The Effect of Smart University Characteristic on Entrepreneurial Orientation of Students: The Mediating Role of Knowledge Sharing

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Abstract: - Smart university is a new concept in education. The characteristic and impact of this university on creating entrepreneurial oriented community has not received adequate attention in the context of developing countries. The purpose of this study is to examine the effect of smart university characteristics (course quality, staff capability, and infrastructure) on entrepreneurial orientation (EO). Knowledge sharing between industry and university is proposed as a mediator. This study is a quantitative and it collects the data using a questionnaire. The data collection took place between April 2020 to August 2020. The data was collected from 279 master of business administration (MBA) graduates and students in Iraq. The data analysis was conducted using smart partial least square (Smart PLS). The findings showed that the effect of smart university characteristics are significant. In addition, knowledge sharing mediated the effect of the characteristics, except infrastructure, on EO. More attention has to be paid to the employment of skilful staff and to focus on the relationship between university and industry.

Key-Words: Smart University, Entrepreneurial Orientation, Knowledge Sharing, Knowledge based View

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1 Introduction

The world is changing rapidly and the need for smart technology is urgent. Recently, several smart applications and techniques were introduced. This includes the smart home, smart city, and smart applications. Among these smart technology, the smart university is essential to enable the transformation to smart live [1]. Building smart city, smart home or smart application is linked to the smart university. This is because a smart university is a university that has the potential to improve the education, research, and work experience of stakeholders to match the need of the industry. This can be enabled by utilizing digital, innovative, and internet based technologies for the goodness of the society at large [2]–[5].

Smart university is the engine for creating smart city. Most countries rely on university to change the behaviour of citizens and to develop the capability of the stakeholders. However, government is the main driver of the smart university and its support for these universities is essential to reduce the gap between industries and university and to encourage the collaboration between these entities [6]. The collaboration between university and industry will result in a company supporting research that are conducted in the university [7].

This has changed the role of university from a knowledge production organization to a product and service producers with the collaboration with the industry [8], [9]. Previous studies dealt with the smart university from technical perspective and employed technology such as the Radio Frequency Identification (RFID) and internet of things (IoT) [10]–[12]. The role smart university in creating EO stakeholders has not been examined.

Nevertheless, great organizations are established and build by entrepreneur [13]. There is a firm link between smart university and the entrepreneurship. Creating a smart university will lead to an entrepreneur graduate. Similarly, the creation of smart university is done by entrepreneurs [13]. However, the link between smart university characteristic and EO has not been investigated by previous studies. In addition, in the current environment where the COVID19 has forced for lockdown and social distance, the need for a smart university has become more urgent [14], [15].

Characteristic of smart university include the staff capabilities as well as the use of the technology. In addition, the content of courses and its relatedness to the industry. These characteristics could potentially increase the entrepreneurship of students in the university [16], [17]. The current situation in

most of developing countries refer to the increase in the level of unemployment. These are mainly driven by weak economic growth and less initiatives as well as the lack of experience by graduates to involve in the workplace. Having entrepreneurial orientation might help in creating more small projects and reduce the employment [18], [19]. This requires the graduates to be equipped with the knowledge and the experience of the marketplace to achieve better performance and be successful [17].

In this process, the knowledge sharing and collaboration between industry and university enables the creation of graduates that suits the market demand and able to produce relevant product and services as well as provide adequate services to community [20]–[23]. Knowledge sharing between these groups has not been discussed in previous studies and this study is among the first study to discuss this issues in the context of developing countries such as Iraq. In Iraq, the employment mostly is based on the public sectors and in particular in the oil and gas industry [24]. Universities are managed in a traditional way and the courses are outdated. The gap between industry and course taught in the university is wide. Therefore, this study aims to understand the effect of smart university characteristic on the EO in the context of developing countries such as Iraq. Further, the study aims to examine the mediating role of knowledge sharing (university-industry) between smart university characteristic and EO. In the next section, the literature as well as the research methodology, findings, discussion, implication, and conclusion are given.

2 Literature Review

The literature focuses on the concept of smart university and EO. It also discusses the theoretical framework and the conceptual framework of this study which includes the hypotheses development.

2.1 Smart University

In the 20th century, the role of university has changed. University turned into "research university" during the 20th century and this is followed by the entrepreneurial university. In the research university, the main purpose is to produce knowledge [25]. However, in an entrepreneurial university, the knowledge is commercialized and sold as product or service to the industry. This has increased the collaboration between university and industry and reduced the gap between the graduates and the market demand [5], [26], [27]. With the advancement of technology and the introduction of technology such as Internet of Things and artificial intelligence as well as the increase collaboration between industry and university, the need for smart university has increased and this has resulted in several initiatives to create smart city in which the main role is laid on the smart university [1], [28], [29].

