E-LEARNING IMPLEMENTATION FACTORS IN THE ALGERIAN HIGHER EDUCATION SECTOR: A STRUCTURAL ANALYSIS VIA ISM METHOD

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Abstract:

Digital learning has become an imperative due to the advantages and solutions it offers that make education a flexible process, which contributes to the achievement of the education objectives. Digital learning emerged in Algeria during the COVID-19 pandemic, which kept the school year running smoothly. This paper aims to determine the key factors that affect the implementation of digital learning in the Algerian higher education sector using the Structural Analysis Methods (ISM-MICMAC). The findings show that digital infrastructure, the allocation of sufficient budget, strong institutional strategy, privacy protection laws, and innovative learning method are the most important factors that contribute to the success of digital education. Furthermore, digital tools, digital activity and social media play a crucial role in the implementation of e-learning.

Keywords: E-learning; Higher education; COVID-19; Digital technologies, Algeria.

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1. INTRODUCTION

The world has witnessed in the last decade a huge technological and industrial revolution, which known as the fourth industrial revolution, or the so-called "Industry 4.0", this term was first introduced in Germany (Rojko, 2017) and later emerge throughout the world. Industry 4.0 contributed in developing several aspects of human life, such as the economic, cognitive, and social aspects (Ghobakhloo, 2020).

The education sector was concerned with this tremendous technological progress, which had a great impact on its content and form. After decades, where the education process remained in its traditional form which is face-to-face education, the new technologies brought new patterns and forms to the teaching and learning process, as well as the creation of new ways of teaching and acquiring knowledge (Hao et al., 2022; Tautz et al., 2021; Tiberius et al., 2021). The main purpose of these changes in the education process is to improve the efficiency of students to achieve the goals of higher education, and enhance their cognitive skills to keep pace with the developments of the twenty-first century (Morozova et al., 2020; Tautz et al., 2021), as well as reduce educational disparities between countries across the world.

The end of 2019 and the beginning of 2020 witnessed the spread of the Corona virus (COVID-19), which forced the world to shut down all businesses and institutions, social events were banned. A strict quarantine imposed for a long period of time in order to prevent and limiting the spread of infection as well as to reduce human losses. This shutdown, due to the Corona virus, affected more than 86 percent of students around the world (Aristovnik et al., 2020; Tang et al., 2021). It has forced educational institutions, such as universities, to switch to the distance learning system (Hao et al., 2022).

Therefore, digital learning provides feasible solutions in order to facilitate the distance learning process and avoid the risk of an outbreak of the Corona virus infection (Abumalloh et al., 2021; Tiberius et al., 2021). Furthermore, the importance of digital learning lies in its flexibility in terms of time and space (Lowenthal et al., 2020). Therefore, most universities across the world have switched to digital learning, relying mainly on digital tools and Internet to carry out the educational process. Many forms of digital education emerged during the COVID-19 pandemic, such as synchronous learning through conference video as well as asynchronous learning via recorded lessons, Massive Open Online Courses (MOOCs), Participatory Open Online Courses (POOCs), and e-books, pdfs and wikis... etc (Biasutti, 2017; Lowenthal et al., 2020; Suter & Rampelt, 2017). In the other hand, many people do not have access to education in different part of the world, especially those in developing countries or in countries considered as a war zone, even when they move to developed countries as refugees, they still lack the possibilities to attend schools or universities for the reason that they do not have appropriate qualifications that enabling them to enrol in educational institutions; For that, e-learning is a suitable solution for refugees to be able to benefit from appropriate education (Suter & Rampelt, 2017), and even the

students in developing countries which do not have a high-level education can benefit from digital courses offered by universities around the world or by famous online study websites such as Coursera, Edx... etc.

Although most of the world's universities have switched to digital learning in its various forms. However, there were differences between the universities in the implementation of digital learning (Aristovnik et al., 2020). This is mainly due to the differences in capabilities between universities in developed countries and the rest of the universities in the world.

Whereas, universities in developed countries were proactive in the transition to digital learning due to their prior preparation and availability of technological tools and expertise in this field. While, the transition of the rest of the universities to the digital education system was slow and faced several problems, most of them related to the lack of digital tools and digital skills (Noori, 2021).

