignificant p-value of 0.820

Table 5
Indirect Effect Path Coefficients

	B-value	Standard Deviation (STDEV)	T-value	P-value	Decision
KM> GI> SP	0.027	0.072	5.705	0.000	Supported
CR > GI> SP	0.272	0.086	4.372	0.000	Supported
AC> GI> SP	0.392	0.462	9.725	0.802	Not Supported
SH> GI> SP	0.689	0.245	13.35	0.022	Supported
AP> GI> SP	0.269	0.032	19.920	0.000	Supported

3.3. Discussion and Implications

The current study explores the complex interactions between sustainable performance, green innovation, and knowledge management. The empirical results show that knowledge management has a considerable and advantageous effect on sustainable performance. This is consistent with findings of earlier research that explained the management of knowledge and sustainable performance have a significant relationship (Hussain et al., 2018). This important finding highlights the effective use of knowledge resources by businesses, whose management demonstrates a strong commitment to knowledge management (KM) by inspiring staff to produce, acquire, share, and apply knowledge to meet sustainable performance.

Notable findings emerge from the analysis of KM's effect on green innovation, demonstrating KM's capacity to encourage green innovation actions and strategies

(Shehzad et al., 2022). This shows how KM greatly improves an organization's capacity for green innovation while developing products and services. Employees have access to external information that may need significant research and development efforts thanks to KM, which gives them the chance to interact and exchange knowledge. To create eco-friendly technologies, they can benefit from the expertise of their colleagues. Additionally, the findings imply that green innovation has a large favorable effect on sustainable performance. This discovery supports research that found that green innovation has a beneficial impact on corporate financial performance (Alkhatib, 2023). Green innovation work as a catalyst for organization to green innovation actions and green innovation strategies which make them environment-conscious and achieve sustainable performance.

Additionally, Globalization and environmental concerns are just two of the problems that businesses face in today's fast-changing business world. To ensure long-term success, businesses need to use green innovation methods and manage their knowledge resources well. Knowledge You can use GI and KM to help you deal with these problems. This study looks at how they work together and how they make a company in the long run. Information and service providers in the KSA like KM because it helps them do better work, think of new goods and services, and plan their business strategy (Alboliteeh et al., 2023). Sustainable performance is becoming more and more important to businesses as people worry about the earth and supplies running out. A common way for companies to meet their long-term goals is through green innovation, which forces them to make items that are good for the earth. Knowing about the environment can help save resources and make the economy, the environment, and business processes work better together. It can also be used in product creation, processes, and management systems (Yuan, 2023). Even though there has been a lot of research on KM and sustainable performance, not much has been said about how KM can help achieve sustainable performance through green innovation, especially in KSA's manufacturing and service sectors. There isn't enough empirical research and a full understanding of how KM and green innovation work together to improve the long-term performance of an organization, especially in KSA's unique situation. This research fills the lack of research and creates a big contribution to looking into the complicated connections between KM and green innovation. This could help us understand how businesses can use KM and green innovation to become more sustainable in a business world that is always changing and adding new things.

3.4. Research Limitations

This research offers significant insights into the complex interconnections of knowledge management, green innovation, and sustainable performance. Nevertheless, there are many restrictions associated with it that require careful attention. The limitations of this study encompass several factors. Firstly, there is a concern regarding the representativeness of the sample, as convenience sampling was utilized. This method may not accurately reflect the broader population. This study only looks at how the factors were at one point in time because it uses cross-sectional data. This makes it tougher to see how things change over time or find straight links. Lastly, the reliance on a single survey instrument for all variables introduces the risk of common method bias, potentially influencing the results. The research's narrow scope, which concentrates only on organizations inside the Kingdom of Saudi Arabia, restricts the capacity to apply the findings to a broader context. Additionally, the limited relevance of knowledge acquisition as a mediator raises questions about its involvement in the study. Furthermore, the exclusion of pertinent contextual elements, such as organizational culture and leadership styles, together with the inherent limits in assessment, indicate potential avenues for further study. By examining the phenomenon of reverse causality and conducting a thorough analysis of industry-specific insights, it is possible to deepen our comprehension of these processes. Without a doubt, the study stated above helps us understand these connections much better.

4. Conclusion

The significance of this research lies in its ability to shed light on the intricate interplay between Green Innovation (GI) and Knowledge Management (KM) and how it impacts the long-term success of businesses. It demonstrates how businesses can better

their long-term profitability by combining these two crucial elements. Closing Research Vacuum: By examining the relationships between Knowledge Management (KM) and Sustainability Performance (SP), this study closes significant research gaps. Structured equation modelling (SEM) and complex multivariate analysis are the tools that are used. We can see how these things are linked better now that we've seen them in a new way. People who work as pros and managers can use the study's data to learn how to use Knowledge Management to bring Green Innovation into their companies. This practical part is very important for using it in the real world. The concept of combining green innovation strategy with organizational activities to enhance sustainability performance (SP) is presented in this study. This new concept offers us a fresh perspective on how to make organizations more sustainable in terms of performance, a critical aspect of modern life. The study examines many aspects such as industry and organization size, acknowledging the significance of these elements in comprehending the particular challenges and opportunities that organizations encounter, particularly in the Kingdom of Saudi Arabia (KSA). This deepens the research and increases its utility. This study demonstrates the critical role that knowledge management and green innovation play in advancing corporate sustainability in an ever-evolving globalized and environmentally conscious world. It supports businesses in resolving issues, adjusting to changing circumstances, and pursuing a more sustainable future.

This study is crucial for academic as well as business and organizational purposes if they hope to succeed in the complicated and evolving world of today. This aids in our comprehension of how to apply GI and KM more thoroughly in order to accomplish long-term sustainability objectives that take into account social, economic, and environmental factors.

4.1. Future Directions

Future research in the domain of knowledge management (KM) and green innovation should contemplate several crucial possibilities. By conducting a more comprehensive examination of certain knowledge management (KM) practices, such as knowledge production, acquisition, sharing, and application, a more nuanced comprehension of their distinct effects on green innovation and sustainable performance may be attained. This will empower organizations to discern the most impactful KM methods. Furthermore, a comprehensive analysis of contextual variances among diverse sectors and countries may provide valuable insights into the unique difficulties and possibilities that are distinct to each sector. Longitudinal studies are essential for monitoring the enduring impacts of knowledge management (KM) and green innovation on sustainable performance, offering a dynamic perspective on the evolving nature of these associations across time. It is important to comprehend the significance of leadership in fostering knowledge management (KM) and green innovation, which entails examining leadership styles and techniques that effectively allow integration. Additional investigation into the roles of mediating and moderating factors, comparative analyses, and multidisciplinary methodologies has the potential to enhance our holistic comprehension of these intricate processes. The use of precise sustainability indicators and the undertaking of comprehensive case studies will help organizations in the quantification and comparison of their sustainable performance. Furthermore, the inclusion of cross-cultural research will provide valuable insights into the impact of cultural elements. Simultaneously, the examination of information transfer and training approaches will facilitate the adoption of knowledge management (KM) and green innovation practices among workers. In conclusion, it is essential for governments and international organizations to thoroughly assess the policy implications associated with the promotion of knowledge management (KM) and green innovation in order to ensure the successful support of sustainability efforts at different levels. These study areas jointly enhance our understanding of the impacts of knowledge management (KM) and green innovation on sustainable performance in the dynamic corporate environment, while also tackling environmental and social concerns.

Authors Contribution
Phan The Cong: Complete the whole manuscript and also the revised manuscript.

Conflict of Interests/Disclosures
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