Smart university is characterised by several factors. It is highly interacted with the industries and product and services that are desired by the industry. It also focuses on several aspects that are related to the society and provide knowledge to all stakeholders. The contribution of the smart university and its graduates is not limited to the present but it is extended to the future generation. Smart university focuses on several domains that are the smart campus (which include the required smart software, hardware, building, and sensors) [4], [30], smart people (smart staff, students, non-academic staff) [12], [27], [29], smart education and research [26], [28], [31]–[33], smart governance [25], [27] (management, education policies, and budgeting), and smart influence (on the community) [1], [26], [27]. In this study the focuses is on the people which are the staff of the university as well as the infrastructure. Further, the focus is on the content of the courses and its quality.

2.2 Theoretical Framework

This study is focusing on the smart university and its characteristic and their effects of entrepreneurial orientation (EO). The utilization of a smart university is an innovative behaviour. According to the Organization-Technology-Environment framework developed by [34], the usage of an innovation is dependent on the organizational factors as well as the technological factors, and the environmental factors. In this study, the organizational factors is operationalized as the course content quality and information quality. Staff capabilities are also organizational orientated. The infrastructure of the university are considered as the technological factors. Environmental factors can be the knowledge sharing between university and staff. Another theory that support the conceptual framework of this study is the knowledge based view and the information system (IS) success which indicate that the information quality, system quality and service quality affect the satisfaction of users which in turn affect the benefit that users can gain from the system [35], [36]. Knowledge based view indicates that better management of knowledge can lead to a competitive advantage which in turn affect the organizational outcome [37], [38].

2.3 Entrepreneurial Orientation

Entrepreneurial Orientation (EO) is defined as an organizational willingness to find and accept new opportunities and taking responsibility to affect change [39]. Early researchers investigated EO and operationalized it to include the risk taking, proactiveness, innovativeness and autonomy [40], [41]. EO is a multidimensional variable. However, in this study following the operationalization of [42], EO is measured as a unidimensional variable. EO is important for organizations and individuals as it helps in improve the competitiveness and it helps in creating competitive advantage for organization [43]–[46]. On the individual level, being an entrepreneur is important to initiate new idea and innovation. Nevertheless, few of the previous studies examined this variable in the context of smart university in developing countries. Therefore, this study will deal with this variable in this context.

2.4 Conceptual Framework

Based on the knowledge-based view, TOE framework, and IS success, this study proposes that the smart university characteristic will have important effect on the EO of students in the Iraqi university. The study proposes that the knowledge sharing between university and industry will mediate the effect of smart university characteristic on EO. Figure 1 shows the conceptual framework of this study.

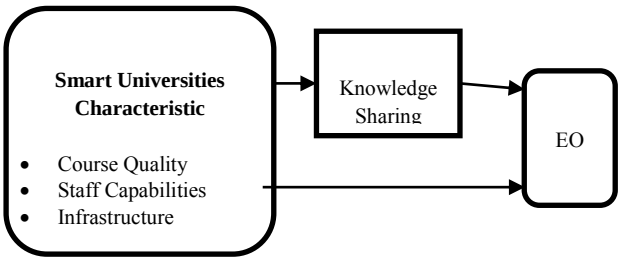

Fig. 1: Conceptual Framework

2.4.1 Smart University Characteristic and EO

Smart university is a new innovation and it deploys the latest technology to enhance the capabilities of its stakeholder. This variable is operationalized to include the quality of courses in the university as well as the information quality, the staff capabilities, and the infrastructure. Course content quality is usually referred to as the information quality and it is the content that can be generated by the system [47]. In the IS success model, information quality was proposed as an important indicators for the usage and the benefit of a system [35]. Course quality is important for students to be aware and updated about the new trend and technology as well as to be up to date with the market changes [48], [49]. In this study, the course quality is expected to affect positively the EO of students.

The staff capabilities is also considered as an important characteristic of a smart university. Experienced and highly educated and qualified staff are able to provide the students with adequate knowledge about the market changed and the possible opportunities [50]–[52]. They also can equip the students with the knowledge that are required to analyse and understand the events that occur in an country and deploy these changes in making accurate decisions [20], [53], [54]. Thus, this study proposes that when the staff has adequate capabilities, they are able to develop the entrepreneurial skills of students.

Infrastructure of the university is critical for fulfilling the duties of the staff and for students to access to knowledge and learn about the new techniques. Building this infrastructure is essential to start a smart university. Several studies refer to the importance of infrastructure in a smart universities [1], [5], [25]–[27], [55]. Infrastructure also includes smart classroom and easy access to knowledge from anywhere at any time [27]. Having the needed infrastructure enable the students and the staff to be equipped and able to share the knowledge with each other. Thus, this study proposes the following hypotheses.

H1: Smart university will lead to a better EO among students in Iraq.
H2: Course quality has a positive impact on EO among students in Iraq.
H3: Staff capabilities have positive impact on EO of students in Iraq.
H4: Infrastructure has a positive impact on EO of students in Iraq.