Algeria as the rest of the world was affected by the corona virus (COVID-19), and there was a full shutdown of almost all institutions in the Algerian territory; In addition, a decision was issued to prevent social activities to control the spread of the virus. In light of these health restrictions, higher education sector was forced to switch to e-learning system in a short period (Amrar, 2021; Rebouh, 2021). The Algerian universities faced several problems in this sudden and massive shift due to the fact that e-learning is still in its nascent stage in the country (Boukhdouni & Boukhdouni, 2021; Rebouh, 2021). These problems are mainly the lack of readiness to such a fast and enormous transition as well as to the inadequate level of digitization, limited digital skills and experiences, and even students' lack of access to the Internet as well as to digital tools (Amrar, 2021; Boukhdouni & Boukhdouni, 2021).

Through the above, this paper aims to explore the main factors of digital learning implementation in the higher education sector in Algeria, and, therefore, we suggest the following research question:

What are the main factors that contribute to successful digital learning implementation in the Algeria's higher education sector?

In order to achieve the purpose of our study, we are based on a prospective approach using the Structural Analysis Methods (ISM-MICMAC). It allows for identifying the most important factors for the successful implementation of digital education in Algeria.

The interpretive structural analysis can be defined as a methodology used to analyse and understand the relationships between variables within a given system.

The rest of this paper is structured as follows: section 2 presents a review of the literature that discussed the development of digital education, its benefits and solutions in the world and in Algeria. In section 3, we explain the methodology of the the Structural Analysis Method (ISM-MICMAC). Findings and discussion were reported in section 4. Finally, we conclude the paper with a brief summary of results and some policy implications.

2. Literature review

The literature discussed the concept of digital education from several aspects. Numerous studies focused on the importance of the digital shift, role, tools, and solutions as well as its benefits. In the Algerian case, the existed literature discussed the emergence of digital education, the obstacles it faced, and the opportunities for its successful implementation.

2.1 Digital education aspects

The literature review shows that the digital education has emerged recently as a perfect alternative to traditional education, given to its advantages and the new ideas that it brought to the educational process, which facilitate the teaching and learning process. Digital learning has created new educational forms, allowing universities to provide their educational services beyond their physical and geographical borders to include all parts of the world (Bygstad et al., 2022). Tautz et al. (2021) suggest that digital learning contributes to varying the lectures and supporting the educational process, which contributes to enhancing the efficiency of higher education students (Tautz et al., 2021). Moreover, previous studies have shown that digital education enables students to attend their lessons despite their circumstances, whether they were refugees or irregular students who are not registered at universities (Suter & Rampelt, 2017; Zawacki-Richter et al., 2015). New ways of teaching have been examined in prior studies such as synchronous and asynchronous learning which are gaining a lot of attention, as they are flexible and ease of use (Lowenthal et al., 2020; Suter & Rampelt, 2017): Additionally, other tools like wikis and forums facilitate the learning process as well as improving students' cognitive and social skills (Biasutti, 2017). Morozova et al. (2020) indicated that technologies such Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) are contributing in digital learning faster than was expected in light of the tremendous technological advances. Further, Virtual Learning (VL) is considered as one of the most important technologies that help students to develop their cognitive skills (Lacka et al., 2021). According to Morozova et al. (2020), digital learning process enhances the efficiency of learners which enables them to keep pace with the developments of the twenty-first century and the requirements of the labor market.

A large number of existing studies in the literatures have examined the implementation of digital education in the higher education sector, where it is subject to several factors that affect the success of the process and the extent of its impact on improving education. Orji et al. (2022) think that the allocation of sufficient budget for digitizing the education sector, in addition to technical skills, with the appropriate legal frameworks to protect privacy are the most important success factors of the digital learning process. Some authors argued that teachers' digital skills are a major determinant digital education success and the improvement of students' cognitive skills (Bond et al., 2018; Núñez-Canal et al., 2022; Ronzhina et al., 2021), where enhancing teachers' digital skills by providing the necessary resources and increasing

