Center for Management Science Research
ISSN: 3006-5291 3006-5283 Volume 4, Issue 1, 2026

IMPACT OF GREEN KNOWLEDGE MANAGEMENT ON ORGANIZATIONAL SUSTAINABILITY IN HIGHER EDUCATION: THE MEDIATING ROLE OF KNOWLEDGE-ORIENTED LEADERSHIP

Liaquat Ali Rahoo[1], Narvind Kumar*[2], Dr. Dildar Ali Maree[3], Dr. Ain Bemisal Alavi[4]

[1]*Mehran University of Engineering and Technology, Jamshoro Pakistan*
[2]*Institute of Business Administration, University of Sindh Jamshoro*
[3]*Benazir Bhutto Shaheed University, liyari*
[4]*Senior Lecturer, Department of Business and Management, Bath Spa University Academic Center, RAK, UAE*
[1]Liaquatalirahoo2003@gmail.com, [2]knarvind@hotmail.com, [3]dildar.ali@bbsul.edu.pk, [4]ain@bathspa.ae

DOI: https://doi.org/10.5281/zenodo.18374389

Keywords
Green Knowledge Management, Knowledge Oriented Leaders, Organizational Sustainability and Higher Education Institutes.

Article History
Received on 22 Dec 2025
Accepted on 22 Jan 2026
Published on 24 Jan 2026

Copyright @Author

Corresponding Author: *
Narvind Kumar

Abstract

Purpose *This study examines the impact of green knowledge management on organizational sustainability in higher education institutions of Pakistan, with knowledge-oriented leadership as a mediating variable.* ***Design/Methods*** *The researchers conducted an internet based survey among these involved in faculty positions, administrative and support staff of higher education in a cross-sectional design. This survey was conducted using a convenience sampling technique and a total of 360 valid responses were returned. Data analysis was done using structural equation modeling.* ***Findings*** *The results above indicate that green knowledge management has a positive impact on organizational sustainability with an estimated value of 0.262. This research provides further understanding of implications and recommendations in the area being studied and can help fill knowledge gaps. To sum up, the t study stresses that technology and green knowledge management can help organizations attain sustainability. Outcomes may include competitive edge, organization effectiveness, enhanced, and stakeholder satisfaction increased.*

Originality/value *– This research takes up an effort to investigate the influence of green knowledge management on the organizational sustainability through mediating role of knowledge oriented leaders at the higher education institute of Pakistan. Using data from 360 respondents and structural equation modeling (SEM), this study contributes to the green knowledge management and organizational sustainability literature by providing empirical evidence from higher education institutions in a developing economy. In this study there is a positive correlation among these variables was observed, proving the conceptual framework for this study.*

Introduction

Human activities have significantly impacted the environment, leading to catastrophic consequences such as global warming, pollution, biodiversity loss, and ecological crises (Tariq & Khalid, 2023). Contemporary businesses believe that protecting natural resources is crucial to solving the world's environmental problems (Abbas, 2020). The growing interconnectedness of the world's economies, cultures, and societies throughout the globalization era underscores to the significance of protecting natural resources as a crucial component of any plan to address the environmental challenges. Stakeholders need to concentrate on environmental issues to be addressed by getting social and economic advantages to remain competitive (Sahoo et al., 2023). Technologies have become an inseparable part of the industry, networks, digital tools, and monitoring systems help assess the green management practices and generate sustainable business outcomes (Gauthier & Zhang, 2020). The Digital technology is critical to create a sustainable supply chain and reduce the consumption of energy and resources, enhancing operational efficiency and providing social, economic and environmental benefits (Y. Wang et al., 2023). The increased involvement of companies in numerous functions makes it obvious that, to make informed decisions and improve the processes, it is feasible and useful to evaluate the green knowledge management through data analysis (Raharjo, 2019; C. L. Wang et al., 2008).

Environmental concern has become an essential part of business decision making. The growing awareness of the difficulties posed by multiple sources indicates that data and knowledge should be exploited to acquire knowledge and ensure a competitive advantage (Zhuge et al., 2023). Modern management focuses internal knowledge management efforts on ensuring their best benefits and assist companies to achieve environmental performance objects (Song et al., 2020). In numerous organizations, sustainability implies the high-quality, well informed decisions relating ecological problems (Chopra et al., 2021; Jamison, 2001). It refers to satisfying the current needs and protecting the future generations in addressing their needs as well (Schianetz et al., 2007). Social sustainability creates robust communities that are inclusive and whose citizens are listened to and governments are responsive. Economic sustainability deals with effective, responsible utilization of resource and humanity and seeks a permanent, equitable mechanism due to recycling and conservation (Khalid & Batool, 2020; Marcelino-Sádaba et al., 2015). The green knowledge management can be adopted by an organization to overcome sustainability issues and remain competitive by collecting, sharing and using important environmental data (Cai et al., 2024). Previous literature indicates that companies have optimized their fundamental operations by focusing on making their businesses more environmentally friendly to enhance production and identify key aspects of a sustainable business (Martins et al., 2019). A more recent phenomenon, green knowledge management, combines the green aspects with the conventional knowledge management practices (Abbas & Khan, 2023).

According to recent research (Abbas & Khan, 2023; Cai et al., 2024), green knowledge management has evolved from a supportive organizational practice to a strategic sustainability capability, particularly in knowledge-intensive institutions such as universities. The emerging evidence is associated with digital and AI-driven knowledge systems that strengthen the results of environmental, social, and economic sustainability (Z. Wang et al., 2025; Zhuge et al., 2023). However, limited studies have been done to identify these relationships in emerging economies, and especially in higher education institutions."

