Knowledge Management and its Role in the Development of a Smart University in Iraq

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Abstract **– There is a lack of extensive research on the development of smart universities (SU). The aim of this paper is to investigate the impact of knowledge management (KM) on the development of SU (DSU) in Iraq. According to the knowledge-based view (KBV), resource-based view (RBV), and KM capability model, this study suggests that the KM process (KMP) and KM infrastructure (KMI) have a positive impact on SUs development. Furthermore, the study suggests that KMI functions as a mediator. The study was conducted using a sample of five public universities in Iraq. A purposive sampling method was utilised to collect data from a total of 209 academic staff members. The study's results demonstrate that KMP (knowledge acquisition, knowledge sharing, and knowledge application) and KMI (IT infrastructure and human KM) have a significant impact on the DSU. Additionally, it was discovered that KMI plays a role in mediating the influence of KMP on the DSU. The findings indicate that successful KM can support the progress of SU. Further cross-national and variable-based studies are required to enhance the validity of this conclusion.**

Keywords **– Knowledge management, KM process, KM infrastructure, smart university.**

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1. Introduction

Recently, scholars and practitioners discovered the gaps between education and industry. This has led to the creation of a research university where the university can link more with the industry [1]. A new advancement in higher education is smart university (SU). SU is a higher education establishment that makes use of cutting-edge technology, data analytics, and novel teaching strategies to raise educational standards, increase productivity, and support sustainable development [2]. The notion of SU embodies a novel framework in tertiary education that endeavors to utilize technology and ingenuity to augment the caliber of education, foster sustainability, and propel societal and economic progress [3]. Effective knowledge management processes (KMP) can be considered a crucial factor in facilitating the development of SU (DSU). KMP encompasses a set of procedures that entail the acquisition, use dissemination, implementation, and safeguarding of knowledge resources within a corporate entity [4]. This practice can foster the creation and utilization of cutting-edge technologies and pedagogical approaches. Nevertheless, when it comes to KM, the concept is still relatively new and studies are focusing on developed countries [5]. The successful execution of KM procedures within Iraqi higher education institutions has the potential to surmount the obstacles of restricted resources and infrastructure and foster the growth of a durable and inventive higher education framework [6].

KMP has the potential to significantly contribute to the improvement of teaching and learning in SU.

This is achieved by granting faculty members access to valuable knowledge, resources, and expertise, which can assist them in creating and delivering courses that are both captivating and efficient, while also being tailored to meet the specific requirements of their students [7]. KM can serve as a crucial facilitator of research collaboration within SU by granting researchers access to valuable knowledge, resources, and expertise. This, in turn, can enhance their ability to collaborate more efficiently and generate research outcomes of superior quality [8], [9]. Through the utilization of KM, higher education institutions can establish a collaborative and innovative environment, enabling them to maintain a leading position in their respective areas of research [7], [8].

However, to enable KMP to be effective in the DSU, it requires complementation with the KM infrastructure (KMI). A pioneer work in KM capability, such as the work of [10] referred to the need to include KMP and KMI to enhance the effectiveness of an organization. This perception was held true in several other studies such as [4], [5]. There is a gap in the current literature on KM. Existing research has predominantly focused on the influence of KM in the progress of smart cities, while only a few studies have examined its effects on the advancement of SU [11]. Further, studies are still conceptual and proposed a model for the link between KM and smart institutions and universities [1], [12], [13]. In addition, previous studies focused on KMP while limited studies examined the KMI [14]. The gap is also related to the inconsistent findings regarding the role of KMP and KMI where studies found the effect on organizational effectiveness or organizational performance to be mixed [15].

Most studies on SU have focused on developed countries with established infrastructure and readiness to implement the concept [13]. Iraq is currently in the process of developing its infrastructure. Understanding the role of KM capability is crucial for enhancing the DSU in Iraq. This study seeks to examine the effects of KMP and KMI on the progress of SU within the nation. Furthermore, this study investigates the potential mediating effect of KMI on the relationship between KMP and the DSU. The paper's remaining parts provide a deeper examination of the study's literature review, methodology, results, discussion, and conclusion.

2. Literature Review

This section introduces the theoretical framework that supports this study, which includes the knowledge-based view (KBV), resource-based view (RBV), and KM capability model.

Additionally, we examine the relationship between the theoretical framework and the concept of a SU, specifically focusing on the importance of KMP within this context.

2.1. Theoretical Framework

Theoretical frameworks such as KBV and RBV can provide insight into the impact of KMP and infrastructure for the DSU. According to KBV, possessing knowledge is the foundational resource that empowers organizations to achieve a sustainable competitive edge. In this perspective, organizations can leverage their internal knowledge to develop innovative strategies, make informed decisions, and adapt to dynamic environments, thereby gaining a distinct advantage over their competitors. Within the framework of SU, the implementation of KMP and infrastructure can facilitate the utilization of knowledge assets by universities to augment their pedagogical and learning capacities, optimize operational efficiency, and foster sustainable growth [16]. KBV can explain the relationship between KMP and the DSU. The application of KBV principles allows for an understanding of how effective KMP influence the progress and growth of SU. This, in turn, promotes innovation, adaptability, and sustainable competitive advantage. On the other hand, the RBV suggests that the competitive advantage of an organization is primarily contingent upon its resources and capabilities [17]. Within the framework of SU, the KMI can be regarded as a scarce and valuable resource that has the potential to facilitate universities' attaining exceptional performance. Through the implementation of efficient KMI, academic institutions can establish a distinctive array of resources and capabilities, which can facilitate differentiation from their rivals and foster the attainment of sustainable competitive advantage.