their digital activity (Tang et al., 2021), as well as giving sufficient time to develop digital content enables the improvement of digital education process (O'Doherty et al., 2018). On the other hand, several studies have shown that teachers' acceptance of digital education is an important factor to the success of its implementation, where the openness of teachers toward new methods of teaching and the use of digital tools positively affects the knowledge level of students, as well as their harmony in the new educational system (O'Doherty et al., 2018; Ronzhina et al., 2021). Furthermore, constant monitoring of students for their concerns regarding the use of digital technologies is required in order to improve their use of technology (Bond et al., 2018; Heider, 2015); Therefore, there must be an appropriate support for both teachers and students so that they can benefit from digital tools in the best possible way (Selwyn, 2016). Some studies indicated that students' digital skills and their interaction with each other and with teachers, as well as digital education preparatory classes are important elements in the digital education process (Aristovnik et al., 2020; Heider, 2015; Ronzhina et al., 2021; Suter & Rampelt, 2017). In addition, students' motivations are a crucial factor to benefit the digital learning advantages (Ronzhina et al., 2021), where these motivations can be achieved through the feedback process and the formal recognition of their digital learning and their performed work (Suter & Rampelt, 2017). Jackson (2019)pointed out that business leaders and executives should contribute to defining the education curriculum framework in line with the modern requirements of the labor market.

Like any other process, the process of the education digitizing can face some obstacles and difficulties, especially with regard to insufficient structures, the absence of institutional strategies, and the lack of interaction between the participants from students and teachers (O'Doherty et al., 2018). Additionally, inadequate leadership skills and the prevailing mindset that refuses to change can also negatively affect the development of digital education (Rodríguez-Abitia & Bribiesca-Correa, 2021). Lacka et al. (2021) argued that higher education should not rely on digital technology tools because they require additional resources, and Selwyn (2016) suggested that digital technologies could be a distraction for students and negatively affect their learning (Selwyn, 2016). The same goes for social media, which should remain only as a means of communication (Lacka et al., 2021).

2.2 Digital education in Algeria

Digital education has emerged recently in the Algerian education system for many reasons, mainly related to the level of digitization in the country. Although Algeria has begun to move towards the digitization of institutions in the twenty-first era to keep pace with technological developments and keep pace with the ranks of major countries. It has not yet reached the required level, where Algeria is ranked 120 from 193 countries with an E-government index equal to 0.51730, which refers to government digitalization level according to the united nation reports (United Nations e-government survey, 2020). Digital education appeared in Algeria in the early

2000s (Amrar, 2021), but the actual embodiment on the ground was after the Corona pandemic, especially in the higher education sector due to the inability to continue education face-to-face in universities (Boukhdouni & Boukhdouni, 2021). Amrar (2021) pointed out that the transition to digital education was immediate and faced some difficulties. These difficulties are mainly due to the lack of structures and insufficient experience, in addition to limited digital skills. However, it was a useful experience and effectively contributed to completing the education curriculum (Rabouh, 2021). Therefore, there must be a strategic plan for the country to establish digital education, through digitizing the educational sector and encouraging teachers and students to digital education, as well as working to open digital universities, in order to develop the self-learning process (Rebouh, 2021). According to Amrar (2021), granting an adequate budget to develop digital content for libraries at universities is an important factor in the transition to digital education in order to improve the efficiency of the education process. Furthermore, Boukhdouni & Boukhdouni (2021) indicated that Algeria lags behind the rest of the countries with regard to digital education because of the weakness of the internet network, information, and communication technology, which calls for improving the communication network in Algeria as well as training teachers and students in order to implement digital education. Hence, it is highly recommended to develop a long-term vision for the transition from the traditional educational system to the digital educational system (Hanniche & Elbey, 2020). According to Benkhider & Kherbachi (2020), the students' attitude towards the digital learning also considered as a main component in the successful implementation of digital learning. They conducted a study on a sample of 420 students from different universities in Algeria to determine the factors that influence students' learning habits during COVID-19 pandemic, the results indicate that students' awareness of the need to progress in learning during quarantine, the more accurate coordination of digital resources, as well as the provision of digital technologies and the development of the knowledge environment are the most influential factors on students' learning habits. In the same context, (Kaddeche et al., 2021) in their study which conducted on a sample of 130 professors indicated that lack of student discipline regarding e-learning is an obstacle to e-learning implementation. Furthermore, the Internet and lack of training courses on digital education are considered as crucial obstacles to the application of e-learning at universities (Kaddeche et al., 2021; Lassassi et al., 2020).

Lassassi et al., (2020), conducted a study of the teachers' handling of the COVID-19 situation, they revealed that the teachers' environmental working conditions are acceptable. However, there were difficulties in communication between teachers and students.

Based on the previous studies, it is evident that there is a research gap with regard to the implementation of E-learning in the higher education sector in Algeria. In this paper, we are going to focus on identifying the main factors

that contribute to successful digital learning implementation in the Algeria's higher education sector.

