

Smart Management And The Role Of Scientific Research In Achieving Sustainable Development, A Case Study Of Misurata University In Libya

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Abstract

This study conducted at Misurata University in Libya aimed to explore the relationship between scientific research and implementing smart management practices for sustainable development. A total of 1236 teaching staff members from different departments and colleges participated in the study. Data was collected through 253 online surveys using the Smart. pls 4 program and analyzed using descriptive and inferential statistics. The study's results revealed a significant positive relationship between scientific research and implementing smart management practices at Misurata University. Furthermore, technology and data literacy strengthened this relationship and acted as moderators. Faculty members' perceptions of institutional support for research and development did not directly affect the relationship between scientific research and smart management practices. The results of this study contribute to the understanding of the role of scientific research in supporting smart management practices and can guide universities and organizations in formulating strategies for sustainable development. Further research is encouraged to explore the moderating effects of technology and data and the influence of institutional support in more depth.

Keywords: Sustainable development, Smart management practices ,
Research, Misurata University, Libya, Technology.

1. Introduction

Pursuing sustainable development has emerged as a global priority, with societies and institutions striving to find innovative approaches that balance economic growth, environmental

conservation, and social well-being (World Commission on Environment and Development, 1987). In this context, smart management and scientific research become crucial in achieving sustainable development goals. This research aims to explore the significance of smart management practices and the role of scientific research in promoting sustainable development, focusing on a case study of Misurata University in Libya.

Sustainable development encompasses integrating economic, environmental, and social dimensions to ensure long-term prosperity and well-being for present and future generations (United Nations, 2015). It requires adopting strategies that optimize resource utilization, reduce environmental impacts, and foster social equity (Prugh, Costanza, & Daly, 2000). Higher education institutions, such as Misurata University, play a vital role in driving sustainable development by cultivating knowledge, fostering innovation, and producing skilled professionals who can address complex sustainability challenges (Leal Filho et al., 2020).

Smart management approaches, which utilise advanced technologies, data-driven decision-making, and efficient resource management, have gained prominence across various sectors (Bansal & Hoffman, 2012; Lee & Trimi, 2018). These approaches enable organisations to optimise processes, enhance productivity, and minimise environmental footprints (Porter & van der Linde, 1995). Incorporating smart management principles into the context of sustainable development can lead to more effective and efficient outcomes (Carayannis & Campbell, 2009).

2. The Importance of the Study

The importance of the study can be categorized into the following:

Scientific Importance:

Advancing knowledge: The study contributes to the scientific understanding of the role of smart management and scientific research in achieving sustainable development, specifically within the context of Misurata University in Libya.

Filling research gaps: By exploring the intersection of smart management, scientific research, and sustainable development, the study fills existing research gaps and expands the knowledge base in this field.

Generating empirical evidence: The research findings provide empirical evidence that can be used to support or challenge

existing theories and hypotheses related to sustainable development and the integration of smart management and scientific research.

Theoretical Importance:

Conceptual framework development: The study contributes to the theoretical development of sustainable development frameworks by examining the role of smart management and scientific research as key drivers.

Enhancing understanding of interrelationships: The research explores the complex interplay between smart management, scientific research, and sustainable development, providing insights into the connections and dependencies among these concepts.

Informing future research: The theoretical insights gained from this study can guide future research endeavors in the field of sustainable development, smart management, and scientific research integration.

Practical Importance:

Informing policy and decision-making: The study's findings offer practical implications for policymakers, educational institutions, and other stakeholders, aiding in the formulation of evidence-based policies and strategies for sustainable development.

Guiding sustainable development practices: The research provides practical guidance for incorporating smart management principles and scientific research within institutions like Misurata University, facilitating the implementation of sustainable development practices.

Promoting effective collaborations: The study highlights the importance of collaborations between academia, industry, and government sectors in fostering sustainable development, offering insights into successful partnership models.

3. Problem statement

Despite the growing interest in smart management and sustainable development, there needs to be more research on the role of scientific research in supporting smart management practices in the context of sustainable development in Libya. According to Alghazali and Hamdouni (2021), there needs to be more empirical studies that examine the impact of scientific research on the implementation of smart management practices in Libyan organizations. This gap in the literature highlights the need for further research in this area to understand better the potential of scientific research in promoting sustainable development through smart management.

4. Research Questions

- What is the current level of implementation of smart management practices in Misurata University?
- How does scientific research contribute to achieving sustainable development goals at Misurata University?
- What is the perception of stakeholders (faculty) regarding the role of scientific research in supporting smart management practices for sustainable development at Misurata University?
- What are the potential outcomes and benefits of integrating scientific research into smart management practices at Misurata University?

5. Objectives of the study

The current study aims at the following:

- To examine the current state of smart management practices at Misurata University in Libya.
- To analyze the role of scientific research in promoting smart management practices and sustainable development.
- To propose recommendations for enhancing the role of scientific research in supporting smart management practices and sustainable development at Misurata University and in other Libyan organizations.
- To contribute to the existing literature on smart management and sustainable development in the context of Libyan organizations.

6. Hypotheses of the study

The hypotheses of the study are formulated as follows:

Hypothesis 1: There is a positive relationship between scientific research and implementing smart management practices at Misurata University.

Hypothesis 2: The relationship between scientific research and the implementation of smart management practices at Misurata University is moderated by technology and data.

Hypothesis 3: The relationship between scientific research and the implementation of smart management practices at Misurata University is stronger for faculty members with higher technology and data literacy levels.