This is in line with the suggestions of the KM capability model by [10] who suggested that a combination of KMP and infrastructure will lead to high efficiency of organizations. According to the model, the successful implementation of KM necessitates the integration of personnel, procedures, technological tools, and societal norms.

Within the realm of SU, the implementation of proficient KMP and infrastructure can facilitate the utilization of universities' knowledge resources, thereby fostering a learning milieu that is favorable to innovation and collaboration. The implementation of the KM capability model can potentially augment the knowledge acquisition (KA), knowledge sharing (KS), knowledge application (KAP), and knowledge protection (KP) capabilities as well as the organizational culture (OC) and structure along with the IT and human infrastructure of universities, thereby facilitating the development of a sustainable competitive edge. Therefore, this model is deployed to explain the impact of both the KMP and KMI on the DSU.

2.2. Smart University

SU refers to a higher education establishment that utilizes cutting-edge technologies, data analytics, and inventive methodologies to improve teaching, learning, research, and administrative processes [1]. The emergence of the SU is a direct response to the swift technological advancements and the imperative to adjust to the evolving educational terrain in the digital era. The integration of technology into academic and administrative processes is a hallmark of SU, with the purpose of achieving higher accessibility, and efficiency as well as engaging students [2]. The utilization of digital platforms and tools for the purpose of delivering courses, facilitating online collaboration, and creating virtual learning environments is encompassed within this context [1], [2], [18]. There are numerous advantages associated with the implementation of SU. The utilization of technology to offer tailored learning experiences, immediate feedback, and a plethora of educational materials contributes to the improvement of the educational standard.

Furthermore, it fosters inclusiveness by dismantling geographical and socio-economic obstacles, enabling individuals from various backgrounds to attain educational opportunities [1]. The main goal of this paper is to examine the determinants of DSU in Iraq.

2.2.1. SU in Iraq

The notion of SU is increasingly gaining prominence in Iraq, as academic institutions endeavor to adjust to the digital age and augment their educational provisions. Iraqi universities with a strategic vision are endeavoring to utilize cutting-edge technologies and inventive methodologies to enhance pedagogical practices, research proficiency, and administrative operations [19]. Nevertheless, there are some obstacles that face the DSU in Iraq and these mainly are related to the IT infrastructure (TI) and the human resource capable of managing the applications of SU [6]. The utilization of smart technologies presents an opportunity for Iraqi universities to assume a crucial function in promoting the nation's educational growth and facilitating its societal and economic advancement. Therefore, this study is examining the role of KM in fostering the DSU in Iraq.

2.3. Conceptual Framework and Hypotheses Development

Based on KBV as well as RBV and KM capability model, this study proposed that the effects of KMP, which include KA, KS, KAP, and KP will impact positively the DSU in Iraq. In addition, the study proposes that the KMI such as OC, organizational structure (OS), and TI as well as human KM (HR) will affect positively the DSU. In this study, KMI is proposed as a composite measure to mediate the combined impact of KMP on the DSU.

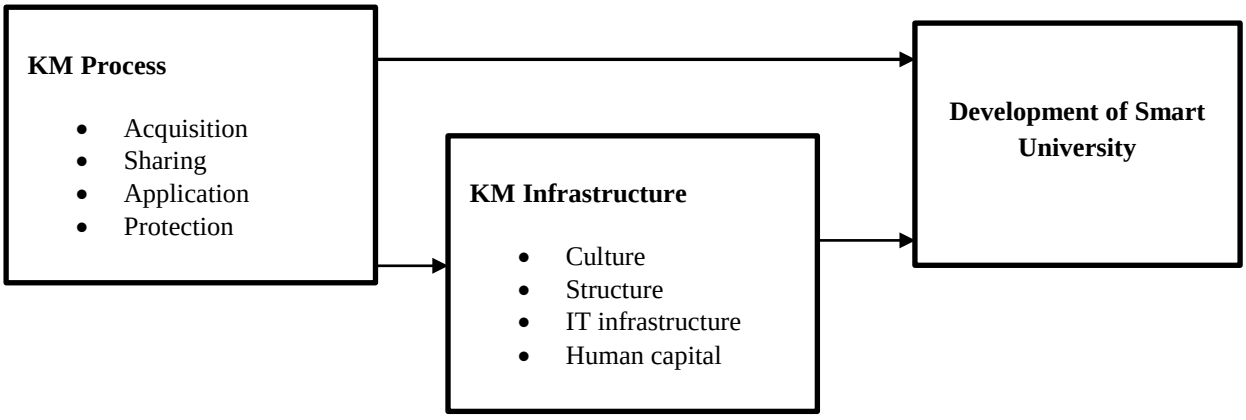

Figure 1. Conceptual Framework

2.3.1. KMP and SU

KMP is essential to the growth and achievement of smart institutions. Effective KM methods help higher education institutions utilize their intellectual capital, facilitate cooperation, and promote continuous improvement as they adopt digital transformation and creative techniques. KMP has been found to affect organizational effectiveness [4]. Furthermore, it was discovered that KMI has a noteworthy influence on the OC of universities [14]. Additionally, KMP showed a positive influence on organizational innovativeness and the implementation of HRM practices [20], and organizational readiness and agility [21]. Therefore, this study proposed that KMP positively affects the DSU in Iraq.

