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E-MANAGEMENT AS A DIGITAL TRANSFORMATION STRATEGY TO IMPROVE PERCEIVED EDUCATION QUALITY AND STUDENT SATISFACTION, EVIDENCE FROM ALGERIA

Abstract. The wider recognition of the importance of digital transformation and its various applications in institutions has led to its adoption by higher education institutions seeking to improve their education quality and retain their customers. Accordingly, through this study, the researcher aims to investigate the effect of e-management in improving perceived education quality and student satisfaction in Algerian higher education. To achieve this objective, the researcher distributed an online survey to a random sample of 218 international students enrolled in the faculty of sciences and technology at Oran University in Western Algeria. Based on structural equation modelling analysis using Amos Program (v24.0.0), the results showed that e-management positively and significantly affects perceived education quality. Likewise, e-management also has a positive and significant effect on student satisfaction. Moreover, the results revealed that perceived education quality has a positive and significant effect on student satisfaction in Algeria HEIs.

Keywords: e-management; digital transformation; perceived education quality; student satisfaction; SEM analyses; Algeria.

Introduction and problem statement. In the last few years, the unstoppable development of information and communication technologies (ICTs) has given birth to what has been called the digital age or Industry 4.0. These technological advances are dramatically changing most fields of our day to day lives, as well as the dynamics of social and economic relations. The academic literature has often called this phenomenon Digital Transformation (Díaz-García et al., 2022). Digital transformation (DT) is a series of profound and coordinated shifts in culture, workforce, and technology that enable new learning and operational models and transform an organization's business model, strategic orientation, and value proposition. Thus, it is not just about disruption or technology, but about the fact that technology and digitalization have become a fundamental necessity for society, implying a significant change in terms of people's jobs and skills, and the type of work they do, to significantly impact all aspects of human life (Kaputa et al., 2022).

Among the forms of digital transformation in institutions, we find digital management, also known as e-management (Khadim et al., 2018). E-management is a modern strategic approach that uses advanced ICT for information management, dissemination, service delivery, marketing, decision making, etc. E-management paradigm enables direct and immediate communication with employees, consumers, and suppliers, harnesses the potential of talent, improves organizational performance through multifunctional teams, increases customer satisfaction, reduces operating costs, and strengthens knowledge management (Vilkaite-Vaitone & Povilaitiene, 2022).

Like other sectors, the higher education sector has been affected by digitalisation, and it faces a variety of challenges because of the environment's rapid and diverse changes. To survive and thrive, higher education leaders must consider the digital transformation agenda (Jakoet-Salie & Ramalobe, 2022). Which can be used as a means to attract sufficient and upper-class students, enhance students' experience, accessibility, deliver quality teaching materials and provide them blended learning. (Mohamed Hashim et al., 2021)

Research aim. Although there are extensive contributions to highlighting the impact of ICT applications in the institutional context, studies are still warranted to gain a deeper understanding of the implications of other forms of digitization such as e-management in higher education institutions (HEIs), especially in developing countries, such as Algeria. Therefore, this study focuses on highlighting the effect of e-management as a digital transformation strategy in improving perceived education quality and student satisfaction in Algerian higher education.

This section is followed by the literature review, conceptual model & hypotheses development. Following these, methodology, results, discussions, conclusions, implications & recommendations, limitations & areas for further studies are also presented

Literature Review.

E-management. The concept of e-management or electronic management is modern compared to other concepts and has high importance, particularly in the rapid developments in ICT (Ridha & Abdulrahman, 2018). In academic circles, researchers mutually refer to e-management in different terms such as: e-administration, smart management, digital management, and administration of the future (Khadim et al., 2018). and cyber management (Bouzidi & Boulesnane, 2015).

Generally, e-management refers to the use of all modern technologies such as information systems, computer networks and communications in the implementation of tasks and administrative work within the institution, which leads to their completion easily, conveniently and with high accuracy and works to save time and effort and simplify procedures while ensuring privacy and security of information (Waswas & Jwaifell, 2019). In the same context, Al-Hamdany & Al-Rekibe, (2021) describe e-management as an integrated electronic system that aims to convert ordinary administrative work from traditional management to computer management by using strong information systems that help in making administrative decisions.