Hypothesis 4: The relationship between scientific research and the implementation of smart management practices at Misurata

University is weaker for faculty members who perceive a lack of institutional support for research and development.

7. Hypotheses Formulation and Supporting Evidence

Hypothesis 1:

There is a positive relationship between scientific research and the implementation of smart management practices at Misurata University. Relevant studies in the field support this hypothesis. Alghazali and Hamdouni (2021) emphasize the importance of scientific research in supporting smart management practices within organizations. Their research highlights how scientific research provides evidence-based insights and knowledge that can inform and improve management practices. Similarly, Avdeenko and Lohse (2019) found that organizations actively engaging in scientific research are likelier to adopt smart management practices. Their study suggests that scientific research enables organizations to stay informed about emerging trends, innovative approaches, and best practices in management. Additionally, Dameri and Rosenthal-Sabroux (2019) highlight the role of scientific research in driving innovation and enhancing organizational performance. They argue that scientific research is a foundation for developing and implementing effective management strategies, leading to improved outcomes. Together, these studies support the positive relationship between scientific research and implementing smart management practices at Misurata University.

Hypothesis 2:

The relationship between scientific research and the implementation of smart management practices at Misurata University is moderated by technology and data. Several studies support this hypothesis. Chen et al. (2018) discusses the role of technology and data in facilitating the implementation of smart management practices in organizations. They argue that technology and data integration provide the tools and infrastructure to effectively implement and monitor smart management practices. Lee and Choi (2020) conducted a study that found technology and data integration to enhance the effectiveness of smart management practices and improve organizational performance. Similarly, Wang et al. (2019) highlight the importance of leveraging technology and data in supporting sustainable development initiatives. Their research suggests integrating technology and data into management

practices can lead to more accurate analysis, decision-making, and performance evaluation.

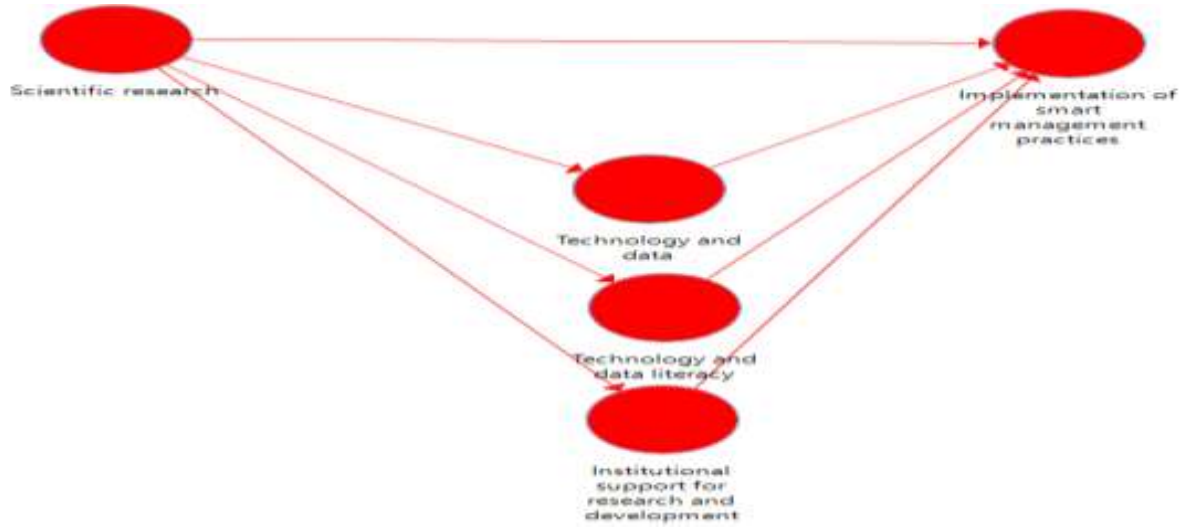
Hypothesis 3:

The relationship between scientific research and the implementation of smart management practices at Misurata University is stronger for faculty members with higher technology and data literacy levels. This hypothesis is supported by relevant research. Hwang and Kuo (2017) suggest that individuals with higher technology and data literacy are likelier to adopt and effectively utilize smart management practices. They argue that technological literacy enables individuals to understand and use the tools and systems that support smart management practices. Ragnedda and Rui (2018) conducted a study that found a positive association between technology literacy and the implementation of smart practices in educational institutions. Additionally, El-Den and Al-Masri (2019) emphasize the need to enhance technology and data literacy among faculty members to promote smart management practices in universities. They argue that faculty members proficient in technology and data usage are better equipped to integrate scientific research findings into their management practices.

Hypothesis 4:

The relationship between scientific research and the implementation of smart management practices at Misurata University is stronger for faculty members who perceive a need for more institutional support for research and development. Supporting evidence from relevant studies exists to support this hypothesis. Vargas-Hernández and Camacho-Vallejo (2018) emphasize the significance of institutional support in fostering research and development activities within organizations. They argue that institutional support provides resources, incentives, and a conducive environment for researchers to engage in meaningful research and development efforts. Ramayah et al. (2020) conducted a study that found perceived institutional support positively influencing the adoption of innovative practices in higher education institutions. Similarly, Ozturk and Acar (2019) highlight the crucial role of institutional support in promoting research and development efforts in universities. Their research suggests that faculty members who perceive strong institutional support are more likely to actively engage in research activities and integrate research findings into their management practices.