H1: KMP positively influences the DSU.

2.3.1.1. Knowledge Acquisition and SU

SU development requires effective KA. Experts, databases, research papers, and other sources are identified, captured, and organized [22]. Smart institutions may acquire information about new trends, innovations, and best practices in higher education. This insight may increase research productivity, decision-making, and innovation [7]. SU may utilize KM to learn about new pedagogy and instructional design trends to create student-centered teaching methods and resources. KA can assist SU to keep current on research and industry developments [1]. Smart institutions use KA to collect and organize academic research and scientific publications to keep their professors and students ahead of the curve [2], [13]. Prior studies have examined the effects of KA on different outcomes, such as organisational effectiveness [4], and innovation capability [15]. This study proposes that KA plays a role in the DSU in Iraq.

H1a: KA affects positively the DSU in Iraq.

2.3.1.2. Knowledge Sharing and SU

In the context of SU, KS is an essential element of the KMP [13]. By employing KM strategies, SU can bolster collaboration, innovation, and responsiveness to stakeholder needs, facilitated by seamless KS within the institution [1], [18]. KS is not only pivotal for SU's development [7], but also plays a significant role in shaping other organizational outcomes, such as organizational learning [23] and implementing organizational change in higher education [8]. Therefore, in this paper, KS is hypothesized to have a substantial positive impact on the DSU.

H1b: KS positively influences the DSU.

2.3.1.3. Knowledge Application and SU

By giving space for experimentation and innovation, KM may support the application of knowledge in SU. SU can provide fresh ideas and answers to the difficulties confronting higher education by using the knowledge and experience of its faculty members and researchers. For instance, KM may aid in the creation of new educational technologies, learning management systems, and other electronic tools that can enhance the standard of instruction. SU may increase their agility, responsiveness, and effectiveness in addressing the demands of their stakeholders by using the potential of KM to drive innovation, enhance decision-making, and encourage evidence-based practices. KAP affected significantly the development of smart campuses [3]. KAP affected organizational effectiveness and performance [4], [24]. Therefore, this study predicts that KAP can contribute to the DSU.

H1c: KAP positively influences the DSU.

2.3.1.4. Knowledge Protection and SU

The protection of knowledge is a crucial element within the KMP when establishing intelligent academic institutions. The procedure entails the preservation of intellectual property, the protection of confidential information, and the guarantee of ethical and responsible utilization of the university's knowledge resources. SU can safeguard sensitive information, such as student records and research data, from unauthorized access and use by implementing data security and privacy protocols. The implementation of such measures can serve to safeguard the reputation and credibility of the academic institution, while also instilling confidence among stakeholders with regards to the integrity of its operations. In their study, [10] proposed that KP plays a vital role in enhancing organizational effectiveness and performance. Nevertheless, it was observed that KP had no impact on information use, as reported by [25]. Consequently, this research suggests exploring the influence of KP on the DSU.

H1d: KP positively influences the DSU.

2.3.2. KMI and DSU

KMI is critical for the DSU. KMI was proposed by [10] to be an essential component of KM and it supports the functionality of a KM system. The KMI consists of OC, structure, and TI. Other researchers add the fourth element which is the HR. KMI affected positively the quality improvement in service companies in the European Union [9].

KMI also affected positively the performance of universities [26]. Consequently, this study puts forth the proposition that KMI will positively influence the DSU. Therefore, the following hypothesis is proposed:

H2: KMI positively influences the DSU.

2.3.2.1. Organizational Culture and SU

A knowledge-sharing culture promotes the active involvement of faculty, staff, and students in the processes of knowledge creation, dissemination, and application. SU fosters an environment of openness and support that promotes the integration of emerging technologies, experimentation with novel pedagogical approaches, and a disposition toward continuous learning. OC affects positively the teacher's innovative capability [27]. Furthermore, research has shown that KMI also yield a positive impact on the performance of research organizations [28]. However, it has been found that OC has a negligible effect on both employee and organizational performance [29], [30]. As a result, this study puts forth the following hypothesis for investigation.

H2a: OC positively influences the DSU.

2.3.2.2. Organizational structure and the DSU

The implementation of a flexible and decentralized OS facilitates effective communication, collaboration, and decision-making processes within the academic institution. Agile and adaptive structures within the university setting enable a proficient response to technological advancements and evolving educational requirements. According to existing research, OS has been shown to positively influence innovation capability [27] and the dynamic capability of organizations [31]. However, it is worth noting that prior literature has indicated no significant effect of OS on overall organizational performance [32]. In light of these findings, this study puts forth the following hypothesis for further examination.

H2b: OC positively influences the DSU.

2.3.2.3. IT infrastructure and the DSU

The establishment of SU necessitates a resilient TI, encompassing hardware, software, and networking capabilities [13]. The availability of dependable and fast internet connectivity facilitates uninterrupted entry to digital resources, e-learning platforms, and cooperative utilities [33].

The incorporation of nascent technologies and data analytics, augments the capacity of higher education institutions to gather, scrutinize, and apply data to facilitate well-informed decision-making and individualized pedagogical encounters [34]. TI is critical for the DSU [11]. Thus, this study proposed that TI can have a strong impact on the DSU.