Green knowledge management is a five-factor model which consists of creation, application, sharing, acquisitions and storage of green knowledge. Green knowledge acquisitions entails the concerted moves by a company to identify, collect and structure information on environment conversations (Aboelmaged & Hashem, 2019). The ecological resources and technologies can significantly help in improving the defense of natural resources (C. L. Wang et al., 2008). Businesses receives information that is relevant in their fields of interest and this information is available in diverse sources both internal and external. The knowledge gained could be retained to be used in the future and disseminated in real time to the relevant stakeholders. The available literature highlights knowledge creation, acquisitions, and utilisation in the benefit of the organisations (Maravilhas & Martins, 2019). Organizations which

embrace green knowledge and utilize organizational capacity and data analysis, are at better position to adapt to the market changes, reinforce the sustainability of the business core, eventually gain the trust of the customers (Tajpour et al., 2022).

Although much has been written about green knowledge management, including the creation and applications of the knowledge, less has been stated about research implications on the sustainability and leadership of organizations. Knowledge leadership where leaders determine practices to enhance Knowledge-related operations has been identified to be a vital component that affects knowledge management (Channar et al., 2023).

This leadership has several aspects including the abilities of the leaders and their ability to work well in groups. The communication channels should be open and transparent to facilitate frequent conversations where the sharing of ideas experiences across all departments is possible (Mabey et al., 2012). The extent of collaboration and trust between leaders and subordinates is critical to building long-lasting, reliable relationships that lead to the desired success and ensuring positive outcomes on behalf of the organization (Avidov Ungar & Shamir-Inbal, 2017). The foundation of Knowledge-based leadership is innovation and knowledge integration, which allows using the most up-to-date methods to achieve organizational goals (Hallinger & Suriyankietkaew, 2018).

Conclusively, green knowledge management entails the management knowledge and abilities that deal with environmentally sustainable practices and technologies. This idea increases the sustainability by promoting green solutions, nurturing environmental-friendly solutions, and lowering the risks and costs to the environment. This is supported by knowledge-based leadership, which harnesses the green knowledge throughout the organization, creates awareness of the value of sustainability, and invests resource in it (Martins et al., 2019).

Although prior studies have examined green knowledge management and sustainability, limited empirical research has been conducted on the role of knowledge oriented leadership in mediating the outcomes of higher education institutions, particularly in developing nations like Pakistan. Moreover, most existing studies focus on manufacturing and corporate sectors, leaving the education sector underexplored. This study aims at exploring the connection between green knowledge management and organizational sustainability in the case of higher education institute and how the knowledge-oriented leadership mediates the relationships. This study will be focused on understanding the effects of the implementations of green knowledge management practices in sustainability efforts in educational institutions as well as the mediating role of leadership that puts knowledge first in this relationship. Through the analysis of these dynamics, the study aims at making its contribution to the further development of the understanding of the factors that promote the sustainability in higher education and to share some insight into the active strategies of the leadership aimed at promoting the formation of the environmental and social responsibly in the academic institutions. Although the current research has developed an interest in green knowledge management, it is still deficient in research studies that investigate its impact on organizational sustainability in terms of knowledge-oriented leadership in higher education institutions of developing countries such as Pakistan.

Review of Literature

Green knowledge management and Organizational Sustainability:

The rapid shifts in managerial attitudes regarding technology and knowledge management have resulted in a heightened emphasis on environmentally-friendly knowledge management as a means to gain a competitive edge (Santoro et al., 2021). Recognition of knowledge-centric management as crucial for organizational success is evident in the literature concerning knowledge management and organizational outcomes. Furthermore, in order to raise the caliber of their goods and services, businesses are encouraged by green technology and knowledge management standards to participate in various knowledge management development activities (Shehzad et al., 2023). Using this strategy also helps businesses to offer creative solutions that address the social and environmental needs of their clients. Green knowledge management is essential to a company's survival in the modern business environment and can lead to excellent results like boosting its ability to compete in the marketplace (Hottenrott et al., 2016).

The latest empirical studies confirm the fact that green knowledge acquisition, storage, and application significantly improve the sustainability of organizational performance through the increase in the quality of decisions and environmental innovation (Cai et al., 2024; Khan et al., 2024). Green knowledge management in higher education ensures sustainable campus life and guarantees the institutional legitimacy in the long term (Demir et al., 2023).

A novel facet of knowledge management, sharing and acquiring knowledge, has been discussed in literature. Organizations that are successful establish new divisions that focus on knowledge (Anand et al., 2007). The (Ibn Batouta et al., 2023) emphasizes the fundamental organizational procedures required for sustainability and evaluates knowledge-driven methodologies to investigate practical problem-solving techniques. It is suggested that incorporating green knowledge related to social and environmental sustainability issues yields actionable insights (Iazzolino & Laise, 2016). Recognizing the importance of active coordination among organizational activities to enact public policies within their operations is crucial (Shaikh, 2022).

One of the primary challenges confronting contemporary enterprises revolves around green knowledge management concerning organizational sustainability. Enhancing the knowledge dissemination process prompts businesses to prioritize the dissemination and organization of green knowledge, thereby challenging the conventional perception of businesses as less concerned with sustainability issues (Saeed et al., 2022).

Knowledge-Oriented Leadership and Sustainability:

While the primary objective of businesses remains profit generation, there is a scarcity of research on knowledge management overall, particularly on green knowledge management, which enhances organizational management practices (Khan et al., 2024). Recent studies of knowledge management reveal inconsistencies in the empirical data could describe the most significant factors, such as knowledge based leadership (Zia, 2020). Therefore, researcher ought to expand their research by investigating the relationship between knowledge based leadership, knowledge management, and sustainability (Demir et al., 2023).