In the higher education setting, e-management is defined as a set of electronic communication networks in which data and documents are transferred from virtual organizations to educational organizations (Mudholkar & murshed, 2020). However, Ismael & Abbas, (2019) describe e-management in HEIs as the use of ICT by universities to carry out its activities through the transformation of electronic work to improve performance and administrative processes, achieve service quality and university objectives with the least time, effort and cost.

According to Almutairi, (2014) e-management is based on four main elements**:**

Computer Hardware: It is the mechanical part of the computer networks and accessories.

Computer Software: It is the invisible and the untouchable part installed in the computer hardware. It is divided into system software, for example, network management, and OS and software applications such as e-mail, web browsers, electronic scale etc.

Communication Networks: These are the transmitters of information, for example, extranet, intranet and internet.

Knowledge Makers: These are the information technology literate leaders, managers and analysts of cognitive resources and the capital to install the IT technologies in a firm.

Perceived Education Quality. Over the last decade, the debate has changed and become increasingly in favour of quality in higher education and researchers seem to focus more on quality and service excellence at HEIs (Alzafari & Kratzer, 2019).

It is now generally accepted that the research field of quality in higher education is very complex, with a variety of theories, models, standards and indicators (Alzafari, 2017). Although quality is considered a rational concept, there is no clear and commonly accepted definition, due to the multiplicity of stakeholders in higher education and the multiplicity of their objectives (Alzafari, 2017; Liu, 2016). According to Eliophotou Menon, (2016), The emphasis placed on different conceptions of quality in higher education will not only vary based on the stakeholder, but it will also depend on the economic environment, as countries severely affected by the financial crisis are more likely to adopt perspectives associated with an economic agenda.

Referring to stakeholders, students, who are the main stakeholders in HEIs and the ultimate beneficiaries of the services provided by the institutions, appraise the quality of education based on their perception, indicating overall strengths and weaknesses, which in turn are used to assess the performance of HEIs. In other words, how students perceive the quality of education offered by an institution becomes one of the most important criteria for evaluating the institution's performance (Khagendra et al., 2020). Briefly, perceived education quality can be described as "the difference between what a student expects to receive and his/her perceptions of the actual delivery" (O'Neill & Palmer, 2004).

Student Satisfaction. The success of organizations such as manufacturing or service providers, profit or non-profit and governmental or non-governmental is determined by several factors. Customer satisfaction can be considered one of the most important factors among them (Mallika Appuhamilage & Torii, 2019). Although the concept of customer satisfaction varies in the literature, all the conceptual frameworks agree that satisfaction is an objective that every organisation strives to achieve, and long-term customer relationships are obtained from their satisfaction (Wang et al., 2023).

In the educational context, over the past two decades, student satisfaction has received considerable research attention due to its related valuable consequences (Abdelmaaboud et al., 2021). And it is considered a crucial indicator of the performance of HEIs in today's world (Wong & Chapman, 2022). According to Elliott & Healy, (2001), student satisfaction refers to short-term expectations that are determined based on the quality of education service received from the HEI. Similarly, Khan & Hemsley-Brown, (2021) defined student satisfaction as 'a student's favorability of educational outcome and experience based on subjective evaluation'.

Conceptual model and hypothesis developments

E-management and Perceived Education Quality

After conducting an empirical study at Al-Kindi Education Hospital. Shoda & Firdous, (2018), found that e-management improves the quality of service in public institutions. In educational settings, Abdullahi & Babagana (2023), claimed that universities have benefited from the use of electronic management in providing their educational services. This was confirmed in another study carried out by Al-Khattabi, (2016) who found that there is a positive impact of applying e-management on the quality of educational service level provided to students at Yemeni Universities. Similarly, Assiri, (2023) stated that e-management improved the quality of educational services at Saudi universities during COVID-19. Additionally, Abu Ragab, (2021) found that there is a significant role of e-management in improving the quality of the educational process during COVID-19. Based on this literature, we present the following research hypothesis:

H1: E-management has a positive and significant effect on perceived education quality.