H2c: TI positively influences the DSU.

2.3.2.4. Human KM and SU

The DSU is facilitated by the proficiencies, aptitudes, and knowledge possessed by the faculty, staff, and student. Professional development programs and training initiatives that are ongoing facilitate the acquisition and improvement of digital literacy and KM skills among individuals. HR plays a key role in recruiting, developing, and retaining employees with the necessary knowledge and skills for the organization [35]. This includes identifying the knowledge and skills needed for different roles, creating job descriptions and selection criteria that reflect these needs, and developing training and development programs to help employees acquire and maintain the necessary knowledge and skills [36]. Consequently, this study puts forward the hypothesis that HR will exert a positive influence on the DSU.

H2d: HR positively influences the DSU.

2.3.3. Mediating Role of KMI

Effective KMI can facilitate the function of KMP. [10] proposed that KMI is complementary to the KMP, and it is an enabler of the knowledge processes. Having effective KMI can help an organization acquire, share, apply, and protect knowledge. OC as a component of KMI mediated the effect of leadership style on organizational innovation [37], it also mediated the effect of authentic leadership and innovative work behavior [38]. This study proposes that KMI will mediate the effect of KMP on the DSU.

H3: KMI mediates the effect of KMP on the DSU.

3. Research Methodology

This is a quantitative study. The study examines the link between KM and the DSU. Therefore, the population of this study is the academic staff in the IT department and business management in five selected universities in Iraq. The choice of these respondents is due to their understanding of the terms that are used in this study and the suggestions of researchers to choose those who are aware of the topic that is being investigated [4], [10].

Therefore, the study is using purposive sampling. The use of purposive sampling is to select only those who have knowledge about the usage of KM as well as the DSU. Therefore, the measurements of the variables were selected based on prior literature. Measurement of KA adopted from [39], KAP adapted from [40], KS is adapted from [41]. KP adapted from [42], OC and structure as well as TI were adopted from [43], HR resources adapted from [44]. The DSU was self-developed. The measurement of the DSU consists of seven items and it is based on prior literature [1], [2], [7], [18], [22].

The measurement was translated into Arabic using a back-to-back translation. Further, the instrument was validated for the accuracy of translation as well as for content validity. Four Ph.D. holders have read the instrument and provided their feedback and comments. Subsequently, a pilot study was conducted, and 37 respondents were invited to participate. The reliability of the measurements was evaluated using Cronbach's Alpha (CA), and all measurements exhibited values greater than 0.70, indicating satisfactory internal consistency. Following the pilot study, a total of 217 responses were collected from January 2023 to March 2023 for the main data collection phase. The collected data was analyzed using Smart Partial Least Squares (Smart PLS) version 4, a powerful statistical analysis technique commonly employed for structural equation modeling and path analysis.

4. Data Analysis and Findings

In this section, we conduct the data analysis for the study, which encompasses both data examination and the presentation of descriptive information about the respondents.

To evaluate the proposed hypotheses, we utilize Smart PLS for the assessment of both the MM and the SM. Smart PLS allows us to comprehensively analyze the relationships between variables and draw meaningful conclusions from the data.

4.1. Data Examination

A total of 217 responses were successfully collected for the study, and there were no missing values in the dataset thanks to the use of the required function for data collection. To ensure data quality, the measurements were carefully assessed for outliers. Consequently, eight responses were removed due to their significantly high extreme values, as identified through boxplot analysis. The normality of the data distribution was examined using the Skewness and Kurtosis values. A value less than 1 indicates a normal distribution [45].

As presented in Table 1, both Skewness and Kurtosis values were found to be less than 1, confirming that the data follows a normal distribution. Furthermore, to evaluate multicollinearity, the variation inflation factor (VIF) and tolerance were checked. For the data to be free from multicollinearity, VIF should be less than five (5), and the tolerance should be greater than 0.20. As indicated in Table 1, both VIF and tolerance meet these conditions, indicating that the variables are not affected by multicollinearity.

Table 1. Normality and multicollinearity

Variable	Normality		Multicollinearity	
First order				
	Skewness	Kurtosis	Tolerance	VIF
KA	-0.81	-0.52	0.54	1.40
KS	-0.78	-0.36	0.44	1.49
KAP	-0.67	-0.45	0.61	1.82
KP	-0.74	-0.65	0.65	1.33
OC	-0.81	-0.54	0.39	1.94
OS	-0.78	-0.36	0.41	1.89
IT	-0.67	-0.72	0.61	1.43
HR	-0.74	-0.71	0.53	1.42
Second Order				
KMP	-0.78	-0.58	0.57	1.68
KMI	-0.67	-0.49	0.49	1.44
Development of SU	-0.74	-0.65	-	-

Note: OS: HR: Human KM, KMP: KM process, KMI: KM infrastructure, DSU: Development of Smart University.

4.2. Profile of Respondents

The respondents were asked about their age, gender, education, and experience in academia.

A significant majority of the respondents (65%) fall within the age group of 30 to 40 years old. 73% of the respondents are male with all having PhD degrees.

The respondents (63%) have been working in academia between 5 years to 10 years. This background information confirms that the respondents have adequate knowledge and experience in academia.