2.4.2 Knowledge Sharing as Mediator

Knowledge sharing is defined as the exchange of knowledge among two parties [56]. It includes a mutual benefit for both parties [57], [58]. The quality and quality of the knowledge shared among the university and industry can affect the course content, staff capabilities and the infrastructure in the university [1], [27], [59], [60]. Knowledge sharing was found to mediate the effect of IT capabilities and innovation performance [61]. Knowledge sharing also mediated the effect of human resource on organizational ambidexterity [62]. Knowledge sharing is also mediated the effect of information technology on innovation [63]. In addition, knowledge sharing mediated also the

effect of person-organization fit on innovative work behaviour [64]. In this study, knowledge sharing is expected to mediate the effect of course quality, staff capabilities, and infrastructure on EO. Thus, the following hypotheses are proposed:

H5: Knowledge sharing mediates the effect of smart university characteristics on EO.
H6: Knowledge sharing mediates the effect of course quality on EO.
H7: Knowledge sharing mediates the effect of staff capabilities on EO.
H8: Knowledge sharing mediates the effect of infrastructure on EO.

3 Research Methodology

This study adopts a quantitative approach to fulfil the objectives. The study determines the population to be Master of business administration (MBA) students and graduates. It is referred to here as MBA community. The reasons for chosen these groups of respondents is due to the notion that they are familiar with the topic of this study, and they have the required knowledge to answer the questionnaire of this study. The study uses a convenience sampling technique. This is because this technique provides easy access to the respondents who fit in this study category. The data is collected using a questionnaire. The questionnaire is adopted from previous studies. Measurement of EO is adopted from [42]. Knowledge sharing was adopted from [8], measurement of smart university characteristic such as staff capability is adopted from [65], measurement of infrastructure was adopted from [66], course quality was adopted from [67]. The questionnaire was translated into Arabic using back-to-back translation. The questions were validated by three experts. Based on the suggestions of experts, a modification was made on the content of knowledge sharing, staff capabilities, and course quality.

A pilot study was conducted on 37 students. The results showed that the Cronbach's Alphas for all the variables are greater than 0.70 supporting the notion that the measurements are reliable. The data collection took place between December 2020 and February 2021. Follow up were conducted to increase the response rate. As a result, a total of 318 responses were collected. The data was collected using network referral. The data was filtered for missing values, outliers, and normality as well as multicollinearity. The findings showed that 30 responses were removed based on missing value ground. In addition, nine responses were also removed due to outliers' issues. The data is normally distributed because the value of skewness and kurtosis are less than absolute 1. Further, no multicollinearity issue in the data because the value of tolerance is greater than 0.20 and the value of variation inflation factor (VIF) is less than five.

4 Findings

4.1 Background Information

Among the 279 respondents who took part in this study, there are 85.7% are males while females constitute 14.3%. a total of 85.7% of the respondents are younger than 45 with 67.4% are graduated with MBA degree and 32.6% are still studying their master's degree. Experience of the respondents are varied and majority (82.5%) of them have experience of less than 10 years.

4.2 Measurement Model

In the measurement model, there are five criteria must be examined to assess the measurement model [68], [69]. The factor loading (FL) for all the items should be 0.70 or greater. In addition, the composite reliability (CR) and Cronbach's Alpha (CA) should be equal or greater than 0.70. The convergent validity is achieved if the value of Average Variance Extracted (AVE) is greater than 0.50. In addition, the fulfilment of the discriminant validity happens if the square root of AVE is greater than the cross loading. The first criterion assessed was the factor loading and it was found that some of the items of EO, knowledge sharing (KS), infrastructure (INF) has weak factor loading. Accordingly, some items were removed to enhance the reliability and validity of the model. Table 1 shows that all the criteria were achieved. All FL of the items is higher than the threshold of 0.70. CR and CA are higher than 0.70. Lastly, AVE has value higher than the threshold supporting the achievement of the convergent validity.

Table 1. CA, CR, and AVE of Constructs

	Cronbach's Alpha	Composite Reliability	AVE
Course quality	0.942	0.956	0.813
Staff capability	0.944	0.960	0.857
Infrastructure	0.868	0.903	0.700
Knowledge sharing	0.947	0.959	0.825
Entrepreneurial orientation	0.942	0.956	0.812

To examine the discriminant validity, the square root of AVE was calculated and compared with the

cross loading. Table 2 indicates that the discriminant validity was fulfilled due to the fact that the number in bold are greater than the cross loading with other variables.

Table 2. Discriminant Validity

	CQ	SC	INF	KS	EO
Course quality	**0.901**				
Staff capability	0.543	**0.925**			
Infrastructure	0.445	0.473	**0.837**		
Knowledge sharing	0.168	0.140	0.287	**0.908**	
Entrepreneurial orientation	0.518	0.649	0.385	0.133	**0.901**

4.3 Structural Model

To assess the structure model, [70] indicates that there are four criteria. The first criteria are the R-square and it is widely accepted that a value of between zero to 0.25 is weak while values between 0.26 to 0.50 is moderate and between 0.51 to 0.75 is excellent. In this study, the R-square (R2) was found 0.36 for knowledge sharing and 0.46 for EO. The second criterion is the predictive relevance (Q2). This value indicates whether or not the variables can predict the dependent variable. The accepted value is greater than 0. In this study, it was found that Q^2 for the dependent variables such as knowledge sharing and EO were 0.26 and 0.35 respectively indicating that the condition of predictive relevance has been met. The effect size is acceptable if the value of f^2 is greater than 0.02. In all the paths of this study, the value of f^2 was greater than 0.02. The last criterion is the path coefficient, and it is assessed in the following section.