2. E-management and Student Satisfaction

As pointed out by Mudholkar & Murshed, (2020) e-management is a digital strategy in the information age, that works to provide better services for institutions to achieve customer satisfaction. In the educational context, Hazzam & Wilkins, (2023) viewed that technology applications in higher education play a major role in identifying students' participation and their satisfaction with education.

This observation was confirmed by Memon et al., (2022) after their result revealed that technology positively contributed to satisfaction, academic, and functional performance. Similarly, Hoda et al., (2022) reported that technology

contributes to enhancing student satisfaction in Saudi higher education institutions. Moreover, Timotheou et al., (2023) found that digital technologies impacted students' emotions and attitudes. Hence, we proposed the following hypothesis:

H2: E-management has a positive and significant effect on student satisfaction.

3. Perceived Education Quality and Student Satisfaction

Numerous scholars have investigated the relationship between perceived education quality and student satisfaction in different regions and educational levels. More recent empirical research has highlighted a positive and significant effect of perceived education quality on student satisfaction. In China, for example, Chen et al., (2023) revealed that perceived education quality positively influenced student satisfaction. The same finding was reported in Thailand by Phonthanukitithaworn et al., (2022), after conducting an empirical study on 358 international students at 5 universities in the Northeastern region of Thailand. In Tanzania, the findings of Bwachele et al., (2023) also highlighted that the dimensions of perceived service quality collectively affected student satisfaction in Tanzanian higher learning institutions. The third research hypothesis is proposed accordingly:

H3: Perceived education quality has a positive and significant effect on student satisfaction.

To better understand the relationship between variables and summarise the hypotheses developed, we created a conceptual model depicted in Figure 1.

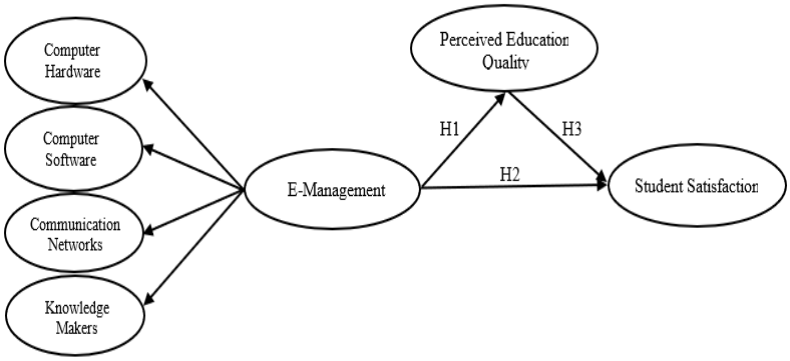

Fig 1. Main conceptual model (***Source:*** Figure created by author)

Research methods. To investigate the relationship between e-management, perceived education quality and student satisfaction in Algerian HEIs, the researcher focused on international students enrolled in the faculty of sciences and technology at Oran University, who are 371 students, upon information obtained from the Vice Rectorate in charge of external relations and cooperation works.

In this study, we used an online survey as a study tool to collect data from the students. To ensure adequate representation, we randomly sent the survey to a random sample of 280 students through emails and social media (Facebook). After 17 days, 218 responses were returned, among them 19 were incomplete, and 197 were valid for conclusive analysis, representing 53% of the total number of students.

The survey was developed based on previous studies and consists of two main parts: (1) the characteristics of participants (gender, age, and level). (2) 29 items related to: e-management (Almutairi, 2014), perceived education quality, and student satisfaction (Phonthanukitithaworn et al., 2022). Students responded to the survey on a five-point Likert scale with the following options: (1) Extremely disagreed, (2) Disagree, (3) Neutral, (4) Agree, and (5) Extremely agree.

Analysis and Results

Respondents' Demographic

Table 1

Respondents' Demographic

Characteristics	Detail	Frequency	Percentage
Gender	male	141	64.67
	female	77	35.32
Age group	18–22	78	39.90
	23–27	101	46.33
	28–32	31	15.59
	≥ 33	08	03.66
Level	Bachelor	123	56.42
	Master	84	38.53
	PhD	11	05.04

Regarding the respondents' demographic, Table 1 indicates that 64.67% of the survey respondents were males. However, females made up 35.32% of the respondents. For age, respondents in the age group 18–22 reached 39.90%, followed by the 23–27 age group at 46.33%, the 28–32 age group at 15.59%, and students who are equal or above 33 years accounted for 03.66% of the respondents. Most of the respondents were bachelor's students 56.42%. While 38.53% were master's students, and the remaining respondents were PhD students 05.04%.