In today's business landscape, organizations heavily rely on the acquisition, retention, and dissemination of knowledge among both their employees and clients (Shaikh, 2021). Consequently, knowledge is recognized by organizational knowledge management as a vital and inseparable component of human capital (Abubakar et al., 2019). Moreover, green knowledge management fosters conditions conducive to achieving competitive advantages by addressing complex and uncertain situations. Leveraging knowledge management to address sustainability concerns can lead to more informed and impactful decision-making processes, as well as the development of knowledge-driven management practices (Rioba et al., 2023). Additionally, as organizations strive to transform individual and organizational knowledge into competencies, green knowledge management is prioritized over tangible knowledge. A sustainable business environment, characterized by reduced apprehension and enhanced confidence in management's willingness to share knowledge, distinguishes successful management from others (Shahzad et al., 2022).

The sustainability concept underwent a transformation in the 1970s, as policymakers, practitioners, and researchers across economic, social, and environmental domains began linking sustainability with other concepts. The need to implement sustainability has become international due to environmental degradation, marginalization of local communities, and green knowledge search that enhances our knowledge of these problem (Herrmann et al., 2014). Studies have shown that organizations embracing sustainability and its associated practices can enhance employee commitment and serve as role models for sustainability. This is rooted in the environmental modernization theory, which posits that ecology and economics share the goal of advancing modern sciences and technologies. To address conflicts between environmental and economic processes, the market must enact laws promoting sustainable development (Ramdhani et al., 2017).

New findings in management literature and theory of knowledge based have impacted the organization knowledge-based theory. This theory describes the existence of businesses emphasizing on the creation, integration, and used of knowledge. It is based on the

resource based perspective which points out strategic resources as key to sustainability (Coff, 2003). According to this perspective, knowledge is a strategic resource enabling businesses to enhance the value of their goods and services. Consequently, organizations employ dynamic capabilities to manage the knowledge they possess. However, research underscores the challenges and hurdles entrepreneurs face in establishing long-term competitive advantages (Cardoni et al., 2020).

The discussions were characterized by skepticism concerning the different leadership practices within particular situations and recommended the use of different leadership philosophies and practices to build knowledge-based organizations. In order to direct and encourage followers to act positively, the leader followers interaction should be the core area of efforts (Donate et al., 2022). Active engagement of leaders is knowledge management, design of knowledge processes that facilitate implementation by reward-based incentive processes are highlighted. Interestingly, suggestions promoting the sharing, assimilation as well as communication of unique explicit and tacit knowledge to solve sustainability challenges suggest that companies require various leadership approaches (Eisenhardt & Santos, 2002).

Mediating Role of Knowledge-Oriented Leadership:

The significance of green knowledge in management is the leadership that used and appreciates green knowledge as a major connection between sustainability and green knowledge management. These leaders are able to motivate their teams to embrace sustainable business practices that are environmentally and socially, responsible, and make sustainable decisions. Having knowledge base, the leaders will be able to relate knowledge to action hence enhancing sustainability. This way, the paper recommends that coordination of such aspects within organizations is critical in attaining green knowledge management, which consequently affects sustainability. Knowledge based leadership mediator in this process. Contemporary leadership literature stresses that knowledge-oriented leaders should act as catalysts, transforming the green knowledge into feasible sustainability strategies (Donate et al., 2022; Zhuge et al., 2023). Recent research also indicates that knowledge integration based on leadership that should be incorporated is especially vital in the field of the public and higher education where their inflexible structure can become a barrier to sustainability efforts (Z. Wang et al., 2025).

Based on the above theoretical arguments and empirical findings, the following hypotheses are proposed:

H1: Green knowledge acquisition has a positive impact on organizational sustainability in HEIs of Pakistan.

H2: Green knowledge storage has a positive impact on organizational sustainability in HEIs of Pakistan.

H3: Green knowledge sharing has a positive impact on organizational sustainability in HEIs of Pakistan.

H4: Green knowledge application has a positive impact on organizational sustainability in HEIs of Pakistan.

H5: Green knowledge creation has positive an impact on organizational sustainability in HEIs of Pakistan.

H6: Knowledge oriented leadership mediate the relationship between green knowledge acquisition (H6a), storage (H6b), sharing (H6c), application (H6d), creation (H6e), and organizational sustainability.