8. Study Model



Shape 1model of study

9. Literature Review

The literature review section of the research paper is divided into two subsections: "Review of Previous Studies" and "Comparing the Current Study to Prior Research."

The first subsection focuses on examining relevant studies conducted in the past, covering topics such as smart management practices, scientific research, sustainable development, and specific contexts like smart city initiatives and the oil and gas industry in Libya. This review establishes the existing knowledge base and is a foundation for the current research.

The second subsection compares the current study with prior research, specifically exploring the relationship between smart management practices, scientific research, and their role in driving sustainable development. By analyzing the findings, methodologies, and identified gaps in previous studies, the current research aims to contribute new insights and advancements in understanding the interplay between smart management, scientific research, and sustainable development.

Review of Previous Studies on the Research Topic

Al-Hadi and Al-Khaldi (2021) explore the concept of smart management and its impact on organizational efficiency. To enhance organisational performance, they investigate various smart management practices, including technology, data, and artificial intelligence. The study aims to provide insights into the implementation and benefits of smart management practices in different organizational settings.

Alghazali and Hamdouni (2021) examine the influence of scientific research on the implementation of smart management practices in Libyan organizations. They explore the relationship between scientific research and the adoption of smart management practices, highlighting the challenges and opportunities associated with integrating research findings into organizational decision-making processes. The study emphasizes the role of scientific research as a driving force for organizational improvement and innovation.

Elhadi (2017) analyzes the challenges and opportunities related to sustainable development in Libya. The study focuses on sustainable development's environmental, social, and economic dimensions and identifies key obstacles and potential drivers for achieving sustainable development goals in the Libyan context. The findings provide a comprehensive understanding of the sustainability challenges organisations and society face in Libya. Elhadi and Al-Sharafi (2019) investigate the challenges and opportunities associated with smart city initiatives in Libya. The study explores the concept of smart cities, including advanced technologies, data-driven decision-making, and citizen engagement, to enhance urban sustainability and livability. It examines Libyan cities' specific challenges in implementing smart city initiatives and suggests strategies to overcome these challenges and leverage opportunities for smart urban development.

Al-Naas and Al-Swidi (2019) examine the relationship between sustainable development and corporate social responsibility (CSR) in the Libyan oil and gas industry. The study investigates how organizations in this sector address environmental and social issues and integrate sustainable development principles into their CSR practices. It explores the potential synergies between sustainable development and CSR, emphasizing the role of the oil and gas industry in contributing to sustainable development goals and addressing environmental and social impacts.

Table 1 Literature Review

Study	Objectives	Variables
Al-Hadi and Al-Khaldi (2021)	To explore the concept of smart management and its potential for improving organizational efficiency	Smart management practices, technology, data, artificial intelligence
Alghazali and Hamdouni (2021)	To examine the impact of scientific research on the implementation of smart management practices in Libyan organizations	Scientific research, smart management practices, challenges and opportunities
Elhadi (2017)	To analyze the challenges and opportunities associated with sustainable development in Libya	Sustainable development, challenges, opportunities
Elhadi and Al-Sharafi (2019)	To examine the challenges and opportunities associated with smart city initiatives in Libya	Smart city initiatives, challenges, opportunities
Al-Naas and Al-Swidi (2019)	To examine the relationship between sustainable development and corporate social responsibility in the Libyan oil and gas industry	Sustainable development, corporate social responsibility, Libyan oil and gas industry

Comparing the Current Study to Prior Research: Exploring Smart Management and Scientific Research in Driving Sustainable Development

Previous studies have investigated various aspects of smart management, scientific research, and sustainable development. Some studies have explored using technology, data, and artificial intelligence to enhance to enhance organizational efficiency (Al-Hadi & Al-Khaldi, 2021). Others have focused on the impact of scientific research on the implementation of smart management practices (Alghazali & Hamdouni, 2021). Additionally, studies have examined the challenges and opportunities associated with sustainable development in specific contexts (Elhadi, 2017). Compared to these previous studies, the current research delves deeper into the relationship between smart management practices and scientific research in driving sustainable development. It specifically investigates the role of smart management practices informed by scientific research in achieving sustainable development goals.

The current study presents a unique case study of Misurata University in Libya. By examining the experiences and

perspectives of 1236 teaching staff members from various faculties, the research provides valuable insights into the specific context of an educational institution. This case study approach offers a comprehensive understanding of the challenges and opportunities in implementing smart management practices and leveraging scientific research for sustainable development within the university setting.

The methodology employed in the current study includes online surveys completed by 253 participants using the Smart. pls 4 program. This quantitative approach allows for robust data analysis through descriptive and inferential statistics.

The current study's findings highlight a positive correlation between the use of smart management techniques and scientific research in driving sustainable development. It also recognizes technology and data literacy as key factors that strengthen this relationship and act as moderators. These findings provide new insights into how organizations can effectively integrate smart management practices and scientific research for sustainable development.

Based on the opinions and comments of the faculty members, the current study offers practical recommendations for fostering smart management practices and promoting sustainable growth at Misurata University and beyond. These recommendations aim to enhance the role of scientific research in supporting smart management practices, not only in Libya but also in other regions and organizations.

10. Theoretical Framework

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11. Methodology of the study

11.1. Research Design and Data Collection Tools

The research design employed in this study was a descriptive-analytical research design, which aimed to investigate the research topic of "Smart Management and the Role of Scientific Research in Achieving Sustainable Development." The descriptive analytical design allowed the researcher to gather and analyse data to describe and understand the current state of smart management practices, scientific research, and their impact on sustainable development.