4.3. Measurement Model (MM)

Based on the suggestions of Hari *et al.* (2017), the assessment of MM was conducted. Factor loading was checked for all the variables. Items from TI (TI1, TI3) were removed as well as items from OC (OC6, OC7).

After eliminating specific items, the remaining items all exibited factor loadings above 0.70, indicating a strong relationship with their respective constructs.

To ensure the reliability of the MM, both composite reliability (CR) and CA were examined, and their values, as presented in Table 2, exceeded 0.70.The assessment of convergent validity was carried out by evaluating the average variance extracted (AVE), and the obtained values, also shown in Table 2, exceeded the threshold of 0.50, indicating satisfactory convergent validity. Furthermore, to confirm the discriminant validity, the heterotrait-monotrait ratio (HTMT) was evaluated based on [46]. The HTMT's correlations were found to be below 0.85, demonstrating that the constructs have discriminant validity. The comprehensive results of the measurement model assessment are provided in Table 2.

Table 2. Results of assessing first and second order MM

Variable	Reliabilities and Convergent validity			Discriminant validity using HTMT								
	First Order											
	CA	CR	AVE	DSU	HR	KA	KAP	KP	KS	OC	OS	TI
DSU	0.82	0.82	0.74									
HR	0.78	0.79	0.81	0.87								
KA	0.72	0.73	0.74	0.68	0.52							
KAP	0.84	0.85	0.61	0.56	0.49	0.42						
KP	0.81	0.81	0.66	0.22	0.31	0.22	0.47					
KS	0.83	0.85	0.83	0.43	0.24	0.33	0.19	0.31				
OC	0.80	0.82	0.86	0.35	0.12	0.42	0.67	0.19	0.09			
OS	0.81	0.81	0.74	0.59	0.73	0.55	0.36	0.41	0.35	0.47		
TI	0.76	0.82	0.67	0.33	0.43	0.12	0.12	0.49	0.64	0.67	0.35	
Second Order												
DSU	0.82	0.82	0.74									
KMP	0.79	0.78	0.61	0.58								
KMI	0.83	0.82	0.59	0.71	0.62							

4.4. Structural Model (SM)

The SM is assessed based on the suggestions of [45]. The R-square as shown in Figure 2, accounted for 0.776 for DSU and 0.571 for KMI indicating that both KMP and KMI can explain 77.6% of the DSU while 57.1% of the KMI can be explained by KMP.

The assessment also includes the F-square, where the value of 0.02 is considered weak but acceptable. Some paths showed a value less than 0.02 and this could be due to the rejection of the related hypotheses as shown in Table 3.

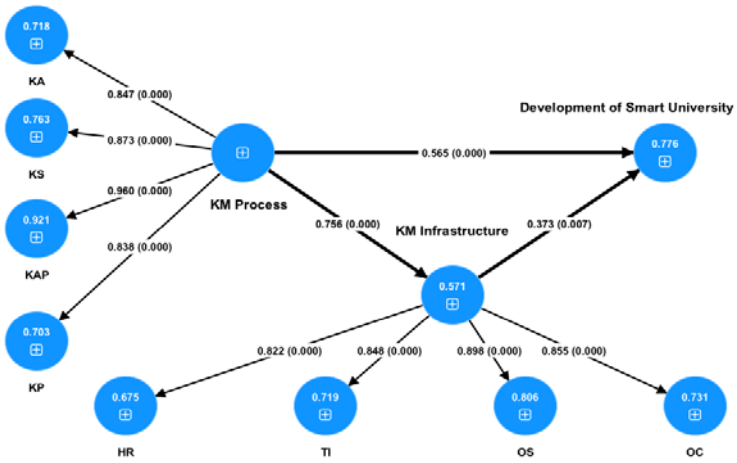

Figure 2. SM

Table 3 displays the findings of hypotheses testing, revealing the hypothesis (H), coefficient (B), standard deviation (Std), T statistics (T), P-values (P), F-square (F2), and conclusive insights regarding the significance of the hypotheses in the study.

These results offer valuable information on the relationships between variables and their impact on the research model.

Table 3. Results of assessing SM

H		B	Std	T statistics	P values	F2	Conclusion
H1	KMP -> DSU	0.565	0.138	4.09	0.000	0.22	Accepted
H1a	KA -> DSU	0.345	0.167	2.06	0.039	0.19	Accepted
H1b	KS -> DSU	0.184	0.079	2.32	0.276	0.09	Accepted
H1c	KAP -> DSU	0.251	0.94	2.67	0.005	0.11	Accepted
H1d	KP -> DSU	0.091	0.121	0.75	0.120	0.01	Rejected
H2	KMI-> DSU	0.373	0.138	2.70	0.007	0.10	Accepted
H2a	OC -> DSU	0.051	0.188	0.27	0.784	0.00	Rejected
H2b	OS -> DSU	0.032	0.171	1.35	0.174	0.00	Rejected
H2c	TI -> DSU	0.312	0.079	3.94	0.002	0.17	Accepted
H2d	HR -> DSU	0.211	0.092	2.29	0.018	0.08	Accepted
H3	KMP -> KMI -> DSU	0.282	0.096	2.93	0.003	-	Accepted

The findings from the hypothesis testing provide substantial evidence in favor of the influence of KMP on the DSU, as shown by p-values that are less than 0.05. According to the findings shown in Table 3, the hypothesis H1 is supported, indicating a strong effect of KMP on the DSU. Furthermore, the findings shown in Table 3 provide support for H1a, H1b, and H1c, which correspond to the variables of KA, KS, and KAP, respectively. The aforementioned results underscore the significance of acquiring, sharing, and using information in order to enhance the DSU. Nevertheless, the hypothesis H1d, which pertains to the influence of KP, was invalidated, suggesting that KP does not have a major effect on the DSU.In regard to the second hypothesis, the impact of KMI on the DSU was deemed valid. However, the statistical analysis conducted on the influence of OC and OS on the DSU did not provide significant results. Consequently, hypotheses H2a and H2b were shown to be not valid. In contrast, the study revealed that both TI and HR have a substantial impact on DSU, hence confirming the validity of hypotheses H2c and H2d.