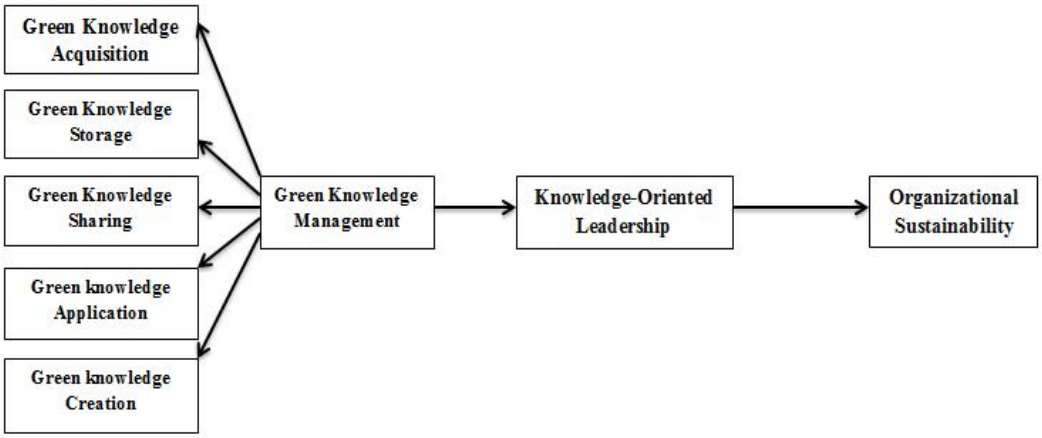


Figure 1: Research Framework

Research Methodology

The present study employed a quantitative research methodology, utilizing a cross-sectional survey to gather data from the study population. The population of the study comprised 24 public sector higher education institutes of Sindh province of Pakistan, totaling 15,600 individuals. This population data was sourced from the various resources such as websites, registrar officers, and human resource officers of the institutions. The questionnaire was adopted from previous literature i all covering variables of the study and consisted of two parts, a demographic section and a section related to the study variables. The questionnaire was distributed via email to employees of the institutions using convenience sampling was adopted due to accessibility constraints and time limitations, which is common in organizational research involving large institutional populations. Out of the 500 questionnaires distributed, 381 were returned. After discarding 21 incompletes, 360 valid responses were used for analysis. To address the existing research void and provide new insights valuable for practitioners of green management, the researchers constructed a causal model Figure-1 grounded in existing theoretical frameworks. Figure-1 illustrates the dependent variable, organizational sustainability, the mediating variable, knowledge-oriented leadership, and the independent variable, green knowledge management. The hypothesized relationships in the figure represent the associations between the variables under study. This model effectively determines the direction of the associations and tests the study hypotheses.

For the analysis, the Statistical Package for Social Sciences (SPSS) was used to measure reliability, mean, standard deviation, and other descriptive statistics. Additionally, Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for both the measurement model and the structural model.

Data Analysis

The analysis of the data that was gathered is covered in this section. Data analysis is the process of looking over, recognizing, and measuring the information gathered, as well as developing hypotheses and testing them in order to establish the relationship between the variables that will allow a researcher to predict and reveal the study's actual outcome. SPSS software is utilized in this particular study to test the data collected from various respondents. PLS-SEM was also used to measurement model and structural model for data testing.

Reliability analysis

The instrument's internal consistency and dependability are examined by the reliability tool. The Cronbach alpha maximum value is 1. An instrument will be deemed reliable if its reliability value is closest to 1. If the values fall between 0.6 and 0.7, the instrument's reliability will be acknowledged. The instruments will not be very reliable and will need to be rebuilt or modified if the values are less than 0.5.

Table 1: ***Reliability Statistics***

Cronbach's Alpha	No Items
0.705	27

Table 2: ***Demographic Profile of Respondents***

Variables	Values	Frequency	Percentage
Gender	Male	293	81.38
	Female	67	16.62
	Total	**360**	**100**
Designation	Faculty members	86	24
	Top-level Management	60	17
	Middle Level Management	118	32
	Supporting Staff	56	16
	Librarians	40	11
	Total	**360**	**100**
Education	Bachelor/Master (16 years)	228	63
	MS/M.Phil.	94	26
	Ph.Ds.	38	11
	Total	**360**	**100**
Experience	Less than 10 years	133	37
	11-20 Years	129	36
	Above 20 Years	98	27
	Total	**360**	**100**

Male respondents accounted for 83.38% while female respondents made up 16.62% of the participants in the study. The highest representation among library staff roles was observed in faculty members 24%, top level management 17%, and middle level management 32%, supporting staff 16%, librarians only 11%. Regarding qualifications, the majority of participants held a graduate degree (16 years) at 63%, followed by MS/M.Phil., at 26%, and Ph.D. at 11%. In terms of the experience 37% have less than 10 years, 36% 11-20 years' experience, 27% have more than 20 years of experience in higher education institutions of Pakistan have participated in this study.

Measurement Model

PLS-SEM looks the relationships between constructs that are difficult to measure directly. The measurement model and the structural model are the two components of the model that will be tested independently. Before coming to any conclusions, the measurement model must be analyzed to confirm its validity and reliability. Internal consistency, discriminant validity, and individual item reliability are tested in order to analyze the measurement model. Outer loading model after purification variables those variable loading less 0.7 are removed only two items were less than 0.70 which were GKM2 and GKA4.

Outer Loading and Reliability

In order to evaluate the validity of a measurement model, the Average Variance Extracted (AVE) should

be at least 0.5 of every construct. In the model factor loadings larger than 0.7 and AVE values greater than 0.5 are indicated by the convergent validity findings good for model. Table 3 shows the item loading as well as the composite reliability and AVE findings in well.

IEER
Institute for Excellence in Education & Research

Table 3: *Outer Loading and Reliability*

Item	Outer Loading	Cronbach's alpha	C. R	(AVE)
GKA1	0.834			
GKA2	0.840			
GKA3	0.872	0.885	0.875	0.688
GKA4	0.862			
GKA5	0.731			
GKAC1	0.796			
GKAC2	0.817			
GKAC3	0.774	0.859	0.86	0.641
GKAC4	0.807			
GKAC5	0.805			
GKC1	0.806			
GKC2	0.841			
GKC3	0.870	0.889	0.891	0.693
GKC4	0.847			
GKC5	0.794			
GKST1	0.860			
GKST2	0.889			
GKST3	0.816	0.781	0.912	0.710
GKST4	0.863			
GKST5	0.849			
GKST6	0.773			
GSK1	0.857			
GSK2	0.868			
GSK3	0.898	0.923	0.853	0.757
GSK4	0.877			
GSK5	0.848			
KOL1	0.753			
KOL2	0.875			
KOL3	0.854	0.831	0.784	0.723
KOL4	0.886			
KOL5	0.866			
KOL6	0.863			
OS1	0.776			
OS2	0.827			
OS3	0.865			
OS4	0.876	0.832	0.859	0.708
OS5	0.863			
OS6	0.835			
OS7	0.848			

Note: Green Knowledge (GK), Acquisition (GKAC), Storage (GKST), Sharing (GKSR), Application (GKAP), Creation (GKC), Oriented Leadership (KOL), Organization Sustainability (OS)

Discriminant Validity

Discriminant validity is reflected in the high correlation between indicator pairs shown by the square root of AVE values. According to (Hair et al., 2010) there should be less than a 0.9 correlation.