Structural equation modelling (SEM). To evaluate the model and test the proposed hypotheses, the structural equation modelling (SEM) method was adopted using CB-SEM with IBM Spss Amos software (v24.0.0). According to (Anderson & Gerbing, 1988), in the SEM method there are two main steps: assessing first the measurement model, and then testing the causal relationships among the latent variables in the structural model.

Measurement model. According to Hair et al., (2021), before testing the proposed hypotheses, the measurement model must first be evaluated through a set of criteria. Starting with the indicator's reliability Hair et al., (2021) suggested that the indicator's outer loadings equal to or higher than 0.60 are acceptable for analysis, while the indicator's outer loadings that are equal to or higher than 0.70 are considered very important and ensure the validity of the measurement model in explaining the latent variables. As a result, we excluded six indicators from the analysis process that failed to meet the cut-off value and kept the remaining indicators, as illustrated in Figure 2. In addition, the correlation value between the sub-constructs (Computer Hardware, Computer Software, Communication Networks, and Knowledge Makers) of the second-order construct, e-management, is less than 0.85, indicating that every sub-construct is distinct from the others (Anderson & Gerbing, 1988).

The internal consistency reliability was verified through two criteria, α Cronbach's Alpha) and CR (composite reliability), as shown in Table 2. Cronbach's alpha values ranged between 0.751 and 0.866, and the (CR) values ranged between 0.805 and 0.894, all these values were higher than the designated threshold (0.70) (Hair et al., 2021). Furthermore, the AVE values (average variance extracted) ranged between 0.547 and 0.694, which were greater than the designated threshold (0.50), signifying adequate convergent validity. (Fornell & Larcker, 1981)

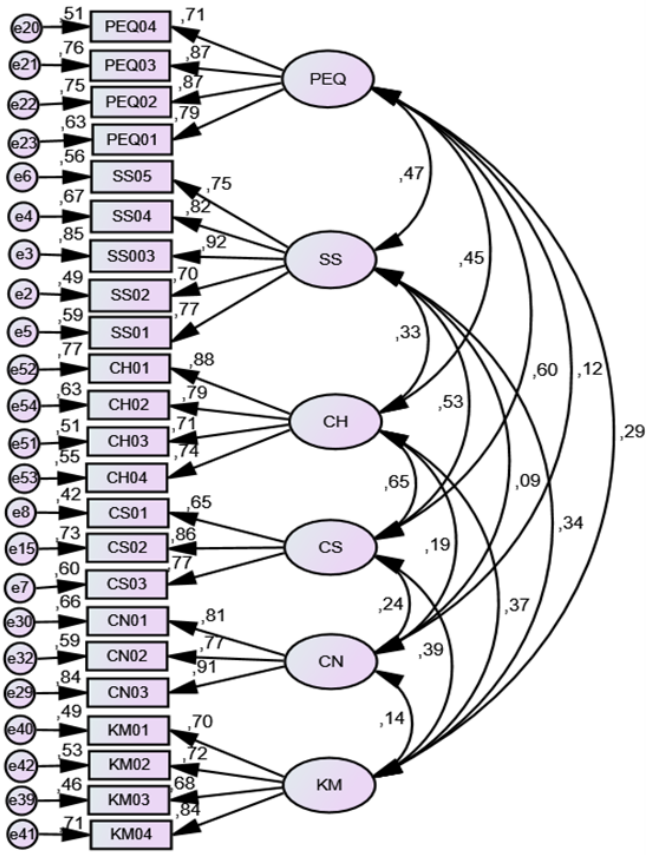

Fig 2. Measurement model

Notes: PEQ: Perceived Education Quality, SS: Student Satisfaction, CH: Computer Hardware, CS: Computer Software, CN: Communication Networks, KM: Knowledge Makers

Table 2

Validity and reliability results / Convergent validity of the measurement model.

