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Analyzing the Structural Effects of Green Knowledge Management on Sustainable Development Goals and Green Innovation in Algerian Economic Firms

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Abstract

The objective of the research was to examine the impact of Green Knowledge Management (GKM) on Sustainable Development Goals (SDGs) and Green Innovation (GI) in Algerian economic firms. Data were gathered from lower, middle, and upper-level managers in both small, medium and large manufacturing and service firms situated in five cities in Algeria.

The data were examined through structural equation modeling (SEM) to investigate how (GKM) processes (creation of green knowledge, acquisition, sharing, and application) impact (SDGs) (environmental, social, and economic sustainability) and (GI) (green technology, management innovation). According to the results, (GKM)

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significantly impacts both (SDGs) and (GI). The dimensional analysis indicated that, with the exception of acquiring green knowledge and its application, which showed an insignificant impact on green innovation. Finally, firm size and industry type were examined concerning (SDGs) and (GI). Regarding (SDGs), firm size presented significant positive results. However, an insignificant result was found for firm size concerning (GI). Similarly, the role of industry type was examined in relation to (SDGs) and (GI), revealing significant results for both paths.

Key words: Green Knowledge, Sustainability Development, Green Innovation, Organisational Strategy, Algeria Economic firms.

1. INTRODUCTION

The 19th-century Industrial Revolution lifted millions out of poverty, but its prosperity came at a cost: environmental and resource degradation, The economic progress of emerging markets is threatened by their vulnerability to global warming and the depletion of natural resources (Wang & al, 2022). In the past, the success of organizations was largely dependent on promoting economic value. However, today they must pay great attention to reducing the effects of environmental pollution and giving importance to social factors. In addition to economic and financial considerations, organizations need to address these aspects to achieve the goals of sustainable development (Ahmad & al, 2023). Sustainable development is no longer an intellectual luxury but an essential requirement to achieve justice and equity in the distribution of the fruits and gains of economic development and wealth between the present and future generations, This was proposed at many forums, such as the Johannesburg Summit held in South Africa in 2022, and the United Nations also supported this proposal (Chen & al, 2023). Organizations have come to recognize the importance of a green environment, which has led them to rethink their operations and management systems. Dynamic firms are now using knowledge, quality, and environmental practices to create a competitive advantage in today's business world (Al-Qudah & al, 2023).

(KM) is a rapidly emerging field of management science that is becoming increasingly essential for modern managers. (KM) helps organizations leverage their knowledge assets to improve customer satisfaction and gain a competitive advantage (David & Eva, 2017). In recent years, (KM) has become increasingly attractive to businesses of all sizes. (KM) is now seen as a critical component of strategic planning, product and service innovation, and operational efficiency (Wang & al, 2022). In response to environmental challenges, dynamic organizations have broadened the scope of (KM) to include environmental considerations (Ni & al, 2023).

(GKM) is a process that assists companies in developing products that are less harmful to the environment. This contributes to the achievement of the Sustainable Development Goals (SDGs) (Xie & al, 2019). It has become a vital strategic resource for many firms in the current globalized market. (GKM) is a novel concept in knowledge management that aims to integrate green or environmental aspects into all dimensions of (KM), providing them with a competitive advantage over their rivals in achieving the (SDGs) (Yu & al, 2022).

(SDGs) constitute a worldwide call to action to attain a better and more sustainable future for all. They seek to tackle the interrelated challenges of poverty, inequality, climate change, environmental degradation, green innovation, peace, and justice. (Juan & al, 2023). The (SDGs) were adopted by all United Nations Member States in 2015 and provide a blueprint for achieving a better life for all, now and into the future. These are the goals that firms strive to achieve (Rant, 2020).

(GI) is the development and implementation of new products, services, processes, and business models that reduce environmental impact and improve resource efficiency. It is a key component of the transition to a more sustainable economy (Yanan & Qunna, 2023).

Although a number of researchers have studied (GKM) and (SDGs) from various perspectives, inadequate attention has been given to exploring the impact of (GKM)

on achieving (SDGs), particularly with the assistance of (GI). In light of the above discussion, the current research aims to investigate:

- What is the role of (GKM) in (SDGs) and (GI) within economic firms?
- Are there statistically significant differences related to the size of the firms and the nature of their activities that affect this relationship?