The findings of this study provide confirmation of the mediating function of KMI in the relationship between KMP and DSU. This confirmation is based on the support for both the direct and indirect impacts seen in the analysis. As a result, hypothesis 3 (H3) was deemed valid, hence emphasizing the significance of KMI in explaining a portion of the impact of KMP on the DSU.

5. Discussion

This study was conducted to investigate the impact of KMP and KMI on the DSU. The effect was confirmed to be positive and significant. The DSU can be supported by an effective KM. The KMP is critical for shifting toward SU. The impact of KA, KS, and KAP is significant on DSU. Having the capability to acquire knowledge and disseminate the knowledge among stakeholders as well as implement the knowledge will help in avoiding reinventing the wheel and creating smart choices. These findings are in line with the findings of prior literature such as [4] who suggested that KA, sharing, and application are critical for improving the overall performance of an organization. The finding is also supported by the KM capability model by [10] who proposed and tested the KM model and noted that process of KA, sharing, and application are important predictors of organizational effectiveness.

The findings also showed that KMI is important as a composite for the DSU. The findings showed that OC and structure did not affect the DSU in Iraq. This could be due to the fact that in a public university, rigidity is high which limits the impact of OC and structure. These findings contradict the findings of previous studies [27], [28]. However, findings of prior literature also supported the findings of this study [29], [30], [32]. The findings showed that TI and HR are important predictors of the DSU in Iraq. This might be due to the fact that TI such as IoT and other supportive technology is part of the ecosystem of the SU.

Similarly, the HR capable of managing and contributing to the SU is essential for the successful DSU. In line with this result, the finding of the literature showed that TI is critical for organizational performance and effectiveness [11].

The mediating role of KMI between KMP and the DSU was confirmed. This indicated that the increase in the level of KMI can support the effect of KMP on the DSU in Iraq. The mediation is partial indicating that part of the relationship can be interpreted via the KMI. This finding is supported by prior literature such as [37] [38] who found that OC as a component of KMI can play a mediating role.

6. Implication

This research provides a valuable addition to the current body of literature by examining the interplay between KMP and KMI within the context of the DSU. The existing body of literature about the DSU mostly consists of technical research studies that center on the integration and deployment of smart city work. There is a limited body of research in the existing literature that has effectively examined the DSU and its determinants. Within this particular context, the research expands upon the existing KM capability model and includes a unique variable pertaining to HR, hence enhancing the existing body of knowledge within this domain. Moreover, the paper illuminates the mediating function of KMI, a facet that has received comparatively less attention in previous studies.

Moreover, this research confirms the relevance of the RBV and KBV in explaining the influence of KMP and KMI on DSU. These findings provide significant contributions to both theoretical understanding and practical applications. This study may provide crucial support for the DSU in developing nations, namely in the case of Iraq. The results of this research may be used by decision-makers to optimize KS, and application, hence leading to enhanced performance of the DSU. It is essential to emphasize the importance of cultivating a resilient TI and providing staff with the requisite competencies to properly administer the DSU. This research emphasizes the significance of using a blend of KMP and KMI to enhance the DSU, providing a holistic understanding of the elements that contribute to its effectiveness.

This research offers useful information for decision-makers in the higher education sector to boost the growth of the DSU. By using the insights derived from this study, individuals may make educated choices to enhance the efficacy and productivity of their particular DSU, so resulting in more knowledgeable and solid decision-making procedures.

7. Conclusion

The primary aim of this study was to investigate the impact of KMP and KMI on the DSU, while also exploring the potential mediating role of KMI between KMP and the DSU. The findings were derived from academic staff using purposive sampling. The findings showed that both KMP and KMI are critical for the DSU. Among the components, KA, KS, and KAP as well as TI and HR are critical for the DSU. As this study utilized purposive sampling, the generalizability of findings might be restricted to the participating universities. Moreover, the context being limited to Iraqi universities could impact its applicability elsewhere. Future research could extend these findings by exploring SU development in different countries, employing random sampling for improved generalizability. Additionally, examining variables like leadership, industry 4.0, and their implications could be promising avenues for enhancing the DSU.

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References:

[1]. Glukhova, L. V, Syrotyuk, S. D., Sherstobitova, A. A., & Pavlova, S. V. (2019). Smart university development evaluation models. *Smart Education and E-Learning 2019*, 539–549.

[2]. Uskov, V. L., Bakken, J. P., Pandey, A., Singh, U., Yalamanchili, M., & Penumatsa, A. (2016). Smart university taxonomy: features, components, systems. *Smart Education and E-Learning 2016*, 3–14.