The results shown in (Table 4) are entirely compatible with discriminant validity criteria proposed by (Fornell & Larcker, 1981; Hair et al., 2010)

Table 4: ***Fornell-Larcker***

Variable	GKA	GKAC	GKC	GKST	GSK	KOL	OS
GKA	**0.830**						
GKAC	0.723	**0.800**					
GKC	0.771	0.638	**0.832**				
GKST	0.721	0.841	0.636	**0.842**			
GSK	0.826	0.786	0.678	0.799	**0.870**		
KOL	0.683	0.627	0.783	0.627	0.634	**0.850**	
OS	0.723	0.684	0.742	0.672	0.706	0.797	**0.842**

Note: Green Knowledge (GK), Acquisition (GKAC), Storage (GKST), Sharing (GKSR), Application (GKAP), Creation (GKC), Oriented Leadership (KOL), Organization Sustainability (OS)

Collinearity statistics (VIF)

Collinearity statistics, specifically the variance inflation factor (VIF), are used in regression analysis to detect the presence and severity of multicollinearity among predictor variables. Multicollinearity occurs when two or more predictor variables are highly correlated, making it difficult to assess the individual effect of each predictor on the response variable. VIF = 1: There is no correlation between and other predictors. This means that there is no multicollinearity. 1 < VIF < 5: Moderate correlation, usually nothing to worry about. VIF ≥ 5: Highly correlated, possibly indicating problematic multicollinearity. Some researchers use a threshold of 10 instead of 5. Although one indicator (OS1) showed a slightly higher VIF value, it remained below the conservative threshold of 10 and was retained due to its theoretical relevance and contribution to content validity.

Table 5: ***Collinearity Statistics***

Item	VIF	Item	VIF	Item	VIF	Item	VIF
GKA1	2.192	GKC1	2.334	GKST6	2.985	KOL5	3.362
GKA2	2.552	GKC2	2.506	GSK1	2.721	KOL6	3.407
GKA3	3.028	GKC3	2.827	GSK2	2.931	OS1	5.941
GKA4	2.528	GKC4	2.431	GSK3	3.647	OS2	2.808
GKA5	2.521	GKC5	2.010	GSK4	3.285	OS3	3.354
GKAC1	2.544	GKST1	3.119	GSK5	2.476	OS4	3.491
GKAC2	2.115	GKST2	3.980	KOL1	3.771	OS5	2.995
GKAC3	2.968	GKST3	2.230	KOL2	3.213	OS6	2.870
GKAC4	2.065	GKST4	3.273	KOL3	2.748	OS7	2.944
GKAC5	2.593	GKST5	2.725	KOL4	3.414		

Note: Green Knowledge (GK), Acquisition (GKAC), Storage (GKST), Sharing (GKSR), Application (GKAP), Creation (GKC), Oriented Leadership (KOL), Organization Sustainability (OS)

Structural Model

In the structural model we can see the relationship between the constructs and hence test the hypothesis of the study. We consider these links through path coefficients and R^2 values. Our finding indicates that the model could be used as per the established threshold, being less than 3.00, with a $\chi 2/df$ value of 2.077. Moreover, upper limit value of 0.08 aligns with RMSEA value of 0.069. Additionally, based on (Bagozzi & Yi, 1988) criteria, the GFI and CFI values exceed 0.9. These values prove that the model fits well (Table 6).

Table 6. ***Model Fit Indices***

Fit index	Green Knowledge Management	Knowledge-Oriented Leadership	Organizational Sustainability	Recommended criteria
X^2/df	1.234	1.624	1.523	between 2–5
GFI	0.916	0.921	0.919	Greater than 0.90
RMSEA	0.048	0.037	0.068	Between 0.05-0.08
NFI	0.984	0.974	0.979	Greater than 0.90
CFI	0.969	0.939	0.969	Greater than 0.90

Direct Hypothesis

The table shows the results of testing five direct hypotheses that test the effect of the predictor variables that are (GKAC, GKST, GKSR, GKAP, GKC) on the outcome variable (OS). The following is a short explanation of each hypothesis, according to the coefficients, standard errors, t-values, and p-values.

Table 7: ***Direct Hypothesis Effect***

Hypothesis	Coefficient	Std.	T-Value	P-Value
H1 (GKAC>OS	0.641	0.074	13.254	0.024
H2 (GKST>OS)	0.725	0.048	15.387	0.000
H3 (GKSR>OS)	0.794	0.041	11.874	0.047
H4 (GKAP>OS)	0.734	0.084	14.365	0.032
H5 (GKC>OS)	0.711	0.073	18.249	0.000

Note: Green Knowledge (GK), Acquisition (GKAC), Storage (GKST), Sharing (GKSR), Application (GKAP), Creation (GKC), Oriented Leadership (KOL), Organization Sustainability (OS)

H1: The predictor variable GKAC has a positive impact on OS with a coefficient of 0.641. The t-value of 13.254 indicates a strong effect, and the p-value of 0.024 indicates that the effect is statistically significant (usually significant at the 5% level, although close to the threshold). H2: The predictor variable GKST had a significant positive effect on OS with a coefficient of 0.725. The high t-value (15.387) and the very low p-value (0.000) indicate a very strong and statistically significant relationship. H3: GKSR also showed a positive impact on OS with a coefficient of 0.794. The t-value (11.874) indicates a strong effect, and the p-value (0.047) indicates statistical significance (usually significant at the 5% level, but close to the threshold). H4: The predictor variable GKAP has a positive impact on OS with a coefficient of 0.734. The t-value of 14.365 indicates that the effect is strong, and the p-value of 0.032 indicates that the effect is statistically significant. H5: GKC had a significant positive impact on OS with a coefficient of 0.711. The high t-value (18.249) and very low p-value (0.000) provide strong evidence of a statistically significant relationship.