3. Methodology and Data

The use of interpretative structural modelling aims to analyse and understand the relationships between the study variables, which allows to know the variables that are necessary to develop the system related with the problem posed.

In this study, we used the SmartISM tool, which was developed by Ahmad & Qahmash, (2021). This tool is an and-to-end software tool for implementing ISM in an error-free, easy-to-use, and graphical manner. In addition to automating existing ISM procedures, the Warshall algorithm is used for transitivity calculations and a new algorithm, a reduced conic matrix, has been introduced to convert the digraph into a final form with fewer edges while retaining the digraph structure and reachability of variables (Ahmad & Qahmash, 2021).

3.1 ISM (Interpretative Structural Modelling) Methodology

Interpretive Structural Modelling is a directional structuring technique based on contextual relationships identified by field experts, using computerized transformation of the relationships into a pictorial model using matrix algebra and graph theory (Ahmad & Qahmash, 2021).

It can be defined as a methodology used to analyse and understand the relationships between variables within a given system. The ISM model builds a structural framework that represents the relationships between variables based on expert opinions as well as literature reviews. This model develops accessibility matrices and defines the levels or divisions within the model, allowing researchers to evaluate the influence between different factors and identify the key variables driving the system (Kumar et al., 2021).

The ISM model contributes to an improved understanding of complex relationships in order to enhance research processes, enable researchers and decision-makers to make assessments and predictions about the behaviour of the system under study, and to improve the decision-making process. The ISM model is used in several fields such as management, engineering, and social sciences. Many researchers have adopted ISM with MICMAC analysis in their research (Kumar et al., 2021). The steps to develop an ISM model are shown in figure 1.

3.2 Determine the study variables

Determining the study variables is the first and most important step, as the variables are identified by reviewing the literature and expert opinions. In addition, these variables are defined based on their objectives and indicators. There are other methods to determine the variables of know-how, such as the use of objective analysis, higher-level theory, contingency theory, content analysis, strengths, weaknesses, opportunities and threats (SWOT) analysis, engineering ideas workshop, and Delphi technology (Ahmad & Qahmash, 2021). Table 1 shown a list of 10 variables has been determined by the research team based on the extant literature review results.