In the following sections, the author will discuss the study's theoretical framework, then review the literature, explain the methodology and data analysis, discuss the findings and their implications, and conclude the study with recommendations for future research.

2. Theory and Hypotheses

The current research is based on the theories and concepts of: (GKM), (SDG) and (GI).

2.1. Theory of Green Knowledge Management (GKM)

Knowledge is an intangible concept that exists independently of the physical world. It can be classified into two forms: explicit knowledge (can be codified, verbalized, transferred, and articulated) and tacit knowledge (is hidden and unwritten, existing in people’s minds) (Maravilhas & Martins, 2019). (KM) is a comprehensive approach to identifying, capturing, analyzing, storing, and disseminating an organization's data assets, including databases, records, regulations, procedures, and the knowledge of its employees (Idrees & al, 2023). (KM) is a vital asset for organizations, as demonstrated by previous research identifying (KM) as a core tactical component of organizational processes. As a result, (KM) has become essential for organizational success (Pepple & al, 2022). Modern knowledge has increasingly focused on various environmental aspects within the framework of what is known as Green Knowledge (GK) to address various environmental challenges. It is also related to sustainable development (Everard, 2015). This knowledge includes an understanding of ecosystems and the relationships between

humans and the environment, as well as the technologies and practices that can help protect the environment, promote environmental awareness, and develop new technological solutions (Pan & al, 2022).

This study employs four dimensions of (GKM): Creation green knowledge (CrGK), Acquisition green knowledge (AcGK), Sharing green knowledge (ShGK), and Application green knowledge (ApGK), in view of (Vo & Nguyen, 2023); (Fan & al, 2023); (Zhou & al, 2020):

- **Creation green knowledge (CrGK):** is the process of developing and sharing knowledge about how to reduce environmental impact and improve sustainability. This can include a wide range of topics, such as renewable energy, energy efficiency, waste reduction, sustainable materials, and green management practices (Khan & al, 2024). is an essential part of building a sustainable organization. By investing in green knowledge, organizations can create a better future for the planet and for their bottom line (Vo & Nguyen, 2023).
- **Acquisition green knowledge (AcGK):** is the process of identifying, gathering, and evaluating information about how to reduce environmental impact and improve sustainability. It is an essential part of building a sustainable organization. By investing in green knowledge (Fan & al, 2023).
- **Sharing green knowledge (ShGK):** The process of communicating information on how to reduce environmental impact and enhance sustainability to employees, stakeholders, and the public is crucial. This can be achieved through various means, and sharing green knowledge plays an essential role in building a more sustainable future (Olaisen & Revang, 2017). By sharing green knowledge, organizations can help to raise awareness of environmental issues and promote sustainable practices (Zhou & al, 2020).
- **Application green knowledge (ApGK):** Involves utilizing information to minimizing environmental impact and enhancing sustainability, thereby modifying an organization's operations, products, or services. This can be

accomplished through various means. The Application of green knowledge is a crucial aspect of constructing a sustainable organization (Fan & al, 2023).

2.2. Theory of The Sustainable Development (SD)

(SD) were inspired by the Brundtland Commission report "Our Common Future," which was submitted to the United Nations in 1987. In other words, the (SDGs) were created as a means to achieve the objective of sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Hummels & Argyrou, 2021). Sustainable development is important because it helps protect the environment and ensures that everyone has a good quality of life, It is a prominent topic in development economics because human economic activity is having a negative impact on the planet and leading to inequality (Nguyen, 2023). The overall aim of (SD) is to achieve economic, social, and environmental sustainability by integrating all approaches into the decision-making process. The concepts of (SD) also relate to a modern and multidisciplinary approach called the green theory which states that firms should focus on adopting green management strategies and capitalize on modern technology to develop environment-friendly products and services (Abbas & Sağsan, 2019).

This study employs three dimensions of (SDGs): Environmental Sustainability (EnS), Social Sustainability (SoS), and Economic Sustainability (EcS), in view of (Peoples & al, 2023):

- **Environmental Sustainability (EnS):** is about minimizing the organization's environmental impact and operating in an environmentally responsible manner. It involves conserving natural resources, reducing pollution, and mitigating the effects of climate change. This is important for organizations for various reasons. It can help to reduce costs, improve brand reputation, and attract and retain top talent (Nguea, 2023).