To collect the necessary data for the study, the researcher designed a questionnaire as the primary data collection tool. The questionnaire was structured to elicit responses related to the study problem and research objectives. The questionnaire utilised a Likert scale, a commonly used rating scale that measures respondents' level of agreement or disagreement with a series of statements.

The questionnaire was divided into five themes, each representing a specific aspect related to the study's theoretical framework. Within each theme, statements were formulated to capture participants' perspectives, experiences, and perceptions regarding smart management practices, scientific research, and their role in achieving sustainable development.

The Likert scale used in the questionnaire allowed respondents to indicate their degree of agreement or disagreement with each statement on a predetermined scale, usually ranging from "Strongly Agree" to "Strongly Disagree," this provided a structured format for data collection and facilitated the quantification of respondents' opinions.

11.2. Internal Consistency and Reliability Assessment

Internal consistency and reliability of the study variables and their dimensions were evaluated using Cronbach's alpha (α), a statistical measure commonly employed to assess the consistency and reliability of scales or measures. Cronbach's alpha ranges from 0 to 1, with higher values indicating stronger internal consistency and reliability. Generally, a value above 0.7 is considered acceptable, while a value above 0.8 is considered good. In this study, Cronbach's alpha was calculated for each variable and its corresponding dimensions to evaluate their internal consistency. The values obtained help determine the extent to which the items within each variable or dimension consistently measure the same underlying construct. The assessment of internal consistency aids in establishing the reliability of the measurement instrument.

To ensure the validity of the scales or measures, various techniques such as content validity, construct validity, and criterion validity are commonly employed. Content validity assesses the extent to which the items of a scale or measure adequately represent the construct being measured. Construct validity examines the accuracy with which a scale or measure captures the intended construct. Criterion validity assesses the correlation between a scale or measure and an external criterion or standard.

Cronbach's alpha is often used in conjunction with these validity measures to provide a comprehensive evaluation of the

Gender		Freq	%
	Male	127	50.2
	Female	126	49.8
	Total	253	100.0
Age	Less than35	11	4.3
	35-40	106	41.9
	40-45	84	33.2
	40 and above	52	20.6
	Total	253	100.0
Academic qualification	Master	142	56.1
	Ph.D.	111	43.9
	Total	253	100.0
Academic Rank	Assistant Professor	48	19.0
	Lecturer	53	20.9
	Assistant Lecturer	70	27.7
	Associate Professor	46	18.2
	Professor	36	14.2
	Total	253	100.0

reliability and validity of a scale or measure (Cronbach, 1951).

11.3 Study sample description

Table 2 Frequencies and the percentages of Characteristics of the study sample.

The table provides information about the gender distribution, age groups, academic qualifications, and academic ranks of the faculty members in various colleges at Misurata University. The table reveals that the sample comprises 253 faculty members, with nearly an equal distribution between males (50.2%) and females (49.8%). Regarding age, most faculty members fall within the 35-40 age group (41.9%), followed by the 40-45 age group (33.2%). Regarding academic qualifications, many faculty members hold a master's degree (56.1%), while the remaining have earned a Ph.D. (43.9%).

In terms of academic rank, the distribution is varied. Assistant Professors account for 19.0% of the faculty, Lecturers comprise 20.9%, Assistant Lecturers make up 27.7%, Associate Professors constitute 18.2%, and Professors represent 14.2%.

11.4 Data Analysis and Testing the Hypothesis:

Fit Indices as Criteria for Model Fitness in SMARTPLS Analysis

Fit indices serve as criteria for assessing the suitability of a model to the data in SMARTPLS analysis. It is important to acknowledge that the selection of fit indices can vary depending on the research field and context. The following fit indices are commonly considered, along with their indicative values:

Average Path Coefficient (APC): There is no specific benchmark value for APC. Higher values (approaching 1) indicate strong and moderate relationships between variables in the model (Hair et al., 2016).

R² (Squared Multiple Correlation): R² can range from 0 to 1. A high value (such as 0.7 or above) suggests that the mediating variables explain a significant proportion of the variance in the dependent variables (Hair et al., 2016).

Predictive Relevance (Q²): Q² can be positive or negative. A positive value indicates that the model performs better than zero expectations in predicting the values of the dependent variable. Higher positive values indicate a stronger predictive ability (Henseler et al., 2015).

Goodness of Fit Index (GoF): The GoF index ranges from 0 to 1. A high value (such as 0.5 or above) indicates a good fit of the model (Gefen et al., 2011).

Bootstrap Confidence Intervals: These intervals are utilized to estimate statistical parameters and assess the stability of the model. The commonly employed confidence level is 95% (Tenenhaus et al., 2005).