Fig.1. Interpretative Structural Modelling methodology

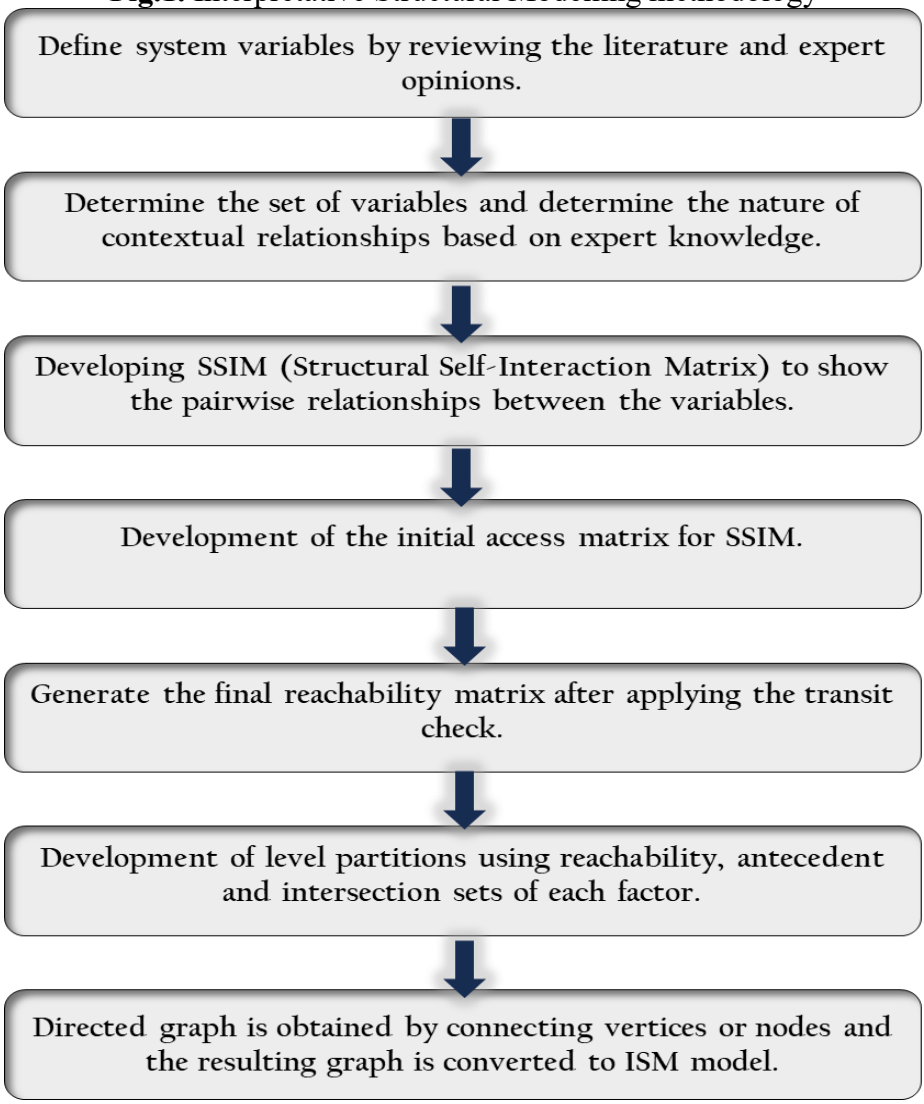


Table 1. List of variables

N°	Long label	Short label	Description
1	Privacy regulatory	priv-reg	Privacy law is the body of laws dealing with the organization, storage, and use of personally identifiable information, personal healthcare information, and financial information for individuals.
2	Digital tools	dig-tools	Digital tools are mobiles, tablette, software, websites, or online resources that can make it easier to get things done.
3	Innovative learning method	Inno-LM	Innovative learning is the process of creating an atmosphere where students regularly learn about new things and ask and think of new ideas for themselves.
4	Digital activity	Dig-act	Activities that include the use of digital tools, such as online collaborative activities, social media interactions and communications.
5	Social media	SM	Social media platforms allow users to have conversations, share information, and create web content.
6	Online collaborative activities	Collab-act	students and teachers to engage in joint efforts to seek solutions to complex problems.
7	Digital infrastructure	Dig-infra	Digital infrastructure includes the physical resources needed to enable the use of computerized data, devices, methods, systems, and processes.
8	Student efficiency	Stud-eff	The produce of learning outcomes at the lowest level of available resources.
9	Budget allocation	Budget	The amount of spending allocated to digital learning.
10	Institutional strategy	Institu-st	Institutional strategies are patterns of organizational action concerned with managing institutional structures.

4. Results and discussion

4.1. Development of Structural Self-Interaction Matrix

In order to determine the relationship between two variables (i and j) and the direction of the relationship, the literature review was relied upon, and experts were used to verify the validity of the identified variables. The following four symbols were used to indicate the direction associated with the relationship between two variables.

V => Variable i will affect barrier j,
A => Variable j will affect barrier I,
X => Variable i and j will affect each other,
O => Variable i and j are unrelated or will not influence each other.

Based on contextual relationships developed between the variables after considering responses from experts, SSIM is constructed using symbols V, A, X and O.

Table 2 represents the structural self-interaction matrix that was developed based on contextual relationships between variables.

Table 2. Structural Self-Interaction Matrix of variables

Variables	Institu-st	Bud-get	St-effic	Dig-infra	Colla-act	SM	Dig-act	Inno-LM	Dig-tools	priv-reg
Priv-reg	A	A	O	A	V	V	V	X	V	
Dig-tools	A	A	O	A	V	V	V	X		
Inno-LM	A	A	V	O	V	V	V			
Dig-act	A	O	O	A	V	V				
SM	O	O	V	O	X					
Colla-act	O	O	V	A						
Dig-infra	A	X	O							
St-effic	O	O								
Budget	A									
Institu-st										

Source: Own circulations using SmartISM

4.2. Initial reachability matrix

The formation of this matrix is done by substituting the symbols used in SSIM (Table 2) into binary values 1 and 0 to obtain the initial accessibility matrix. The symbols V, A, X, and O have been replaced with 1 or 0.

- If the symbol (i, j) in SSIM is V, then replace it with 1 in the initial accessibility matrix and the corresponding entry becomes (j, i) 0.
- If the symbol (i, j) in SSIM is A, then replace it with 0 in the initial reachability matrix and the corresponding entry (j, i) becomes 1.
- If the symbol (i, j) in SSIM is X, then replace (i, j) and (j, i) both entries as 1.
- If the symbol (i,j) in SSIM is O then replace both inputs (i,j) and (j,i) both inputs as 0. After the process of replacing symbols with binary values 1 and 0 is over, the initial accessibility matrix is formed as shown in Table 3.