- **Social Sustainability (SoS):** in an organization is about creating a workplace that is fair, equitable, and inclusive, and that promotes the well-being of its employees and the communities in which it operates. It involves building strong relationships with stakeholders and operating in a manner that is responsible and ethical. This approach can help attract and retain top talent, improve productivity and morale, and reduce turnover (Pitkänen & al, 2023).
- **Economic Sustainability (EcS):** is about achieving long-term financial success while also operating in a socially and environmentally responsible manner. It involves making decisions that are beneficial for both the business and the community. It is an essential part of building a sustainable organization, achieved through investing in employees and innovation. (Fatourehchi & Zarghami, 2020).

2.3. Green Innovation Theory (GI)

Innovation is the process of creating something new or improving upon something that already exists. It can involve developing new products or services, improving existing ones, or finding new ways to do things. Innovation is essential for economic growth and social progress, including technological advances, market forces, and the creativity of individuals and organizations (Geissinger & al, 2023). The theory of innovation is a broad field of study that seeks to understand the processes and factors that lead to the creation and adoption of new ideas, products, services, and processes. There are many different theories of innovation, each with its own focus and perspective (Bhatt & al, 2023).

This study employs three dimensions of (GI): Green Technology Innovation (GtI), and Green Management Innovation (GmI), in view of (Khan & al, 2024):

- **Green Technology Innovation (GtI):** involves the development and implementation of new technologies aimed at reducing environmental impact. This can encompass a broad spectrum of technologies, including renewable energy, waste reduction, and sustainable materials. It is an essential component of establishing a sustainable organization. By investing in green technology, a

company can contribute to mitigating its environmental footprint and fostering a more sustainable future (Luo & al, 2019).

- **Green Management Innovation (GmI):** is the development and implementation of new management practices and processes that reduce environmental impact and enhancing sustainability. This can encompass a broad array of practices and is a crucial component in establishing a sustainable organization. (Ma & al, 2018).

2.4. Green Knowledge Management (GKM) and Sustainable Development goals (SDGs)

(GKM) is the systematic development (creation, acquisition, sharing, and application of knowledge and information related to environmental sustainability, its goal is to encourage more sustainable practices and reduce the impact of human activity on the environment (David & Eva, 2017). It is the systematic: creation, acquisition, sharing, and application of knowledge and information related to environmental sustainability to promote more sustainable practices and reduce the impact of human activity on the environment. (GKM) can play a significant role in helping organizations achieve their (SDGs) (Hummels & Argyrou, 2021). (GKM) is a powerful tool that can help organizations achieve their sustainability goals. By effectively managing their green knowledge, organizations can make a real difference in the fight against climate change and other environmental challenges (Ma & al, 2018). Therefore, the first principal hypothesis of the study is:

H1. There is a positive impact of (GKM) on achieving (SDGs) in the economic firms under study.

This main hypothesis is divided into the following sub-hypotheses:

H1a. There is a positive Impact of (CrGK) on achieving (SDGs) in the economic firms under study;

H1b. There is a positive impact of (AcGK) on achieving (SDGs) in the economic firms under study;

H1c. There is a positive impact of (ShGK) on achieving (SDGs) in the economic firms under study;

H1d. There is a positive impact of (ApGK) on achieving (SDGs) in the economic firms under study.

2.5. Green Knowledge Management (GKM) and Green Innovation (GI)

There is a strong positive relationship between (GKM) and (GI) in organizations. (GKM) provides the foundation for (GI) by creation a shared understanding of environmental challenges and opportunities and by facilitating the transfer and application of green knowledge throughout the organization (Abbas & Sağsan, 2019). For example, a company with a robust (GKM) system may be able to develop a new green product more quickly and efficiently because it has easy access to relevant knowledge and expertise from across the company (Bhatt & al, 2023). Additionally, a company with a strong (GKM) system is more likely to be aware of the latest green technologies and trends, which can help it to develop new green products and processes (Luo & al, 2019). Therefore, the second principal hypothesis of the study is:

H2. There is a positive impact of (GKM) on achieving (GI) in the economic firms under study.

This main hypothesis is divided into the following sub-hypotheses:

H2a. There is a positive impact of (CrGK) on achieving (GI) in the economic firms under study;

H2b. There is a positive impact of (AcGK) on achieving (GI) in the economic firms under study;

H2c. There is a positive impact of (ShGK) on achieving (GI) in the economic firms under study;

H2d. There is a positive impact of (ApGK) on achieving (GI) in the economic firms under study.