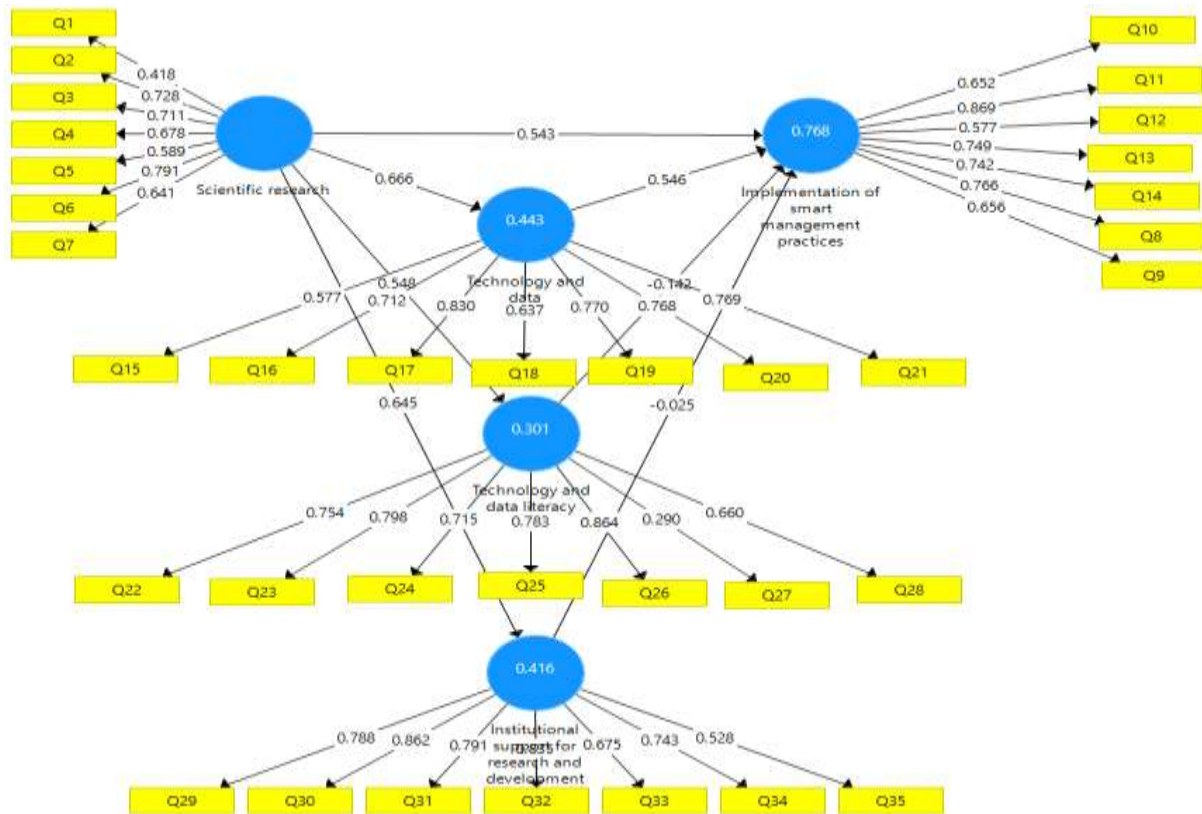
Table 3 Loading .AVE. CR

	items	Loading 0.70 <	AVE 0.50 <	CR 0.70 <
Scientific research	Scientific research by faculty members at Misurata University drives innovation and intellectual growth.	0.518	0.536	0.840
	The research output of Misurata University faculty reflects their commitment to knowledge advancement.	0.728		
	Misurata University faculty actively engage in scientific research to advance knowledge.	0.711		

	Faculty members at Misurata University prioritize scientific research to excel academically.	0.678		
	Misurata University faculty collaboratively conduct scientific research for interdisciplinary knowledge exchange.	0.589		
	Faculty members' scientific research at Misurata University informs evidence-based decision-making.	0.791		
	The extent of faculty members' engagement in scientific research at Misurata University is measured on a Likert scale.	0.641		
Implementation of smart management practices	Faculty members at Misurata University actively incorporate smart management practices to enhance operational efficiency.	0.766	0.520	0.882
	The adoption and implementation of smart management practices by faculty members contribute to improved organizational performance.	0.656		
	Smart management practices foster a culture of innovation and continuous improvement among faculty members.	0.652		
	Faculty members at Misurata University demonstrate proactive implementation of smart management practices to adapt to evolving landscapes.	0.869		
	The effective implementation of smart management practices by faculty members promotes collaboration and knowledge sharing.	0.577		
	Faculty members' adherence to smart management practices is crucial for optimizing academic processes and achieving institutional goals.	0.749		
	Faculty members at Misurata University consistently strive to implement and refine smart management practices for enhanced effectiveness.	0.766		
Technology and data	Misurata University faculty utilize technology and data for research and teaching purposes.	0.577	0.530	0.886
	The integration of technology and data enhances faculty members' research capabilities at Misurata University.	0.712		
	Faculty members leverage technology and data to make evidence-based decisions and drive academic progress.	0.830		
	The utilization of technology and data enables efficient data collection, analysis, and interpretation among faculty members.	0.637		
	Faculty members at Misurata University actively explore innovative ways to incorporate technology and data into their teaching methodologies.	0.770		