Table 3. Initial reachability matrix

Variables	Priv-reg	Dig-tools	Inno-LM	Dig-act	SM	Colla-act	Dig-infra	St-effic	Budget	Institu-st
Priv-reg	1	1	1	1	1	1	0	0	0	0
Dig-tools	0	1	1	1	1	1	0	0	0	0
Inno-LM	1	1	1	1	1	1	0	1	0	0
Dig-act	0	0	0	1	1	1	0	0	0	0
SM	0	0	0	0	1	1	0	1	0	0
Colla-act	0	0	0	0	1	1	0	1	0	0
Dig-infra	1	1	0	1	0	1	1	0	1	0
St-effic	0	0	0	0	0	0	0	1	0	0
Budget	1	1	1	0	0	0	1	0	1	0
Institu-st	1	1	1	1	0	0	1	0	1	1

Source: Own circulations using SmartISM

4.3. Final reachability matrix

The transformation was applied in the initial accessibility matrix according to the rule that if variable A is related to variable B and variable B is related to variable C, then inevitably variable A will be related to variable C. After performing transitivity, the final reachability matrix was inferred as indicated in Table 4.

Table 4. Final reachability matrix

Variables	Priv-reg	Dig-tools	Inno-LM	Dig-act	SM	Colla-act	Dig-infra	St-effic	Budget	Institu-st
Priv-reg	1	1	0	1	1*	1	1	1*	1	1*
Dig-tools	1	1	0	1	1	1	1*	1*	1*	1*
Inno-LM	1	1	1	1	1	1	1	1*	1*	1*
Dig-act	0	0	0	1	1	1	1	1	1	1*
SM	0	0	0	1	1	1	1	1	1	1
Colla-act	0	0	0	1*	1	1	1	1	1	1*
Dig-infra	0	0	0	0	0	0	1	1	1	1*
St-effic	0	0	0	0	0	0	0	1	1	1
Budget	0	0	0	0	0	0	0	1	1	1
Institu-st	0	0	0	0	0	0	0	0	0	1

Source: Own circulations using SmartISM

4.4. Level partitions

The reachability and prior groups for each variable were inferred from the final reachability matrix analysis and from these two groups the intercept groups for that specific variable were derived. The reachability set consists of itself and all the variables it influences, and the antecedent set consists of itself and all the variables influencing it (Ahmad & Qahmash, 2021). The intercept set for each variable was derived from reachability and the previous set. Variables with accessibility and intercept set were identical at the first higher level in the model and indicated that they would not help drive any other variable. Once the first level is recognized, it is removed from all groups and the same procedure is applied to find out the other levels of forms. Table (5) shows the specific levels, which is the basis for building the ISM model.

Table 5. Partitioning of variables

Elements(Mi)	Reachability Set R(Mi)	Antecedent Set A(Ni)	Intersection Set R(Mi)∩A(Ni)	Level
Priv-reg	1, 2, 3,	1, 2, 3, 7, 9, 10,	1, 2, 3,	4
Dig-tools	1, 2, 3,	1, 2, 3, 7, 9, 10,	1, 2, 3,	4
Inno-LM	1, 2, 3,	1, 2, 3, 7, 9, 10,	1, 2, 3,	4
Dig-act	4	1, 2, 3, 4, 7, 9, 10,	4	3
SM	5, 6,	1, 2, 3, 4, 5, 6, 7, 9, 10,	5, 6,	2
Colla-act	5, 6,	1, 2, 3, 4, 5, 6, 7, 9, 10,	5, 6,	2
Dig-infra	7, 9,	7, 9, 10,	7, 9,	5
St-effic	8	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	8	1
Budget	7, 9,	7, 9, 10,	7, 9,	5
Institu-st	10	10	10	6