4.3.1 Direct Effect

In this section, the direct effect of the variables is tested. The results of hypotheses testing are given in Table 3. The hypotheses were testing using 5,000 bootstrapping and p-value less than 0.05.

Table 3. Results of Direct Effect Hypotheses

H	Path	β	Std	T	P
H1	Smart University Characteristic -> EO	0.615	0.040	15.480	0.000
H2	Course Quality -> EO	0.311	0.059	5.263	0.000
H3	Staff Capability -> EO	0.318	0.059	6.480	0.000
H4	Infrastructure -> EO	0.124	0.049	2.092	0.037

Note: H: Hypothesis, β, path coefficient, Std: Standard Deviation, T= t-value, P: p-value.

The effect of smart university characteristic on EO was tested and it was found that it is significant with β= 0.615 and p-value less than 0.001 as shown in Table 3. This indicates that the smart university characteristic are main predictors of creating EO among students. Thus, H1 is supported. The second hypothesis claimed that course quality affects EO significantly. The findings in Table 3 shows that it is true. Course quality is a predictor of EO with β= 0.311 and P-value less than 0.001 supporting the claim that course quality has a significant effect on EO. Accordingly, H2 is supported. Staff capability also predicted to have a significant effect on EO. Findings in Table 3 indicate that the effect of staff capability on EO is significant with β= 0.318 and P-value equal to <0.001 supporting the third hypothesis (H3) of this study. For the effect of infrastructure on EO, it was found that the effect is significant (β= 0.124, P<0.001) supporting H4.

4.3.2 Mediating Role of Knowledge Sharing

The mediating effect of knowledge sharing between the variables and EO was examined by comparing the direct and indirect effect. The direct effect without mediator is given in Table 3. For the direct effect including the mediator and the indirect effect, it is given in Table 4.

Table 4. Result of Testing Knowledge Sharing as a Mediator

H		β	Std	T	P	Label
H5	Smart University Characteristic -> EO	0.487	0.052	9.345	0.000	Partial Support
	Smart University Characteristic -> Knowledge Sharing -> EO	0.128	0.030	4.341	0.000	
H6	Course Quality -> EO	0.249	0.060	4.117	0.000	Partial Support
	Course Quality -> Knowledge Sharing -> EO	0.063	0.023	2.773	0.006	
H7	Staff Capabilities -> Entrepreneurial Orientation	0.261	0.051	5.067	0.000	Partial Support
	Staff Capabilities -> Knowledge Sharing -> EO	0.056	0.018	3.085	0.002	
H8	Infrastructure -> Entrepreneurial Orientation	0.095	0.055	1.729	0.084	Rejected
	Infrastructure -> Knowledge	0.	0.	1.	0.	

	Sharing -> EO	02 9	01 8	58 1	11 4	
	Knowledge Sharing -> Entrepreneurial Orientation	0. 23 7	0. 05 6	4. 20 4	0. 00 0	

Table 4 shows the direct effect with mediator included and the indirect effect through the mediator. In comparison between Table 3 and Table 4, the effect of smart university characteristic on EO was reduced to 0.487. The indirect effect is significant indicating that there is a partial mediation. Thus, H5 is supported. Similarly, for H6, knowledge sharing mediated the effect of course quality on EO. Thus, H6 is supported. For H7, the effect of staff capability on EO was mediated by knowledge sharing. Therefore, H7 is supported. In term of H8, knowledge sharing did not mediate the effect of infrastructure on EO. The direct effect and the indirect effect are not significant. Thus, H8 is rejected. Figure 2 shows the structural model of the mediating effect of knowledge sharing.