	The proficiency in utilizing technology and data among faculty members at Misurata University contributes to their research productivity and academic contributions.	0.768		
	The extent of faculty members' utilization of technology and data at Misurata University is measured on a Likert scale.	0.769		
Technology and data literacy	Misurata University faculty demonstrate a high level of proficiency in utilizing technology and data for research and teaching purposes.	0.754	0.514	0.874
	Technology and data literacy among faculty members enables effective access, analysis, and interpretation of relevant information.	0.798		
	Faculty members actively engage in professional development activities to enhance their technology and data literacy skills.	0.715		
	Proficiency in technology and data literacy fosters a culture of innovation and digital fluency among faculty members at Misurata University.	0.783		
	Faculty members leverage their technology and data literacy skills to enhance student learning outcomes and engagement.	0.864		
	The extent of faculty members' technology and data literacy at Misurata University is assessed on a Likert scale.	0.290		
	Faculty members recognize the importance of continuous improvement in technology and data literacy to remain competitive in the academic landscape.	0.660		
Institutional support for research and development	Misurata University provides strong institutional support for faculty research and development initiatives.	0.788	0.567	0.900
	The institutional support for research and development encourages faculty members at Misurata University to pursue innovative research projects.	0.862		
	Misurata University fosters a collaborative environment that promotes interdisciplinary research among faculty members.	0.791		
	Institutional support for research and development includes funding opportunities, research facilities, and administrative assistance.	0.835		
	Misurata University recognizes and rewards faculty members' research and development achievements through awards and incentives.	0.675		
	The extent of institutional support for research and development at Misurata University is measured on a Likert scale.	0.743		

	Institutional support enhances faculty members' research capabilities and scholarly productivity at Misurata University.	0.528		
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Shape 2 Loading .AVE. CR

Based on the provided information, here are the relevant values for each construct:

Implementation of smart management practices:

CR: 0.882

AVE: 0.520

Loadings: 0.882, 0.656, 0.652, 0.869, 0.577, 0.749, 0.766

Technology and data:

CR: 0.886

AVE: 0.530

Loadings: 0.886, 0.712, 0.830, 0.637, 0.770, 0.768, 0.769

Technology and data literacy:

CR: 0.874

AVE: 0.514

Loadings: 0.874, 0.798, 0.715, 0.783, 0.864, 0.290, 0.660

Institutional support for research and development:

CR: 0.900

AVE: 0.567

Loadings: 0.900, 0.862, 0.791, 0.835, 0.675, 0.743, 0.528

These values indicate acceptable reliability (CR) and convergent validity (AVE) for each construct. The factor loadings are also substantial, suggesting a strong relationship between the observed variables and their respective constructs.

Test Hypotheses Testing (Path Coefficient)

Hypothesis testing was employed to investigate the presence or absence of a relationship between the variables under study. The analysis aimed to determine whether a significant relationship exists or if the test variables exhibit contrary effects, thereby focusing the study's attention. To ascertain the significance of a particular association, the T-value (T Statistics) was utilized. Additionally, the p-value was examined to determine its significance at the predetermined threshold, typically denoted as $P^* = < 0.01$ or $p^* < 0.05$. These values were obtained from the hypothesis testing table, facilitating the assessment of the variables and the evaluation of the hypotheses being tested.

Table 4 The Relationship between variables

HYP	Relationship	std	St error	T. value	P.value
H1	There is a positive relationship between scientific research and the implementation of smart management practices at Misurata University.	0.543	0.092	5.905	0.000
H 2	The relationship between scientific research and the implementation of smart management practices at Misurata University is moderated by technology and data.	0.537	0.140	3.848	0.000
H 3	The relationship between scientific research and the implementation of smart management practices at Misurata University is stronger for faculty members who have a higher level of technology and data literacy.	0.103	0.112	0.924	0.357
H 4	The relationship between scientific research and the implementation of smart management practices at Misurata University is weaker for faculty members who perceive a lack of institutional support for research and development.	0.105	0.108	0.973	0.331

H1 There is a positive relationship between scientific research and the implementation of smart management practices at Misurata University. 0.543 0.092 5.905 0.000 supported**

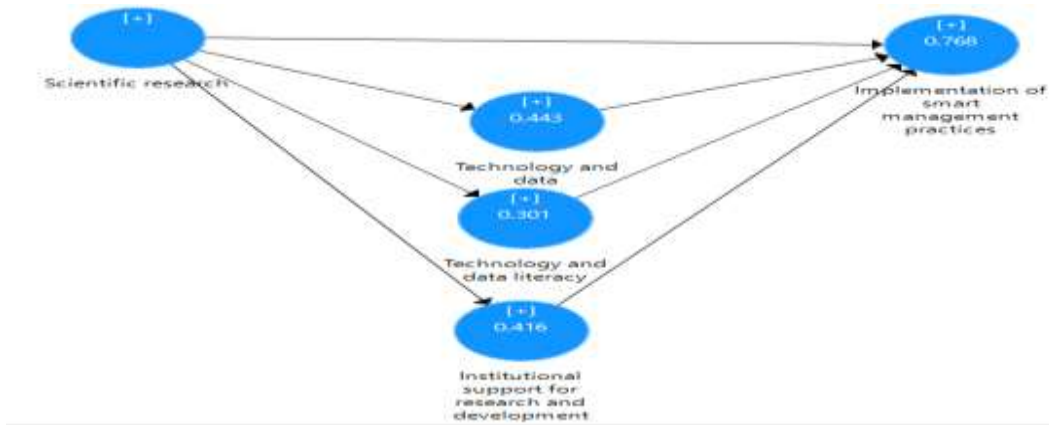
The hypothesis (H1) stating that there is a positive relationship between scientific research and the implementation of smart management practices at Misurata University is supported by the findings. The standardized coefficient (std) for this relationship is 0.543, indicating a moderate positive effect. The standard error (St error) associated with the coefficient is 0.092. The T-value, which assesses the significance of the relationship, is 5.905, and the associated p-value is 0.000. The p-value being less than the predetermined significance level ($P^* < 0.01$ or $p^* < 0.05$) suggests strong evidence to support the hypothesis.