[3]. Liu, X. (2017). A study on smart campus model in the era of big data. *2016 2nd International Conference on Economics, Management Engineering and Education Technology (ICEMEET 2016)*, 919–922.

[4]. Mills, A. M., & Smith, T. a. (2011). Knowledge management and organizational performance: a decomposed view. *Journal of Knowledge Management*, *15*(1), 156–171. Doi: 10.1108/13673271111108756

[5]. Alaarj, S., Abidin-Mohamed, Z., & Bustamam, U. S. B. A. (2016). Mediating Role of Trust on the Effects of Knowledge Management Capabilities on Organizational Performance. *Procedia - Social and Behavioral Sciences*, *235*, 729–738. Doi: 10.1016/j.sbspro.2016.11.074

[6]. Al-Sulami, Z. A., & Hashim, H. S. (2020). Proposed Knowledge Management Conceptual Model to Enhance Teaching Activities Throughout Web 2.0 Technology for Academicians. *IOP Conference Series: Materials Science and Engineering*, *928*(3), 32079.

[7]. Owoc, M., & Marciniak, K. (2013). Knowledge management as foundation of smart university. *2013 Federated Conference on Computer Science and Information Systems*, 1267–1272.

[8]. Dee, J., & Leisyte, L. (2017). Knowledge sharing and organizational change in higher education. *The Learning Organization*, *24*(5), 355–365.

[9]. Karltun, A., Sanne, J. M., Aase, K., Anderson, J. E., Fernandes, A., Fulop, N. J., Höglund, J., & Andersson-Gare, B. (2020). Knowledge management infrastructure to support quality improvement: a qualitative study of maternity services in four European hospitals. *Health Policy*, *124*(2), 205–215.

[10]. Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: an organizational capabilities perspective. *Joiuurnal of Management Information Systems*, *18*(1), 185–214. Doi: 10.1080/07421222.2001.11045669

[11]. Fortes, S., Santoyo-Ramón, J. A., Palacios, D., Baena, E., Mora-García, R., Medina, M., Mora, P., & Barco, R. (2019). The campus as a smart city: University of Málaga environmental, learning, and research approaches. *Sensors*, *19*(6), 1349–1361.

[12]. Dragicevic, N., Ullrich, A., Tsui, E., & Gronau, N. (2019). A conceptual model of knowledge dynamics in the industry 4.0 smart grid scenario. *Knowledge Management Research & Practice*, *18*(2), 199–213.

[13]. Rico-Bautista, D., Medina-Cárdenas, Y., & Guerrero, C. D. (2019). Smart university: a review from the educational and technological view of internet of things. *Information Technology and Systems: Proceedings of ICITS 2019*, 427–440.

[14]. Adeinat, I. M., & Abdulfatah, F. H. (2019). Organizational culture and knowledge management processes: case study in a public university. *VINE Journal of Information and Knowledge Management Systems*, *49*(1), 35–53.

[15]. Suroso, S., Novitasari, D., Nugroho, Y. A., Chidir, G., & Asbari, M. (2021). Managing MSME Innovation Performance: Analysis of Knowledge-Oriented Leadership and Knowledge Management Capability. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(6), 4541–4555.

[16]. Grant, R. (1996). Toward a knoweldge-based theory of the firm. *Strategic Management Journal*, *17*, 109–122. Doi: 10.1002/smj.4250171110

[17]. Rehman, S., Mohamed, R., & Ayoup, H. (2019). The mediating role of organizational capabilities between organizational performance and its determinants. *Journal of Global Entrepreneurship Research*, *9*(1), 1–23. Doi: 10.1186/s40497-019-0155-5

[18]. Uskov, V. L., Bakken, J. P., Howlett, R. J., & Jain, L. C. (2018). *Smart Universities.* Springer.

[19]. Jasim, N. A., TH, H., & Rikabi, S. A. L. (2021). Design and Implementation of Smart City Applications Based on the Internet of Things. *International Journal of Interactive Mobile Technologies*, *15*(13).

[20]. Lei, H., Khamkhoutlavong, M., & Le, P. B. (2021). Fostering exploitative and exploratory innovation through HRM practices and knowledge management capability: the moderating effect of knowledge-centered culture. *Journal of Knowledge Management*, *25*(8), 1926–1946.

[21]. Panda, S., & Rath, S. K. (2021). Information technology capability, knowledge management capability, and organizational agility: The role of environmental factors. *Journal of Management & Organization*, *27*(1), 148–174.

[22]. Nuzzaci, A., & La Vecchia, L. (2012). A Smart University for a Smart City. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, *3*(4), 16–32.

[23]. Nugroho, M. A. (2018). The effects of collaborative cultures and knowledge sharing on organizational learning. *Journal of Organizational Change Management*, *31*(5), 1138–1152.

[24]. Qasrawi, B. T., Almahamid, S. M., & Qasrawi, S. T. (2017). The impact of TQM practices and KM processes on organisational performance. *International Journal of Quality & Reliability Management*, *34*(7), 1034–1055. Doi: 10.1108/IJQRM-11-2015-0160

[25]. Arshad, R., Ismail, R. F., & Razak, H. A. (2021). Discharging non-profit accountability through knowledge management and performance information use. *Academy of Strategic Management Journal*, *20*(2), 1–12.