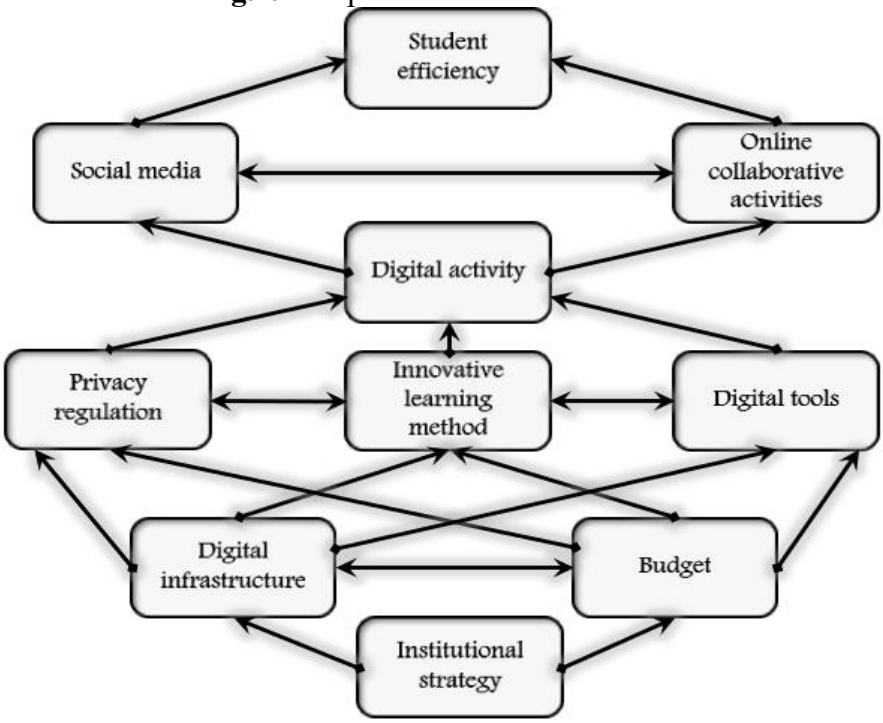
Source: Own circulations using SmartISM

4.5. ISM based model construction

Figure 2 shows the structural model of variables resulting from the final accessibility matrix. In this model, we have six levels of variables derived from the level division iteration process.

Figure 2 shows that the "institutional strategy" is the most important factor for e-learning implementation. The model shows that allocating a budget for e-learning and working to develop the digital infrastructure as a result of institutional strategies mainly. Therefore, the allocation of a sufficient budget to support e-learning and the development of digital infrastructure results in the development of innovative learning methods, as well as the development of digital tools available for education, in addition to securing and enhancing privacy for users. All these factors inevitably lead to the promotion of digital activity, which in turn contributes to the promotion of online collaborative activities and contributes to the spread of the use of social media sites for the purpose of education. As an inevitable result, these factors contribute to the success of e-learning, and this is evident in improving the efficiency of students.

Fig.2. Interpretative Structural model



Source: Own circulations using SmartISM

4.6. MICMAC Analysis

Structural analysis is a tool for structuring ideas, it aims for the most exhaustive description of the system associated with the problem posed. It also simultaneously deals with a large number of variables, sometimes up to a hundred, heterogeneous variables, both quantitative and qualitative, both internal and external (Hatem, 1993). Furthermore, according to Michel Godet

structural analysis is a tool providing a framework for group sessions. Where, it allows one to describe a system with the help of a matrix, that enables comparison of the variables and reveals the influential and dependent variables which are essential to the development of the system (GODET, 2007).

The Micmac method which refers to Matrix of Cross Impacts, Multiplication Applied to a Ranking was initially proposed by Michel Godet and Jean-Claude Duperrin in 1974 (Hatem, 1993). The purpose of Micmac is to identify the most influential and most dependent variables (key variables), by creating a typology of variables in direct and indirect classification (GODET, 2007).

MICMAC analysis is performed on the basis of driving and power dependent variables. The driving force of a variable is the sum of every 1s in the corresponding row in the final reachability matrix, and the dependence force of a variable is the sum of every 1s in the corresponding column in the final reachability matrix. The driving force of a variable means that the variable affects other variables. On the other hand, the strength of dependency of a variable means that the variable depends on other variables. MICMAC analysis classifies the variables into four groups, which are illustrated in Figure 3.