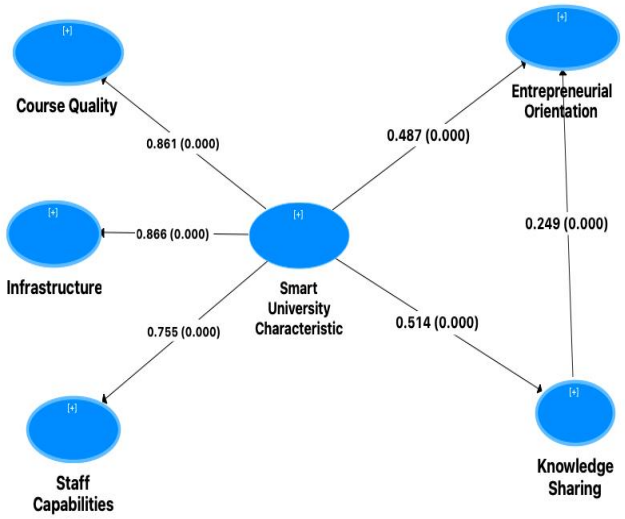

Fig. 2: Structural Model

5 Discussion and Implications

This study investigated the effect of smart university characteristic on EO of MBA graduates and students in Iraq. The findings showed that having a smart university will impact greatly the creation of EO among MBA graduates and students. The most important characteristic is the staff capability. Knowledgeable staff are able to shape the way of thinking of their students and they have high impact on their mentality and the way they look into issues and solving problems. The course quality is also important. Having updated courses that are reflective of the market is important for students to understand the reality of the market and the way of solving contemporary problems in management and business administration. The infrastructure has the least important effect on the EO. This could be due to the notion that infrastructure is complementary to the staff capability and the course quality. Staff cannot do their duties without proper infrastructure. In line with the above findings, previous studies found that the staff capability as well as the course quality and infrastructure are important for the creation of EO [20], [50]–[54].

The findings also showed that knowledge sharing mediated the effect of smart university characteristic, course quality, and staff capability. This indicates that part of the relationship between the characteristic and EO can be explained by knowledge sharing. Knowledge sharing between industry and university is vital for improving the content and the quality of the courses provided by the university. It is also important to sharpen the capability of the staff and enhance their understanding of the market mechanisms. Knowledge sharing did not mediate the effect of infrastructure on EO. This could be due to the notion that collaboration between industry and university in the context of Iraq take a face-to-face form rather than online form. The findings regarding the role of knowledge sharing as a mediator are in agreement with the findings of previous studies [1], [27], [59]–[64].

Based on the findings of this study, decision makers are advised to sharpen the skills of their academic staff. Iraqi universities that wish to be smarter have to employed academic staff with high capability in term of research and teaching as well as relationship. This soft skills of relationship is usually ignored and adequate attention has to be paid to this aspect in the employment contract. In addition, in order for the university to enhance its intellectual capability, the course quality and its relevant to the market demand must be periodically assessed. Case studies approach is good for improving the skills of students. Relevant case study from Iraqi context could be developed and students should be given the opportunity to solve these cases. The cases can be industry-based. Frequent meeting should be held between academic and business organizations. These meetings can be encouraged by the government and in the public sector at the beginning and in later stage can be extended to include the private sector. Such meetings enhance the knowledge sharing between the two parties which found to be a critical factor in this study. It also helps in creating case studies about the current business problem to train the students.

This study has contributed to the literature in term of smart university characteristic in the context of developing countries. Such studies are missing and this study is believed to be the first, at least in Iraq, to deal with smart university characteristic and its impact on EO. Knowledge sharing as a variable has been examined in several studies. However, the contribution of this study is to examine it as a mediating variable between industry and university. The study also contributed to the theory by combing several theories from the technology adoption context and the business context. The theories that are included in this study are the knowledge based view, TOE and IS success. The combination between these theories managed to explain significant part of the variation caused by smart university on EO.

6 Conclusion

This study aimed to explore the effect of smart university characteristics on EO in the context of Iraq. The study deployed the MBA community in Iraq as the population due to the fact that this community is well informed about the implication and concept of smart university and EO. Findings of previous studies and theories were reviewed to develop the conceptual framework. The findings indicated that smart university characteristic (course quality, staff capability, and infrastructure) have significant effect on EO. The study also showed that knowledge sharing mediated the effect of smart university and its characteristic except infrastructure on EO.

As a limitation of this study, the respondents included only MBA community. Other graduates or students from different specialization were not included. The study also used the convenience sampling, and this kind of sampling has generalization limitation. The findings of this study can be generalized on Iraqi MBA community. As a way forward, future studies are recommended to increase the sample and to include MBA and non-MBA community. Engineers and medical doctors can be also included. Further, it is suggested for future studies to conduct a qualitative study by including industry and university employees to understand the way of creating effective EO.

References:

[1] R. K. R. Kummitha, "Smart cities and entrepreneurship: An agenda for future research," *Technol. Forecast. Soc. Change*, vol. 149, no. August, p. 119763, 2019.

[2] M. Kwet and P. Prinsloo, "The 'smart' classroom: a new frontier in the age of the smart university," *Teach. High. Educ.*, vol. 25, no. 4, pp. 510–526, 2020.

[3] S. A. El Talla, M. J. Al Shobaki, N. H. Abusharekh, and S. S. Abu-naser, "The Reality of Implementing the Smart University Transformation Strategy at University of Palestine," vol. 4, no. 9, pp. 35–52, 2020.

[4] T. M. Fernández-Caramés and P. Fraga-Lamas, "Towards next generation teaching, learning, and context-aware applications for higher education: A review on blockchain, IoT, Fog and edge computing enabled smart campuses and universities," *Appl. Sci.*, vol. 9, no. 21, 2019.

[5] D. W. Rico-Bautista, "Conceptual framework for smart university," *J. Phys. Conf. Ser.*, vol. 1409, no. 1, 2019.