Indirect Hypothesis effect

Table 8: ***Indirect Hypothesis***

Hypothesis	Coefficient	T-Value	P-Value
H6a (GKAC>KOL>OS	0.451	9.514	0.000
H6b (GKST>KOL>OS)	0.645	9.654	0.000
H6c (GKSR>KOL>OS)	0.544	8.367	0.000
H6d (GKAP>KOL>OS)	0.574	9.249	0.000
H6e (GKC>KOL>OS)	0.637	9.217	0.000

Note: Green Knowledge (GK), Acquisition (GKAC), Storage (GKST), Sharing (GKSR), Application (GKAP), Creation (GKC), Oriented Leadership (KOL), Organization Sustainability (OS)

H6a: The predictor variable GKAC has a positive impact on the outcome variable OS with a coefficient of 0.451. The high t-value (9.514) and the very low p-value (0.000) indicate that this effect is statistically significant. H6b: The predictor variable GKST has a significant positive impact on OS, with a large coefficient of 0.645. The significance of this relationship is further confirmed by the t-value of 9.654 and the p-value of 0.000. H6c: The predictor variable GKSR also showed a significant positive impact on OS with a coefficient of 0.544. The t-value (8.367) and p-value (0.000) indicate strong evidence against the null hypothesis in favor of this effect. H6d: GKAP was another significant predictor of OS with a coefficient of 0.574. The high t-value (9.249) and low p-value (0.000) confirm the significance of this positive effect. H6e: GKC had a significant positive impact on OS with a coefficient of 0.637. The t-value (9.217) and p-value (0.000) provide strong evidence for this effect.

Discussion

This study extends the knowledge-based view by empirically demonstrating how green knowledge management practices influence organizational sustainability through knowledge-oriented leadership in higher education institutions. We looked at the comprehensive influence of green knowledge management which include the process of acquisition, storage, sharing, application, and generation processes of green technologies and we looked into mediating position of leadership. The results affirm the fact that green knowledge management influences sustainability in a positive researcher have indicated. Pakistan has higher education institutions in Pakistan which are successfully applying green knowledge management practices in order to realize sustainability objectives. These results are in line with existing research tendencies and can be referred to as importance green knowledge management. Green knowledge management facilities the possibilities of collaboration and knowledge sharing, whereas the available information can be employed by the leadership to create environmentally friendly technologies. Green technology adoption also influences innovation and leads to social and economic sustainability, which creates environmental responsibility.

The paper shows that there is a strong association between green knowledge management and organizational sustainability and how the knowledge based leadership can speed up the proces of achieving sustainable objectives. It proposes that effective green knowledge management practices should be embraced by institutions to achieve sustainability goals where by leadership based on knowledge based on knowledge plays a critical role in infusing the principles of sustainability. The research contributes to literature on the connection between the green knowledge management, sustainability, and knowledge. It also highlights the increased role of knowledge leadership in establishing such connections and the necessity to consider all elements of green knowledge management to enhance practices of the institutional environmental and attain sustainability.

Conclusions

In this research, the theoretical framework used that incorporates knowledge management concepts of sustainability. It explores the effects of green knowledge management on organizational sustainability with reference to the five key activities management activities namely, acquisition, storage, sharing, application, and creation and the three dimensions of sustainability which are environmental, social, and economic sustainability. The finding indicated that green knowledge management has a strong influence on organizational sustainability, and knowledge-based leadership plays a mediates such influence. The hypotheses also indicate that green knowledge management and technology significantly influence several aspects of sustainability whereby in higher education institutions in Pakistan, knowledge based leadership mediates the influence.

Nevertheless, there are certain limitations of the study. Only the faculty and manager views of Pakistan-based institutions of higher learning working in the public sector were to be collected. It is suggested that future research should encompass comparative in public and private sector, as well as with manufacturing organizations. The convenience sample was used to recruit the participant, and that is subject to bias. In addition, since the contextual variables analyzed, additional methods of analysis are

recommended to be studied. Despite addressing validity and reliability concerns, complete elimination of bias influence is challenging. Future research should include perspectives from organizations' stakeholders, in addition to management perceptions.

References

Abbas, J. (2020). Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. *Journal of Cleaner Production*, *244*, 118806. https://doi.org/10.1016/j.jclepro.2019.118806

Abbas, J., & Khan, S. M. (2023). Green knowledge management and organizational green culture: An interaction for organizational green innovation and green performance. *Journal of Knowledge Management*, *27*(7), 1852–1870. https://doi.org/10.1108/JKM-03-2022-0156

Aboelmaged, M., & Hashem, G. (2019). Absorptive capacity and green innovation adoption in SMEs: The mediating effects of sustainable organisational capabilities. *Journal of Cleaner Production*, *220*, 853–863. https://doi.org/10.1016/j.jclepro.2019.02.150

Abubakar, A. M., Elrehail, H., Alatailat, M. A., & Elçi, A. (2019). Knowledge management, decision-making style and organizational performance. *Journal of Innovation & Knowledge*, *4*(2), 104–114. https://doi.org/10.1016/j.jik.2017.07.003

Anand, N., Gardner, H. K., & Morris, T. (2007). Knowledge-Based Innovation: Emergence and Embedding of New Practice Areas in Management Consulting Firms. *Academy of Management Journal*, *50*(2), 406–428. https://doi.org/10.5465/amj.2007.24634457