Fig. 1. Visualize the conceptual framework of this study:

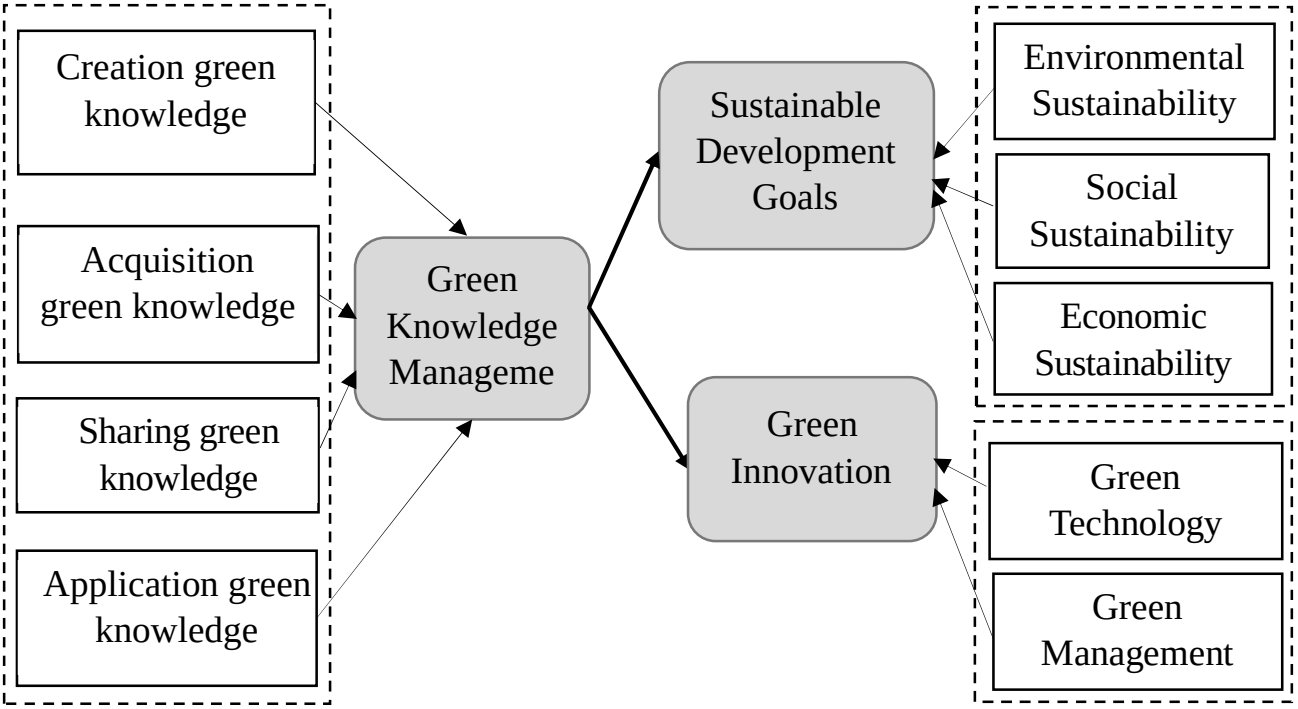

Fig. 1. Conceptual Framework

3. Research Methodology

3.1. Target population and sampling procedure

In this study, the target population comprises manufacturing and service firms in Algeria with only an ISO 14001 certificate. The researcher collected data from five cities in Algeria: (Setif, Jijel, Constantine, Mila, and Bejaia). The researcher specifically requested responses from junior, middle, and senior managers of these firms to assess their firm's performance in (GKM), (GSDs), and (GI) activities using a five-point Likert scale. The researcher contacted managers through both in-person meetings and electronic means (e.g., via email). Data collection focused on management staff due to their possession of the most accurate and up-to-date information about the company's policies and practices. Additionally, managers bear

responsibility for communicating and implementing company policies within their respective departments. The data collection period spanned from January to September 2023, utilizing a non-probability convenience sampling technique. A total of (429) questionnaires were distributed to the target sample, with (397) questionnaires retrieved. After scrutiny, it was evident that (8) of them were invalid, resulting in an estimation of (389) valid questionnaires for the study. Responses included (28) from large-sized firms, (102) from medium-sized firms, and (99) from small firms. Moreover, the number of participating males was estimated at (210), females at (170), and (9) respondents preferred not to reveal their gender. Detailed demographic information about the respondents is provided in **Table 1**.