[6] F. Altinay, Z. Altinay, C. H. Aydin, M. Altinay, G. Dagli, and M. O. Kalac, "Networking and Collaboration in Service Quality for a Smart University and Networking and Collaboration in Service Quality for a Smart University and Society," *Bull. Tech. Comm. Learn. Technol. (ISSN*, vol. 20, no. 11, 2020.

[7] C. Zhou, "Emergence of the entrepreneurial university in evolution of the triple helix," *J. Technol. Manag. China*, vol. 3, no. 1, pp. 109–126, 2008.

[8] R. C. Cockrell and D. N. Stone, "Industry culture influences pseudo- knowledge sharing: a multiple mediation analysis," *J. Knowl. Manag.*, 2010.

[9] E. G. Carayannis, J. Alexander, and A. Ioannidis, "Leveraging knowledge, learning, and innovation in forming strategic government–university–industry (GUI) R&D partnerships in the US, Germany, and France," *Technovation*, vol. 20, no. 9, pp. 477–488, 2000.

[10] A. U. Rehman, A. Z. Abbasi, and Z. A. Shaikh, "Building a smart university using RFID technology," *Proc. - Int. Conf. Comput. Sci. Softw. Eng. CSSE 2008*, vol. 5, pp. 641–644, 2008.

[11] T. G. Stavropoulos, A. Tsioliaridou, G. Koutitas, D. Vrakas, and I. Vlahavas, "System architecture for a smart university building," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 6354 LNCS, no. PART 3, pp. 477–482, 2010.

[12] M. V. Bueno-Delgado, P. Pavón-Marino, A.

De-Gea-García, and A. Dolón-García, "The smart university experience: An NFC-based ubiquitous environment," *Proc. - 6th Int. Conf. Innov. Mob. Internet Serv. Ubiquitous Comput. IMIS 2012*, pp. 799–804, 2012.

[13] R. L. Osborne, "Why Entrepreneurs Fail: How to Avoid the Traps," *Manag. Decis.*, vol. 31, no. 1, pp. 18–21, 1993.

[14] M. T. Alshurideh *et al.*, "Factors affecting the use of smart mobile examination platforms by universities' postgraduate students during the COVID 19 pandemic: an empirical study," in *Informatics*, 2021, vol. 8, no. 2, p. 32.

[15] H. Khan, K. K. Kushwah, S. Singh, H. Urkude, M. R. Maurya, and K. K. Sadasivuni, "Smart technologies driven approaches to tackle COVID-19 pandemic: a review," *3 Biotech*, vol. 11, no. 2, pp. 1–22, 2021.

[16] A. Rafiki and K. A. Wahab, "Measuring entreprenuers' satisfaction from islamic perspective: a study on small firms in north sumatera, indonesia," *4Th Int. Conf. Bus. Econ. Res. (4Th Icber 2013) Proceeding*, no. March, pp. 694–715, 2013.

[17] U. S. A. Bustamam, M. A. Mutalib, and S. N. M. Yusof, "Graduate Employability through Entrepreneurship: A Case Study at USIM," *Procedia - Soc. Behav. Sci.*, vol. 211, no. September, pp. 1117–1121, 2015.

[18] S. Tegtmeier and C. Classen, "How do family entrepreneurs recognize opportunities? 3 propositions," *Rev. Int. Bus. Strateg.*, vol. 27, no. 2, 2017.

[19] C. Recommended Citation Lee, K. Lee, and J. M. Pennings, "Internal Capabilities, External Networks, and Performance: A Study on Technology-Based Ventures," *Strateg. Manag. J.*, vol. 22, no. 7, pp. 615–640, Jun. 2001.

[20] J. Xu, Q. Hou, C. Niu, Y. Wang, and Y. Xie, "Process optimization of the University-Industry-Research collaborative innovation from the perspective of knowledge management," *Cogn. Syst. Res.*, vol. 52, pp. 995–1003, 2018.

[21] J. Hermans and A. Castiaux, "Knowledge creation through university-industry collaborative research projects.," *Electron. J. Knowl. Manag.*, vol. 5, no. 1, 2007.

[22] C. W. Chong and J. Besharati, "Challenges of knowledge sharing in the petrochemical industry," *Knowl. Manag. E-Learning An Int. J.*, vol. 6, no. 2, pp. 171–187, 2014.

[23] J. Han, "Technology commercialization through sustainable knowledge sharing from university-industry collaborations, with a focus on patent propensity," *Sustainability*, vol. 9, no. 10, p. 1808, 2017.

[24] H. R. Abed, W. A. Hatem, and N. A. Jasim, "Role of BIM technology in enhancing safety analysis of Iraqi oil projects," *Asian J. Civ. Eng.*, vol. 21, no. 4, pp. 695–706, 2020.

[25] M. Zapata, J. Madrenas, M. Zapata, and J. Alvarez, *Smart Univeristy for Sustainable Governance in Smart Local Service Systems*, vol. 787. Springer International Publishing, 2019.

[26] V. L. Uskov, R. J. Howlett, and L. C. Jain, *Smart education and smart e-Learning*, vol. 41. 2015.

[27] E. M. Staurset and E. Prasolova-Førland, *Creating a smart virtual reality simulator for sports training and education*, vol. 59. 2016.