Avidov Ungar, O., & Shamir-Inbal, T. (2017). ICT Coordinators' TPACK-based Leadership Knowledge in their Roles as Agents of Change. *Journal of Information Technology Education: Research*, *16*, 169–188. https://doi.org/10.28945/3699

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74–94. https://doi.org/10.1007/BF02723327

Cai, X., Khan, N. A., & Egorova, O. (2024). Transactional leadership matters in green creative behaviour through workplace learning and green knowledge management: Moderating role of social network sites use. *Personnel Review*, *53*(2), 317–335. https://doi.org/10.1108/PR-12-2020-0894

Cardoni, A., Zanin, F., Corazza, G., & Paradisi, A. (2020). Knowledge Management and Performance Measurement Systems for SMEs' Economic Sustainability. *Sustainability*, *12*(7), 2594. https://doi.org/10.3390/su12072594

Channar, P. B., Ahmed, G., Thebo, J. A., Khan, M. A., & Rahoo, L. A. (2023). Factors Of Knowledge Sharing Among Faculty Members In Higher Educational Institutions: An Empirical Study Of The Public Sector. *Journal of Positive School Psychology*, *7*(4), 1498–1506.

Chopra, M., Saini, N., Kumar, S., Varma, A., Mangla, S. K., & Lim, W. M. (2021). Past, present, and future of knowledge management for business sustainability. *Journal of Cleaner Production*, *328*, 129592. https://doi.org/10.1016/j.jclepro.2021.129592

Coff, R. W. (2003). The emergent knowledge-based theory of competitive advantage: An evolutionary approach to integrating economics and management. *Managerial and Decision Economics*, *24*(4), 245–251. https://doi.org/10.1002/mde.1127

Demir, A., Budur, T., Omer, H. M., & Heshmati, A. (2023). Links between knowledge management and organisational sustainability: Does the ISO 9001 certification have an effect? *Knowledge Management Research & Practice*, *21*(1), 183–196. https://doi.org/10.1080/14778238.2020.1860663

Donate, M. J., González-Mohíno, M., Paolo Appio, F., & Bernhard, F. (2022). Dealing with knowledge hiding to improve innovation capabilities in the hotel industry: The unconventional role of knowledge-oriented leadership. *Journal of Business Research*, *144*, 572–586. https://doi.org/10.1016/j.jbusres.2022.02.001

Eisenhardt, K. M., & Santos, F. M. (2002). *Knowledge-based view: A new theory of strategy* (Vol. 1). Handbook of Strategy and Management.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of*

Marketing Research, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Gauthier, J., & Zhang, Z. (Justin). (2020). Green knowledge management and strategic renewal: A discursive perspective on corporate sustainability. *International Journal of Productivity and Performance Management*, *69*(8), 1797–1811. https://doi.org/10.1108/IJPPM-10-2019-0489

Hair, Black, W. C, Babin, B. J, & Anderson, R. E. (2010). *Multivariate data analysis.*

Hallinger, P., & Suriyankietkaew, S. (2018). Science Mapping of the Knowledge Base on Sustainable Leadership, 1990–2018. *Sustainability*, *10*(12), 4846. https://doi.org/10.3390/su10124846

Herrmann, C., Schmidt, C., Kurle, D., Blume, S., & Thiede, S. (2014). Sustainability in manufacturing and factories of the future. *International Journal of Precision Engineering and Manufacturing-Green Technology*, *1*(4), 283–292. https://doi.org/10.1007/s40684-014-0034-z

Hottenrott, H., Rexhäuser, S., & Veugelers, R. (2016). Organisational change and the productivity effects of green technology adoption. *Resource and Energy Economics*, *43*, 172–194. https://doi.org/10.1016/j.reseneeco.2016.01.004

Iazzolino, G., & Laise, D. (2016). Value creation and sustainability in knowledge-based strategies. *Journal of Intellectual Capital*, *17*(3), 457–470. https://doi.org/10.1108/JIC-09-2015-0082

Ibn Batouta, K., Aouhassi, S., & Mansouri, K. (2023). Energy efficiency in the manufacturing industry—A tertiary review and a conceptual knowledge-based framework. *Energy Reports*, *9*, 4635–4653. https://doi.org/10.1016/j.egyr.2023.03.107

Jamison, A. (2001). *The making of green knowledge: Environmental politics and cultural transformation*. Cambridge University Press.

Khalid, A., & Batool, S. H. (2020). A Qualitative Case Study of Green Environment: Practices, Attitudes and Future Strategies of Pakistani University Librarians. *Electronic Green Journal*, *1*(44). https://doi.org/10.5070/G314443701

Khan, A. N., Mehmood, K., & Kwan, H. K. (2024). Green knowledge management: A key driver of green technology innovation and sustainable performance in the construction organizations. *Journal of Innovation & Knowledge*, *9*(1), 100455. https://doi.org/10.1016/j.jik.2023.100455

Mabey, C., Kulich, C., & Lorenzi-Cioldi, F. (2012). Knowledge leadership in global scientific research. *The International Journal of Human Resource Management*, *23*(12), 2450–2467. https://doi.org/10.1080/09585192.2012.668386

Maravilhas, S., & Martins, J. (2019). Strategic knowledge management in a digital environment: Tacit and explicit knowledge in Fab Labs. *Journal of Business Research*, *94*, 353–359. https://doi.org/10.1016/j.jbusres.2018.01.061

Marcelino-Sádaba, S., González-Jaen, L. F., & Pérez-Ezcurdia, A. (2015). Using project management as a way to sustainability. From a comprehensive review to a framework definition. *Journal of Cleaner Production*, *99*, 1–16. https://doi.org/10.1016/j.jclepro.2015.03.020

Martins, V. W. B., Rampasso, I. S., Anholon, R., Quelhas, O. L. G., & Leal Filho, W. (2019). Knowledge management in the context of sustainability: Literature review and opportunities for future research. *Journal of Cleaner Production*, *229*, 489–500. https://doi.org/10.1016/j.jclepro.2019.04.354

Raharjo, K. (2019). The role of green management in creating sustainability performance on the small and medium enterprises. *Management of Environmental Quality: An International Journal*, *30*(3), 557–577. https://doi.org/10.1108/MEQ-03-2018-0053

Ramdhani, Aulawi, M. A., Ikhwana, H., Mauluddin, A., & Yusuf. (2017). Model of Green Technology Adaptation in Small and Medium-Sized Tannery Industry. *Journal of Engineering and Applied Sciences*.