Constructs	α	CR	AVE	Fornell–Larcker criterion					
				SS	PEQ	CH	CN	KM	CS
SS	0.751	0,894	0,632	**0,795**					
PEQ	0.776	0,886	0,662	0,470***	**0,813**				
CH	0.845	0,864	0,615	0,332***	0,453***	**0,784**			
CN	0.823	0,871	0,694	0,091	0,116	0,193*	**0,833**		
KM	0.823	0,828	0,547	0,342***	0,292***	0,372***	0,145†	**0,740**	
CS	0.866	0,805	0,583	0,531***	0,598***	0,650***	0,238**	0,390***	**0,763**

Concerning discriminant validity, which refers to the degree of difference between two or more constructs (Hair et al., 2021), is assessed first through the square root of AVEs (SRAVEs) utilising the Fornell-Larcker criterion, where the SRAVE for each factor must be greater than its highest correlation with any other factors, as shown in the table below. By utilising the HTMT criterion (Heterotrait-Monotrait), the findings showed that all HTMT values are lower than 0.85 (threshold value) (Hair et al., 2021). Thus, the discriminant validity requirement was met.

Table 3

Heterotrait-monotrait (HTMT) criterion results. / Discriminant validity

Construct	Heterotrait-monotrait (HTMT) criterion					
	SS	PEQ	CH	CN	KM	CS
SS						
PEQ	0,476					
CH	0,290	0,437				
CN	0,114	0,135	0,220			
KM	0,353	0,312	0,392	0,148		
CS	0,505	0,598	0,614	0,274	0,412	

Structural model

Normality and collinearity. To assure the validity of our model for testing the hypotheses, we assess its feasibility through the examination of normality and collinearity issues. We first examined the collinearity among the predictor constructs using the tolerance values (T) and variance inflation factor (VIF). According to Hair et al., (2021), the VIF value must be less than 5, and the tolerance value must be greater than 0.2. The results of these tests showed a low degree of collinearity, with VIFs ≤ 4.113 and Ts > 0.251, indicating the absence of collinearity problems.

Regarding the assumption of normality, we relied on the mean, standard deviation, skewness, and kurtosis (M, SD, Sk, and Ku). The outcomes in the table below reveal that the factors with higher values of M and SD have values of 3.657 and 1.281, respectively, with lower values of 2.886 and 0.981. This indicates that the levels of e-management, perceived education quality and student satisfaction at Oran University are higher than the average level. In addition, the Skewness value ranged from –0.711 to –0.175 (±2), and the Kurtosis value ranged between –1.154 and –0.445 (±2). Hence, it can be concluded that the skewness and kurtosis values met the normal distribution criteria (Tabachnick & Fidell, 2007).

Table 4

Normality Inner Mean, SD, Skewness, and Kurtosis values

Main Construct	Variables	Mean	SD	SK	KU
E-management	CH	3.225	1.114	-0.175	-1.154
	CS	3.268	1.281	-0.711	-0.445
	NC	3.356	1.001	-0.236	-0.698
	KM	2.886	0.981	-0.367	-0.556
PEQ	PEQ	3.657	1.045	-0.587	-0.736
SS	SS	3.012	1.087	-0.674	-0.478

Model Fit. After accomplishing the normality and collinearity assumptions, the structural model has been created, to evaluate the model fit and the significance of path estimates. As shown in Figure 3.