[26]. Salama, S., Isaac, O., Habtoor, N., & Ameen, A. (2020). Impact of Availability of Knowledge Management Infrastructure on Improving the Performance of the Education Sector Staff in Libya: Organizational Loyalty as a Mediating Variable. *International Journal of Management and Human Science (IJMHS)*, *4*(1), 1–10.

[27]. Purwanto, A. (2023). The Influence of Organizational Culture on Teacher Innovation Capability and Tacit Knowledge: A CB-SEM AMOS Analysis. *Journal of Indrustrial Engimeering & Management Research*, *4*(2).

[28]. Pratama, A., Syamsuddin, R., Oktora, J., & Sunarsi, D. (2021). Organizational Culture, Transformational Leadership and the Impact on Knowledge Sharing in Selected Research Organization. *Proceedings of the 1st International Conference on Economics Engineering and Social Science, InCEESS 2020, 17-18 July, Bekasi, Indonesia*.

[29]. Suryani, L., Lubis, A. R., & Majid, M. S. A. (2020). Does Work Motivation Mediate the Effect of Organizational Culture and Justice on Employee Performance of the Public Works and Spatial Planning Agency?. *Sumerianz Journal of Business Management and Marketing*, *3*(7), 78–86.

[30]. Wulandari, A. A., & Dewi, A. M. (2023). The Influence of Organizational Culture, Organizational Commitment, and Motivation on Organizational Performance (Case Study: BEM And MCC Solo Technology Christian University). *ProBisnis: Jurnal Manajemen*, *14*(2), 251–259.

[31]. Xia, Y., Li, X., & Wang, X. (2023). The Influence of Organizational Structure on the Dynamic Capability of Enterprises: The Regulating Effect of Technological Innovation. *Science*, *11*(2), 57–66.

[32]. Kojongian, E., Tewal, B., & Taroreh, R. N. (2022). Influence of Organizational Structure, Job Analysis and Organizational Culture on Organizational Performance Mediated by Organizational Commitment AT PT. Grace James Technology. *International Journal of Business Diplomacy and Economy*, *1*(5), 151–166.

[33]. Abusharekh, N. H., Al Shobaki, M. J., Abu-Naser, S. S., & El Talla, S. A. (2020). The Impact of Modern Strategic Planning on Smart Infrastructure in Universities. *International Journal of Academic Management Science Research (IJAMSR)*, *4*(8), 146–157.

[34]. Mitrofanova, Y. S., Tukshumskaya, A. V, Burenina, V. I., Ivanova, E. V, & Popova, T. N. (2021). Integration of Smart Universities in the Region as a Basis for Development of Educational Information Infrastructure. *Smart Education and E-Learning 2021*, 407–416.

[35]. Masenya, T. M. (2022). Integrating talent and knowledge management practices in the new normal business environment: developing future leaders in public sector organizations. In *Navigating the New Normal of Business with Enhanced Human Resource Management Strategies*, 113–144. IGI global.

[36]. Ncoyini, S. S., & Cilliers, L. (2020). Factors that influence knowledge management systems to improve knowledge transfer in local government: A case study of Buffalo City Metropolitan Municipality, Eastern Cape, South Africa. *SA Journal of Human Resource Management*, *18*(1), 1–11.

[37]. Saeed, H., Md Som, H., Mahmood, R., & Hamid, H. (2023). Organizational innovation and leadership styles in healthcare with the mediating role of organizational culture. *Journal of Health Administration*, *25*(4), 69–86.

[38]. Indrayanti, I., & Ulfia, N. (2022). Authentic leadership and innovative work behavior through organizational culture: A study in Indonesian state-owned enterprises. *F1000Research*, *11*(12), 1–16.

[39]. Barney, J. (1991). Firm Reources ad Sustained Competitive Advantege. In *Journal of Management*, *17*(1), 99–120.

[40]. Wu, I.-L., & Chen, J.-L. (2014). Knowledge management driven firm performance: the roles of business process capabilities and organizational learning. *Journal of Knowledge Management*, *18*(6), 1141–1164. Doi: 10.1108/JKM-05-2014-0192

[41]. Cockrell, R. C., & Stone, D. N. (2010). Industry culture influences pseudo-knowledge sharing: a multiple mediation analysis. *Journal of Knowledge Management*, *14*(6), 841–857. Doi: 10.1108/13673271011084899

[42]. Lin, H.-F. (2013). The effects of knowledge management capabilities and partnership attributes on the stage-based e-business diffusion. *Internet Research*, *23*(4), 439–464. Doi: 10.1108/IntR-11-2012-0233

[43]. Hooff, B., & Huysman, M. (2009). Managing knowledge sharing: Emergent and engineering approaches. *Information & Management*, *46*(1), 1–8. Doi: 10.1016/j.im.2008.09.002

[44]. Chuang, S.-H. (2004). A resource-based perspective on knowledge management capability and competitive advantage: an empirical investigation. *Expert Systems with Applications*, *27*(3), 459–465. https://doi.org/10.1016/j.eswa.2004.05.008

[45]. Hair, Hult, T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling* (2nd ed.). India: SAGE Publications.

[46]. Hair, J. F., Sarstedt, M., & Ringle, C. M. (2019). Rethinking some of the rethinking of partial least squares. *European Journal of Marketing*, *53*(4), 566–584. Doi: 10.1108/EJM-10-2018-0665