Table 1. Demographic of respondents.

Particulars	Description	Value	Percentage
Total received responses	large firms	28	12.22 %
	Medium firms	102	44.54 %
	Small firms	99	43.23 %
Job position	Upper management	83	21.33 %
	Middle management	104	26.73 %
	Lower management	202	51.92 %
Industry type	Services	130	56.76 %
	Manufacturing	99	43.23 %
Gender	Female	170	43.70 %
	Male	210	53.98 %
	Prefer not to disclose	9	2.31 %
Years of Experience	Up to 5 Years	58	14.91 %
	6-10 Years	111	28.53 %
	11-15 Years	74	19.02 %
	More than 15 Years	146	37.53 %

Source: Author Calculation

3.2. The measurement instrument

The instrument was divided into four sections, with the first containing demographic information about the participants. The second section focused on the four key processes of (GKM): Creation Green Knowledge, Acquisition Green Knowledge, Sharing Green Knowledge, and Application Green Knowledge. Each of these four dimensions was assessed through a series of items, with five items measuring Creation Green Knowledge and Acquisition Green Knowledge, and six items measuring Sharing Green Knowledge and Application Green Knowledge. The specific items used in this section were sourced from (Vo & Nguyen, 2023); (Fan & al, 2023); (Zhou & al, 2020). Fifteen items within the third section explore the three key dimensions of Sustainable Development Goals (SDGs): Environmental Sustainability, Social Sustainability, and Economic Sustainability. Each dimension is meticulously evaluated through five specific items. These items are sourced from (Peoples & al, 2023). The final section comprised eight items, delving into the two critical aspects of Green Innovation (GI): Green Technological Innovation and Green Market Innovation. The items for this section were derived from (Khan & al, 2024). To guarantee the instrument's reliability and validity in the context of French firms, a pilot test was conducted. The results demonstrated satisfactory internal consistency for the constructs, with values ranging from (0.89) to (0.94). This comfortably exceeds the minimum requirement of (0.7) set by (Miller, 2010). Consequently, the researcher proceeded with the full-scale survey.

3.3. Data analysis and results

To investigate the connection between (GKM), (SDGs), and (GI), the researcher employed the SEM method because it is effective at establishing the hierarchy of latent constructs and eliminating the biasing impact of measurement errors (Cooper & Prajogo, 2010). To interpret the gathered information, the researcher employed statistical software packages SPSS v.23 and AMOS v.23. Prior to conducting multivariate analysis and subsequent SEM, the researcher must verify the sample's

adequacy, check for the absence of multicollinearity, and ensure the elimination of common method bias (CMB), as recommended by (Lee & al, 2010).

For valid multivariate analysis and subsequent SEM, researchers need to address three key concerns: sample size adequacy, multicollinearity, and common method bias (CMB). A previous study by (Hair & al, 2010). suggested is a minimum of (200) participants for factor analysis, this research meets that requirement with a sample size of (389) respondents.

To assess multicollinearity, the Variance Inflation Factor (VIF) was used. The resulting value, (2.359), indicates that multicollinearity is not present. Following (Cooper & Prajogo, 2010). The researcher conducted Harman's single-factor test to assess the presence of common method bias (CMB). This test revealed a single factor explaining only (39.81%) of the variance, significantly lower than the (50%) threshold for CMB concern. This finding suggests negligible CMB influence in the data.

3.4. Analysis of measurement and structural model

The researcher conducted confirmatory factor analysis (CFA) to scrutinize the measurement model. The researcher evaluated the reliability of their measurement using Cronbach's alpha, resulting in a value of (0.911), which surpasses the recommended minimum of (0.8) suggested by (Hair & al, 2010).

This discovery implies that the measurement is adequately reliable. Additionally, the researcher assessed the validity of their measurement through convergent and discriminant validity tests, proposing that items should ideally have a loading exceeding (0.6). They recommend that the minimum AVE value for all constructs should be greater than (0.5). The findings from the convergent validity analysis support these suggestions, revealing item loadings exceeding (0.6) and AVE values surpassing (0.5) for all constructs.