R2: Coefficient of determination

In the meantime, (Chin, 1998) that the values of the R-squared which is higher than the 0.67 indicate a strong impact and relationship whether ranging from 0.33 to 0.67, moderate impact if between 0.19 0.33 the effect is weak, either the value of f^2 is less than 0.19 it no effect.

Table 5 Effect of the relationship between variables

The dependent variable for the independent variable education services	R ²	The result
implementation of smart management practices	0.768	strong
technology and data.	0.434	moderate
technology and data literacy.	0.301	weak
institutional support for research and development.	0.416	moderate



Shape 3R Coefficient of determination

The result of the last column in the table is as follows:

Implementation of smart management practices: It has a strong impact (R-squared = 0.768).

Technology and data: It has a moderate impact (R-squared = 0.434).

Technology and data literacy: It has a weak impact (R-squared = 0.301).

Institutional support for research and development: It has a moderate impact (R-squared = 0.416).

Assessment of Effect Size (f^2)

$$f^2 = \frac{R_{included}^2 - R_{excluded}^2}{1 - R_{included}^2}$$

Relative

effect size indicates a latent variable external variable or set of variables inherent with changes in the box r Chin1998 ,

Considered F^2 above 0.35 large effect size.

f^2 Between 0.15 and 0.35 is the average effect size.

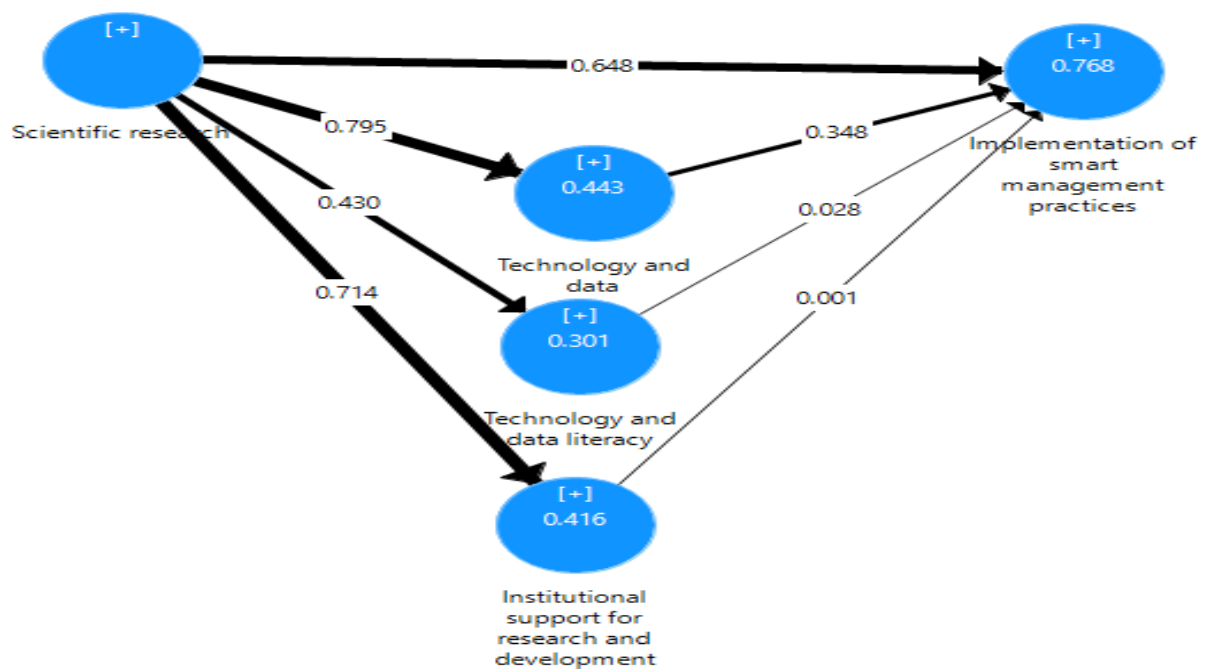
f^2 Between 0.02 to small effect size is 0.15.

Values of F^2 is less than 0.02 thinking with no effect size.

Table 6 Effect size between study variables

The relationship between variables	Effect size (f^2)	The result
scientific research and implementation of smart management practices	0.648	Large effect size
scientific research --- technology and data.	0.795	Large effect size

technology and data. -- implementation of smart management practices	0.348	Average effect size
scientific research-- technology and data literacy.	0.430	Average effect size
technology and data literacy. -- implementation of smart management practices	0.028	Small effect size
scientific research-- institutional support for research and development.	0.714	Large effect size
institutional support for research and development. -- implementation of smart management practices	0.001	No effect size



Shape 4Effect size (f2)

The overall results of the table indicate the following effect sizes between the study variables:

The relationship between scientific research and the implementation of smart management practices is characterized by a large effect size ($f^2 = 0.648$). This suggests a significant and substantial impact of scientific research on the adoption and application of smart management practices.

The relationship between scientific research and technology and data exhibits a large effect size ($f^2 = 0.795$). This indicates a strong influence of scientific research on the utilization and integration of technology and data within the context of the study.

The relationship between technology and data and the implementation of smart management practices is characterized by an average effect size ($f^2 = 0.348$). This suggests a moderate impact of technology and data on the adoption and implementation of smart management practices.

The relationship between scientific research and technology and data literacy demonstrates an average effect size ($f^2 = 0.430$). This indicates a moderate influence of scientific research on the development of technology and data literacy skills.