[28] D. Rico-Bautista, Y. Medina-Cárdenas, and C. D. Guerrero, "Smart University: A Review from the Educational and Technological View of Internet of Things," *Adv. Intell. Syst. Comput.*, vol. 918, pp. 427–440, 2019.

[29] T. Sutjarittham, H. H. Gharakheili, S. S. Kanhere, and V. Sivaraman, "Realizing a Smart University Campus: Vision, Architecture, and Implementation," *Int. Symp. Adv. Networks Telecommun. Syst. ANTS*, vol. 2018-Decem, pp. 1–6, 2018.

[30] V. Tikhomirov, "Development of strategy for smart University," *Open Educ. Glob. Int. Conf.*, pp. 434–436, 2015.

[31] V. L. Uskov, J. P. Bakken, S. Karri, A. V. Uskov, C. Heinemann, and R. Rachakonda, *Smart university: Conceptual modeling and systems' design*, vol. 70. 2018.

[32] D. Rutkauskiene, D. Gudoniene, and R. Maskeliunas, "Smart Education and e-Learning 2016," vol. 59, pp. 291–301, 2016.

[33] V. L. Uskov *et al.*, "Building smart learning analytics system for smart university," *Smart Innov. Syst. Technol.*, vol. 75, no. 5, pp. 191–204, 2017.

[34] L. G. Tornatzky and M. Fleischer, "The processes of technological innovation," *J. Technol. Transf.*, vol. 16, no. 1, pp. 45–46, 1990.

[35] W. H. DeLone and McLean E.R., *Information Systems Success Measurement*, vol. 2, no. 1. 2016.

[36] W. H. DeLone and E. R. McLean, "The DeLone and McLean Model of Information Systems Success : A Ten-Year Update," *J. Manag. Inf. Syst.*, vol. 19, no. 4, pp. 9–30, 2003.

[37] S. Alaarj, Z. Abidin-Mohamed, and U. S. B. A. Bustamam, "Mediating Role of Trust on the Effects of Knowledge Management Capabilities on Organizational Performance," *Procedia - Soc. Behav. Sci.*, vol. 235, pp. 729–738, Nov. 2016.

[38] S. Alaarj, Z. A. Mohamed, and U. S. A. Bustamam, "Do Knowledge Management Capabilities Reduce the Negative effect of Environment Uncertainties on Organizational Performance? A Study of Public Listed Companies in Malaysia," *Int. J. Econ. Res.*, vol. 14, no. 15, pp. 443–456, 2017.

[39] M. H. Morris, L. F. Pitt, and P. Berthon, "Entrepreneurial activity in the Third World informal sector: The view from Khayelitsha," *Int. J. Entrep. Behav. Res.*, 1996.

[40] G. T. Lumpkin and G. G. Dess, "Clarifying the entrepreneurial orientation construct and linking it to performance," *Acad. Manag. Rev.*, vol. 21, no. 1, pp. 135–172, 1996.

[41] G. T. Lumpkin, C. C. Cogliser, and D. R. Schneider, "Understanding and measuring autonomy: An entrepreneurial orientation perspective," *Entrep. Theory Pract.*, vol. 33, no. 1, pp. 47–69, 2009.

[42] S. Radipere, "The effects of entrepreneurial orientation on business performance," *Mediterr. J. Soc. Sci.*, vol. 5, no. 16, pp. 141–152, 2014.

[43] S. Sahoo and S. Yadav, "Entrepreneurial orientation of SMEs, total quality management and firm performance," *J. Manuf. Technol. Manag.*, vol. 28, no. 7, pp. 892–912, 2017.

[44] A. S. Arshad, A. Rasli, A. A. Arshad, and Z. M. Zain, "The Impact of Entrepreneurial Orientation on Business Performance: A Study of Technology-based SMEs in Malaysia," *Procedia - Soc. Behav. Sci.*, vol. 130, no. 1996, pp. 46–53, 2014.

[45] H. S. Al-Dhaafri and A. Al-Swidi, "The impact of total quality management and entrepreneurial orientation on organizational performance," *Int. J. Qual. Reliab. Manag.*, vol. 33, no. 5, pp. 597–614, 2016.

[46] L. T. Lee and B. M. Sukoco, "The Effects of Entrepreneurial Orientation and Knowledge Management Capability on Organizational Effectiveness in Taiwan: The Moderating Role of Social Capital," *Int. J. Manag.*, vol. 24, no. 3, pp. 549–572, 2007.

[47] Y. M. Cheng, "Students' satisfaction and continuance intention of the cloud-based e-learning system: roles of interactivity and course quality factors," *Educ. Train.*, 2020.

[48] H. Mohammadi, "Factors affecting the e-learning outcomes: An integration of TAM and IS success model," *Telemat. Informatics*, vol. 32, no. 4, pp. 701–719, 2015.

[49] N. K. Dakhil and A. Abdullateef, "A Comparison of Academic Staff Performance Evaluations by Head of Department and Their Students," *J. Kufa Math. Comput.*, vol. 3, no. 4, pp. 30–40, 2016.