The details of items loading, along with AVE values and composite reliability, are given in **Table 2**. (Cooper & Prajogo, 2010) suggested that the correlation values among pairs of predictor variables should be less than (0.9).

Table 2. Validity and Reliability of the instrument.

Construct	Items	Factor Loading	Composite Reliability[1]	AVE[2]
Green Knowledge Management (GKM)	22	0.728 - 0.877	0.888	0.762
Sustainable Development Goals (SDGs)	15	0.766 - 0.922	0.896	0.642
Green Innovation (GI)	8	0.772 - 0.898	0.913	0.799

[1] Ideal value ≥ 0.7 (Cooper & Prajogo, 2010)
[2] Ideal value ≥ 0.5 (Hair & al, 2010)

Source: author calculation

This research method facilitated an evaluation of discriminant validity. The authors propose favoring high correlations with a specific construct's indicator (square root values of AVE) and maintaining inter-predictor correlations below 0.90 to ensure adequate differentiation between constructs (Hair & al, 2010). **Table 3** provides evidence that the model's distinct concepts are adequately differentiated. Several statistical measures, including: The Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normative Fit Index (NFI), Comparative Fit Index (CFI) and Standardized Root Mean Squared Residuals (SRMR), chi-square to the degree of freedom, and RMSEA, collectively assess how well the measurement model represents the underlying data (Kaynak, 2003). With ideal Trucker-Lewis index (TLI) scores as seen in **Table 4**, we can confidently claim that the model accurately reflects the real-world phenomena. Both its measurement and structural components excel in capturing the observed data.

Table 3. Constructs' discriminant Validity.

Construct	(GKM)	(SDGs)	(GI)
(GKM)	**0.834**		
(SDGs)	0.423	**0.893**	
(GI)	0.534	0.429	**0.822**

Source: author calculation

Table 4. Structural and measurement models.

The goodness of fit measures	CMIN/ DF	NFI	GFI	AGFI	CFI	TLI	RMSEA	SRMR
Seggested value	≤ 3[1]	≥ 0.9[2]	≥ 0.9[2]	≥ 0.9[2]	≥ 0.9[2]	≥ 0.9[2]	$\leq 0.O8$[3]	≤ 0.08[4]
Measurement Model	1.111	0.922	0.916	0.907	0.906	0.934	0.021	0.0289
Structural Model	1.145	0.968	0.933	0.912	0.934	0.932	0.037	0.0312

[1] (lee & al, 2010).
[2] (Luo & al, 2019).
[3] (Everard, 2015).
[4] (Miller, 2010).

Source: author calculation

4. Testing of Hypotheses and Discussion

Using (SEM), the researcher tested their idea. he checked each path to make sure it made sense statistically.

Table 5. Results of hypothesis testing.

Hypothesis	Constructs	*B*-value	Critical ratio	*p*-Value	Decision
H1	GKM→SDGs	0.299	3.223	0.003*	Supported
H1a	CrGK→SDGs	0.151	0.211	0.011*	supported
H1b	AcGK→SDGs	0.189	3.789	0.007*	Supported
H1c	ShGK→SDGs	0.117	2.015	0.033*	Supported
H1d	ApGK→SDGs	0.343	1.155	0.017*	Supported
H2	GKM→GI	0.218	3.089	0.045*	Supported
H2a	CrGK→GI	0.089	3.184	0.048*	supported
H2b	AcGK→GI	0.342	0.895	0.075	Not Supported
H2c	ShGK→GI	0.220	1.019	0.013*	Supported
H2d	ApGK→GI	0.123	0.111	0.099	Not Supported
Control Variables					
Firm size	FS→SDGs	0.342	3.892	0.033*	significant
	FS→GI	0.021	0.213	0.099	Not significant
Industry type					
	Ind-Typ→SDGs	0.045	2.989	0.009*	significant
	Ind-Typ→GI	0.234	3.129	0.029*	significant

* $p \leq 0.05$;
**$p \leq 0.01$; GKM = green knowledge management; GI = green innovation;
SDGs = sustainable development goals; CrGK = creation green knowledge;
AcGK = Acquisition green knowledge;
ShGK = sharing green knowledge; ApGK = Application green knowledge;
FS = Firm size;
Ind-Typ = Industry type.