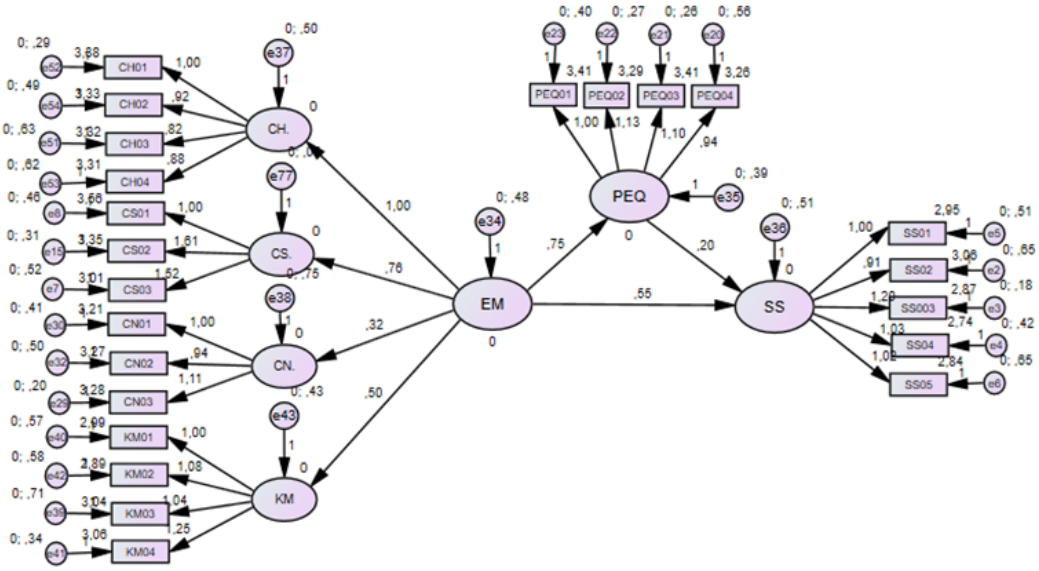

Fig 3. Structural model

Table 5

Goodness of fit indices

Fit Index	p-value	χ^2 / Df	GFI	CFI	SRMR	RMSEA	TLI
Value	0.00	625.241 / 307 (2. 036)	0.904	0.914	0. 079	0.078	0.911
Threshold		<3.00	>0.90	>0.90	<0.08	<0.08	>0.90
Results	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted

Based on table number 5, it can be noted that the structural model presents reasonably satisfactory fit indices. χ2 /df (2.036) was less than 3.00. GFI (0.904) was higher than 0.90. CFI (0.914) and TLI (0.911) were both higher than 0.90. SRMR (0.079) and RMSEA (0.078) were less than 0.08. This indicates that all fit indices have met the goodness of fit criteria (Byrne, 2016).

Hypotheses testing

Table 6

Hypotheses testing

Hypothesis	Causal Path	Estimate		CR	P-value	Decision
		Standardized	Unstandardized			
H1	EM → PEQ	0.752	0.643	6.400	0.000	Significant
H2	EM → SS	0.554	0.411	3.720	0.000	Significant
H3	PEQ → SS	0.201	0.210	2.332	0.043	Significant

Regarding the results of hypotheses testing. Table 6 shows that the Cr values of the three hypotheses were 6.400, 3.720 and 2.332, respectively, and they are all greater than the threshold value of +1.96.

The first hypothesis estimation indicates that the regression weight of EM in PEQ is significant ($\beta = 0.752$, $p \leq 0.05$), indicating that e-management positively and significantly affects perceived education quality, confirming the first hypothesis (H1). In addition, the supported hypothesis H2 ($\beta = 0.554$, $p \leq 0.05$), denotes that the e-management positively and significantly affects student satisfaction. Moreover, the output revealed that there is a positive and significant effect of perceived education quality on student satisfaction ($\beta = 0.201$, $p \leq 0.05$) supporting H3.

Discussion. The result of the first hypothesis showed that e-management positively and significantly affects perceived education quality at Oran University in Algerian higher education. This result is in line with the results of previous studies that found that e-management enhances perceived education quality in HEIs. (Abdullahi & Babagana, 2023; Abu Ragab, 2021; Al-Khattabi, 2016; Assiri, 2023). This indicates that the adoption of e-management as a digital strategy in the higher education context enhances perceived education quality, irrespective of the regions where it was adopted.

The result of the second hypothesis revealed that there is a positive and significant effect of e-management on student satisfaction at Oran University. This finding is consistent with previous studies that reported the same finding (Hazzam & Wilkins, 2023; Hoda et al., 2022; Memon et al., 2022; Timotheou et al., 2023). These findings confirmed that digitization in its various forms boosts the positive impression of students and increases their feelings and attitudes towards adopting e-management in HEIs.