[50] T. J. Soares and A. L. V Torkomian, "TTO's staff and technology transfer: Examining the effect of employees' individual capabilities," *Technovation*, p. 102213, 2020.

[51] E. Heldt and H. Schmidtke, "Measuring the empowerment of international organizations: The evolution of financial and staff capabilities," *Glob. Policy*, vol. 8, pp. 51–61, 2017.

[52] M. Barth and M. Rieckmann, "Academic staff development as a catalyst for curriculum change towards education for sustainable development: an output perspective," *J. Clean. Prod.*, vol. 26, pp. 28–36, 2012.

[53] M. J. Iqbal, A. Rasli, L. H. Heng, M. B. B. Ali, I. Hassan, and A. Jolaee, "Academic staff knowledge sharing intentions and university innovation capability," *African J. Bus. Manag.*, vol. 5, no. 27, pp. 11051–11059, 2011.

[54] I. Liefner and D. Schiller, "Academic capabilities in developing countries—A conceptual framework with empirical illustrations from Thailand," *Res. Policy*, vol. 37, no. 2, pp. 276–293, 2008.

[55] M. Alvarez-Campana, G. López, E. Vázquez, V. A. Villagrá, and J. Berrocal, "Smart CEI moncloa: An iot-based platform for people flow and environmental monitoring on a Smart University Campus," *Sensors (Switzerland)*, vol. 17, no. 12, 2017.

[56] S. Alaarj, Z. A. Mohamed, and U. S. A. Bustamam, "The Effect of Knowledge Management Capabilities on Performance of Companies : A Study of Service Sector," *Int. J. Econ. Res.*, vol. 14, no. 15, pp. 457–470, 2017.

[57] A. A. A. H. Al-Dalaien, S. M. Drus, and H. Kasim, "A conceptual model of motivational factors of knowledge transfer for hospitals," *Int. J. Eng. Adv. Technol.*, vol. 9, no. 1, pp. 2313–2319, 2019.

[58] A. A. A. H. Al-Dalaien, S. M. Drus, H. Kasim, and A. T. Al-Oqaily, "Investigate the extrinsic and intrinsic motivational factors of

knowledge transfer in the hospitals," *J. Comput. Sci.*, vol. 16, no. 1, pp. 92–104, 2020.
[59] J. W. Spencer, "Firms' knowledge- sharing strategies in the global innovation system: empirical evidence from the flat panel display industry," *Strateg. Manag. J.*, vol. 24, no. 3, pp. 217–233, 2003.
[60] M. Z. Alksasbeh, A. A.-H. Al-Dala, and B. A. Y. Alqaraleh, "Factors that Influence the Success of Knowledge Management Implementation in Jordanian Higher Education Institutions," *Res. J. Appl. Sci. Eng. Technol.*, vol. 15, no. 7, pp. 249–260, 2018.
[61] N. I. J. Qammach, "The Mediating Role of Knowledge Sharing on Relationship between IT Capability and IT Support as Predictors of Innovation Performance: An Empirical Study on Mobile Companies in Iraq," *Procedia Econ. Financ.*, vol. 39, no. November 2015, pp. 562–570, 2016.
[62] K. M. Al-shawabkeh, "Exploring the Mediating Role of Knowledge Sharing between Human Resource Development and Organizational Ambidexterity," *Eur. J. Sci. Res.*, vol. 149, no. 3, pp. 345–361, 2018.
[63] O. Kaewchur, "The Mediating Role of Knowledge Sharing on Information Technology and Innovation," *Int. J. Manag. Knowl. Learn.*, vol. 2, no. 2, pp. 227–242, 2013.
[64] L. Natalia and C. W. Sandroto, "The Mediating Role of Knowledge Sharing Behavior on the Effect of Person-Organization Fit on Innovative Work Behavior," *Int. J. Appl. Bus. Int. Manag.*, vol. 5, no. 1, pp. 82–92, 2020.
[65] S. Alaaraj, "Knowledge Management Capabilities, Trust, and Performance of Manufacturing Companies in Emerging Economies," in *Proceedings of 177 th The IIER International Conference*, 2018, pp. 1–9.
[66] A. M. Mills and T. a. Smith, "Knowledge management and organizational performance: a decomposed view," *J. Knowl. Manag.*, vol. 15, no. 1, pp. 156–171, 2011.
[67] J. S. Mtebe, *Acceptance and Use of eLearning Solutions in Higher Education in East Africa*, no. 18. 2014.
[68] J. F. Hair, C. M. Ringle, and M. Sarstedt, "PLS-SEM: Indeed a Silver Bullet," *J. Mark. Theory Pract.*, vol. 19, no. 2, pp. 139–152, 2011.
[69] P. B. Lowry and J. Gaskin, "Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it," *IEEE Trans. Prof. Commun.*, vol. 57, no. 2, pp. 123–146, 2014.
[70] Hair, T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling*, 2nd ed. Thousand Oakes, 2017.