Source: author calculation

From table **(Table 5)**, it is evident that (GKM) has a positive impact on (SDGs), as indicated by (*B*-value = 0.299) and a (*p*-value = 0.003). Based on this finding, the first hypothesis, H1: is accepted. In essence, the sentence conveys that when companies effectively manage their environmental knowledge and utilize it to inform their

decisions, they are better positioned to contribute to a more sustainable future. This result aligns generally with the study of (Wang & al, 2022), which also showed a positive impact of (GKM) on achieving (SDGs).

(Table 5), shows also the results of the sub-hypotheses as follows:

- **H1a**: was accepted: There is a positive impact of (CrGK) on achieving (SDGs) in the economic firms under study, (*B*-value = 0.151 and *p*-value = 0.011);
- **H1b**: was accepted: There is a positive impact of (AcGK) on achieving (SDGs) in the economic firms under study, (*B*-value = 0.189 and *p*-value = 0.007);
- **H1c**: was accepted: There is a positive impact of (ShGK) on achieving (SDGs) in the economic firms under study, (*B*-value = 0.117 and *p*-value = 0.033);
- **H1d**: was accepted: There is a positive impact of (ApGK) on achieving (SDGs) in the economic firms under study, (*B*-value = 0.343 and *p*-value = 0.017).

The second main hypothesis (H2) was accepted, as indicated by (*B*-value = 0.218) and (*p*-value = 0.045) (refer to **Table 5**). This result is generally consistent with the study of (Abbas & Sağsan, 2019), which also showed positive impact of (GKM) on achieving (GI). By effectively creation, sharing, Acquisition and Application green knowledge, firms can develop innovative solutions for environmental challenges. These innovations can address resource efficiency, renewable energy, pollution reduction, and other aspects relevant to specific (SDGs).

The results of the sub-hypotheses as follows:

- **H2a**: was accepted: There is a positive impact of (CrGK) on achieving (GI) in the economic firms under study, (*B*-value = 0.089 and *p*-value = 0.048);
- **H2b**: was rejected: There is not a positive impact of (AcGK) on achieving (GI) in the economic firms under study, (*B*-value = 0.342 and *p*-value = 0.075);
- **H2c**: was accepted: There is a positive impact of (ShGK) on achieving (GI) in the economic firms under study, (*B*-value = 0.220 and *p*-value = 0.013);

- **H2d**: was rejected: There is not a positive impact of (ApGK) on achieving (GI) in the economic firms under study, (*B*-value = 0.123 and *p*-value = 0.099).

Finally, firm size and industry type were examined concerning (SDGs) and (GI). With (SDGs), firm size presented significant positive results, which means that large firms tend to engage in (SDGs) activities higher than small or medium-sized firms. However, an insignificant result concerning (GI) was found for firm size. Similarly, the role of industry type was examined concerning (SDGs) and (GI), which presented significant results for both paths.

Research implications and limitations

This research reveals that (GKM) isn't just for the big players (big firms) – it can help you achieve impressive sustainability goals too. Whether you're in manufacturing or services, implementing (GKM) effectively unlocks numerous benefits.

This research breaks new ground by exploring the link between (GKM), (GI), with an emphasis on how these factors combine to achieve (SDGs). It challenges the traditional separation of knowledge management and environmentalism, proposing that their convergence holds immense potential for competitive advantage and environmental performance. By employing cutting-edge statistical methods, the study uncovers the critical role of green innovation in bridging the gap between (GKM) and sustainability, highlighting the need for strong (GKM) systems to translate green ideas into reality and achieve sustainable development goals.

This study's limitations lie in its restricted data source and potential for perceptual bias. Excluding operational staff and relying solely on managers' views limit the study's generalizability and introduce possible bias. Future research should broaden data collection to include diverse perspectives and incorporate additional data sources (financial reports, etc.) to enhance validity. Furthermore, expanding the study's scope to other countries and integrating additional variables can strengthen the model and deepen our understanding of the key constructs.

5. Conclusion

The study aimed to investigate the impact of (GKM) on (SDGs) and (GI). Using four (GKM) practices: Creation Green Knowledge, Acquisition Green Knowledge, Sharing Green Knowledge, and Application Green Knowledge. This is a group of economic firms in Algeria.

The study reveals that strong green knowledge management (GKM) significantly enhances both green innovation and sustainable performance across manufacturing and service sectors. This suggests that policymakers should integrate (GKM) initiatives into overall business strategies to foster both economic growth and environmental progress.

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