Confirmation of the third hypothesis supports that perceived education quality has a positive and significant effect on student satisfaction at Oran University. This result demonstrates that perceived education quality affects students' emotions and satisfaction. This result gained empirical support from many previous studies that found that perceived education quality positively and significantly affects student satisfaction (Bwachele et al., 2023; Chen et al., 2023; Phonthanukitithaworn et al., 2022).

Conclusions. This study aimed to investigate the contributions of e-management which consists of four key elements (computer hardware, computer software, communication networks, and knowledge makers) to improving perceived education quality and student satisfaction in Algerian higher education. Three hypotheses were developed from the literature. Data were collected online from a random sample of international students enrolled in the faculty of sciences and technology at Oran University in Western Algeria. Lastly, the data was analysed using two software programmes, IBMSpss and IBMSpssAmos. The results revealed that e-management positively and significantly affects perceived education quality. In turn, perceived education quality has a positive and significant effect on student satisfaction. Moreover, the results showed that there is a positive and significant effect of e-management on student satisfaction in Algerian HEIs.

Implications and recommendations. The results reported in this study reveal important insights for managers of universities and policymakers in the Algerian higher education sector. First, e-management is an effective, advancing and valuable strategy/initiative that requires numerous technological, administrative and cultural changes for optimal results. Therefore, it is expedient for university administration to support the e-management elements: especially the communication networks, to maximise the benefits of integrating e-management in HEIs. Second, although the results of the descriptive analysis revealed that the level of applying e-management at Oran University was acceptable (larger than average). However, there is an urgent need to overcome some obstacles that prevent the full implementation of e-management, such as: opposition to the idea of integrating e-management by some administrators. Therefore, administrative policymakers must consider these obstacles while developing the education policy and should be reduced to the lowest limit, particularly in a country like Algeria with limited technical capabilities. Third, this study revealed clearly that perceived education quality contributes to increasing students' satisfaction at Oran University, with a weak standardised estimate ($\beta = 0.201$) between the two constructs. Thus, the instructors and managers at Oran University must pay attention to the development of educational content, to enhance international students' sense of the quality of educational service provided by Oran University.

Limitations and Suggestions for Future Research. Like all studies, this study also has some limitations that pave the way for further studies. Firstly, we categorically relied on quantitative data, so we recommend that future research use both qualitative and quantitative data to get more comprehensive insights. Secondly, the study data has been gathered from a limited sample size consisting of international students registered in the faculty of sciences and technology at Oran University, which makes generalisability a difficult issue. Therefore, subsequent research could expand the target sample scope to include the remaining faculties to extend the generalisability of the final findings. Thirdly, even though Algerian HEIs include: national institutes, higher normal schools, universities, university centres, and national higher schools, the current study's scope was restricted to a single HEI represented at Oran University. Subsequent research endeavours have to consider the remaining Algerian HEIs.

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Е-УПРАВЛІННЯ ЯК СТРАТЕГІЯ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ ДЛЯ ПІДВИЩЕННЯ ПЕРЦЕПТИВНОЇ ЯКОСТІ ОСВІТИ І ЗАДОВОЛЕНОСТІ СТУДЕНТІВ: ДАНІ З АЛЖИРУ

Анотація. Широке визнання важливості цифрової трансформації та її різноманітних застосувань в установах призвело до її впровадження вищими навчальними закладами, які прагнуть покращити якість освіти та втримати споживачів своїх освітніх послуг. У цьому дослідженні дослідник має на меті вивчити вплив е-управління на покращення перцептивної якості освіти та задоволеності здобувачів вищої освіті Алжиру. Для досягнення цієї мети дослідник розповсюдив онлайн-опитування випадковій вибірці з 218 міжнародних студентів, які навчаються на факультеті наук і технологій в Університеті Орана на заході Алжиру. Результати аналізу структурних рівнянь за допомогою програми Amos (v24.0.0) показали, що е-управління позитивно та значуще впливає на перцепцію якості освіти. Також е-управління має позитивний і значущий вплив на задоволеність студентів. Крім того, результати підтвердили, що перцептивна якість освіти має позитивний і значущий вплив на задоволеність студентів в Алжирських вищих навчальних закладах.

Ключові слова: е-управління; цифрова трансформація; перцептивна якість освіти; задоволеність студентів; аналіз структурних рівнянь; Алжир.