Rioba, E. B., Özdemir, B., Çiğdemoğlu, C., & Tuzlukaya, S. (2023). Knowledge-Based Leadership, innovation and Knowledge management in organizational performance of the Kenyan higher education system. İşletme Araştırmaları Dergisi. *İşletme Araştırmaları Dergisi*, *15*(1), 66–78.

Saeed, A., Rasheed, F., Waseem, M., & Tabash, M. I. (2022). Green human resource management and environmental performance: The role of green supply chain management practices. *Benchmarking:*

An International Journal, *29*(9), 2881–2899. https://doi.org/10.1108/BIJ-05-2021-0297

Sahoo, S., Kumar, A., & Upadhyay, A. (2023). How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. *Business Strategy and the Environment*, *32*(1), 551–569. https://doi.org/10.1002/bse.3160

Santoro, G., Thrassou, A., Bresciani, S., & Giudice, M. D. (2021). Do Knowledge Management and Dynamic Capabilities Affect Ambidextrous Entrepreneurial Intensity and Firms' Performance? *IEEE Transactions on Engineering Management*, *68*(2), 378–386. https://doi.org/10.1109/TEM.2019.2907874

Schianetz, K., Kavanagh, L., & Lockington, D. (2007). Concepts and Tools for Comprehensive Sustainability Assessments for Tourism Destinations: A Comparative Review. *Journal of Sustainable Tourism*, *15*(4), 369–389. https://doi.org/10.2167/jost659.0

Shahzad, M., Qu, Y., Rehman, S. U., & Zafar, A. U. (2022). Adoption of green innovation technology to accelerate sustainable development among manufacturing industry. *Journal of Innovation & Knowledge*, *7*(4), 100231. https://doi.org/10.1016/j.jik.2022.100231

Shaikh, S. (2021). Development of Automated Knowledge Management Model (AKMM). *Advances in Data Science and Adaptive Analysis*, *13*(02), 2150008. https://doi.org/10.1142/S2424922X2150008X

Shaikh, S. (2022). The Relationship Between Knowledge Automation and Employee Creativity: *International Journal of Information Technology Project Management*, *13*(2), 1–25. https://doi.org/10.4018/IJITPM.311851

Shehzad, M. U., Zhang, J., Latif, K. F., Jamil, K., & Waseel, A. H. (2023). Do green entrepreneurial orientation and green knowledge management matter in the pursuit of ambidextrous green innovation: A moderated mediation model. *Journal of Cleaner Production*, *388*, 135971. https://doi.org/10.1016/j.jclepro.2023.135971

Song, M., Yang, M. X., Zeng, K. J., & Feng, W. (2020). Green Knowledge Sharing, Stakeholder Pressure, Absorptive Capacity, and Green Innovation: Evidence from Chinese Manufacturing Firms. *Business Strategy and the Environment*, *29*(3), 1517–1531. https://doi.org/10.1002/bse.2450

Tajpour, M., Hosseini, E., Mohammadi, M., & Bahman-Zangi, B. (2022). The Effect of Knowledge Management on the Sustainability of Technology-Driven Businesses in Emerging Markets: The Mediating Role of Social Media. *Sustainability*, *14*(14), 8602. https://doi.org/10.3390/su14148602

Tariq, M. S., & Khalid, A. (2023). Placing Green IT awareness and practices among universities' librarians: A NAT perspective. *The Journal of Academic Librarianship*, *49*(5), 102770. https://doi.org/10.1016/j.acalib.2023.102770

Wang, C. L., Ahmed, P. K., & Rafiq, M. (2008). Knowledge management orientation: Construct development and empirical validation. *European Journal of Information Systems*, *17*(3), 219–235. https://doi.org/10.1057/ejis.2008.12

Wang, Y., Yang, Y., Qin, Z., Yang, Y., & Li, J. (2023). A Literature Review on the Application of Digital Technology in Achieving Green Supply Chain Management. *Sustainability*, *15*(11), 8564. https://doi.org/10.3390/su15118564

Wang, Z., Hou, M., & Luo, W. (2025). Green Knowledge Management and Green Technology Innovation: Roles of Green Organizational Identity and Incentive Environmental Regulation. *Sustainability*, *17*(23), 10781. https://doi.org/10.3390/su172310781

Zhuge, K., Lin, W., Yuan, Y., He, H., & Zhang, Y. (2023). Does Digital Capability Promote Sustainable Development of New Ventures? The Dual Impact of Green Knowledge Creation and Green Pressure. *International Journal of Environmental Research and Public Health*, *20*(3), 2274. https://doi.org/10.3390/ijerph20032274

Zia, N. U. (2020). Knowledge-oriented leadership, knowledge management behaviour and innovation performance in project-based SMEs. The moderating role of goal orientations. *Journal of Knowledge Management*, *24*(8), 1819–1839. https://doi.org/10.1108/JKM-02-2020-0127