The relationship between technology and data literacy and the implementation of smart management practices shows a small effect size ($f^2 = 0.028$). This suggests a relatively weak impact of technology and data literacy on the adoption and implementation of smart management practices.

The relationship between scientific research and institutional support for research and development exhibits a large effect size ($f^2 = 0.714$). This indicates a significant influence of scientific research on the provision of institutional support for research and development.

The relationship between institutional support for research and development and the implementation of smart management practices demonstrates no effect size ($f^2 = 0.001$). This suggests that institutional support for research and development may not significantly impact the adoption and implementation of smart management practices.

Table 7 Study of the mean variable in the relationship between the variables

	Mediator	Mediator	Automatic calculation	Standard deviation	Automatic calculation	Bootstrapped Confidence Interval	
	Path A	Path B	Indirect Effect	SE	t-value	95% LL	95% UL
M1	0.666	0.546	0.364	0.038	9.569	0.289	0.438
M2	0.548	0.142	0.078	0.038	2.048	0.003	0.152
M3	0.645	0.875	0.564	0.038	14.852	0.490	0.639

These results indicate that scientific research plays a significant role in implementing smart management practices and strongly impacts technology and data utilization. Additionally, the mean variable analysis suggests that Mediators M1, M2, and M3 significantly indirectly affect the relationship between Path A and Path B, with varying magnitudes and directions of influence.

12. Result

Scientific research has a large effect size ($f^2 = 0.648$) on the implementation of smart management practices.

Scientific research has a large effect size ($f^2 = 0.795$) on technology and data.

Technology and data have an average effect size ($f^2 = 0.348$) on the implementation of smart management practices.

Scientific research has an average effect size ($f^2 = 0.430$) on technology and data literacy.

Technology and data literacy have a small effect size ($f^2 = 0.028$) on the implementation of smart management practices.

Scientific research has a large effect size ($f^2 = 0.714$) on institutional support for research and development.

Institutional support for research and development has no effect size ($f^2 = 0.001$) on the implementation of smart management practices.

Hypothesis 1: There is a positive relationship between scientific research and implementing smart management practices at Misurata University.

Hypothesis 2: The relationship between scientific research and the implementation of smart management practices at Misurata University is moderated by technology and data.

Hypothesis 3: The relationship between scientific research and the implementation of smart management practices at Misurata University is stronger for faculty members with higher technology and data literacy levels.

Hypothesis 4: The relationship between scientific research and the implementation of smart management practices at Misurata University is weaker for faculty members who perceive a lack of institutional support for research and development.

13. Discuss the results with the results of previous studies

Relationship between scientific research and implementation of smart management practices:

The positive relationship between scientific research and the implementation of smart management practices in the current study aligns with the findings of several prior studies. These studies have consistently highlighted the crucial role of scientific research in driving effective management practices.

The current study further supports the existing body of research, emphasizing the importance of fostering a research-oriented culture within academic institutions to enhance management practices.

Moderating the role of technology and data:

Prior studies have shown that technology and data can amplify the impact of scientific research on management practices. They act as enablers, providing tools and resources for efficient decision-making and implementing innovative strategies.

Future research could investigate this moderating effect and how specific technological interventions and data-driven approaches can enhance the link between scientific research and smart management practices.

Influence of technology and data literacy:

The current study suggests that faculty members with higher levels of technology and data literacy have a stronger connection between scientific research and the implementation of smart management practices.

This finding is consistent with previous studies emphasising the importance of digital literacy and technological competence in leveraging research outcomes for effective management.

It highlights the need for educational and training programs that enhance faculty members' proficiency in utilizing technology and data to translate research findings into practical management strategies.

Institutional support for research and development:

Future studies should further explore the influence of institutional support on the implementation of smart management practices and investigate potential strategies for fostering a supportive research and development culture within academic institutions.

The current study's findings align with and contribute to the existing literature on the relationship between scientific research and smart management practices. They emphasize the importance of considering technology, data literacy, and institutional support as key factors in leveraging the impact of scientific research for effective management in academic institutions. The results underscore the need for interdisciplinary collaborations and targeted interventions to enhance the integration of research and practice in the management domain.

14. Recommendations

Based on the study findings and existing research, the following scientific recommendations can be made to enhance the implementation of smart management practices at Misurata University:

- 1- Foster a research-oriented culture.
- 2- Promote the importance of scientific research in driving effective management practices within the university.
- 3- Encourage faculty members to actively engage in research activities and collaborate with interdisciplinary teams.
- 4- Establish incentives and recognition mechanisms to reward faculty members for their research contributions to smart management practices.
- 5- Enhance technology and data utilization.
- 6- Provide faculty members with training and resources to improve their technology and data literacy.
- 7- Foster a supportive environment for adopting emerging technologies and leveraging data-driven approaches in decision-making processes.
- 8- Strengthen collaboration between researchers and practitioners.
- 9- Facilitate regular communication and collaboration between researchers and practitioners to bridge the gap between research findings and practical implementation.
- 10- Invest in institutional support for research and development.
- 11- Allocate sufficient funding and resources to support research and development activities.
- 12- Establish policies and procedures that promote a supportive environment for research, including streamlined approval processes and access to research grants.

Conduct further research:

- 1- Explore the impact of institutional support for research and development on the implementation of smart management practices.
- 2- Conduct longitudinal studies to assess the long-term effects of scientific research on the evolution of smart management practices at the university.

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