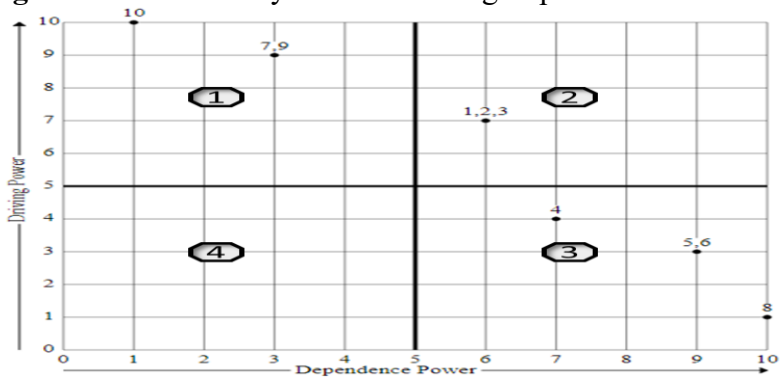
Sector 1: The variables of this sector are characterized by high influence and low dependency. These variables are substantial in the system, as they are the explanatory variables that determine the rest of the system. These variables are Institutional strategy, Digital infrastructure and Budget.

Sector 2: This sector's variables have high influence and high dependency. For that, any change related to these variables will have an effect on the rest of the system and its outputs. Moreover, these variables represent the challenges of the system. These variables are Privacy regulations, Digital tools and Innovative learning methods.

Sector 3: This sector represents the result variables which are characterized by low influence and high dependency. The evolution of these variables is explained by the variables of sectors 1 and 2. These variables are Digital activity, Social media, Online collaborative activities and Student efficiency.

Sector 4: These variables are excluded, as they are characterized by low influence and low dependency, which means that they are not determinants of the future of the system. No such variables are there in this study.

Fig.3. MICMAC Analysis of E-learning implementation factors



Source: Own circulations using SmartISM

The developed ISM model in our study consists of six levels of hierarchy. Where we find the "Institutional strategy" on the first level, and both the "Budget" and "Digital infrastructure" factors on the second level. In addition, the third level consists of three factors: "Digital tools", "Innovative learning methods" and "Privacy regulation". For the fourth level, we find "Digital activity", while the fifth level consists of the "Online collaborative activities" and "Social media" factors. The sixth level is the most important and we find in it "Student efficiency", which is considered the most important factor for the success of e-learning.

From the developed ISM model shown in Figure 2, we can derive an important result set. First, regarding the factors that determine the implementation of e-learning system, we found that **institutional strategy** is a principal factor in the application of e-learning, as the development of a strong institutional strategy with pre-set goals contributes to the organization and acceleration of the digitalization of education, where the results of our study matched those of Hanish & El-bey, (2020); O'Doherty et al.,(2018); Rabouh, (2021). Also, it is clear from the result of our study that the allocation of an adequate budget would support e-learning with the provision of technological tools and training courses in order to improve experience, which is consistent with the results of the study conducted by Orji et al., (2022). In addition, the results indicate that **the digital infrastructure** is a critical factor affecting the implementation of the digital learning process, as the infrastructure of communication networks and the infrastructure of computer power are two main factors in the success of digital education due to their impact on the various teaching methods such as synchronous teaching and **online collaborative activities**, which is similar to the results of the study of Amrar, (2021), Boukhdouni & Boukhdouni, (2021) and O'Doherty et al., (2018). Moreover, **innovative learning** methods are essential for the development of e-learning as they contribute to improving students' comprehension and efficiency, which is consistent with the results of the studies of Bygstad et al., (2022); Lowenthal et al., (2020); Suter & Rampelt, (2017); Tautz et al., (2021). Furthermore, the study results revealed that **digital tools** are essential in the digital learning application, where the use of these tools allows the access to educational digital resources and enhance digital activity which facilitates the implementation of e-learning. The results also revealed that **privacy regulatory** is important factor that contributes in the success implementation of digital learning, as the guarantee of privacy is very important for participants in the e-learning process in order to protect their personal information, which confirms the results of the study conducted by Amrar, (2021). The study results revealed that **digital activity** is essential factor in e-learning implementation success, which confirms the results of the study conducted by (Tang et al., 2021). Our findings suggest that **online collaborative activities** are a result of the digital learning application, these collaborative activities would improve students' competencies, this finding corresponds to that obtained by (Biasutti, 2017). On the contrary to what

(Lacka et al., 2021) concluded, where their study revealed that **social media** remain only as a means of communication, we found that social media is a key factor that influence digital learning, as social media has a significant impact on public opinion regarding learning methods and even curricula. Finally, we found that e-learning improves **students' efficiency**, as it provides various resources and facilitate the learning process, this result is in line with that achieved by Morozova et al., (2020).

5. CONCLUSION

The transition from traditional education to e-learning is the purpose of educational institutions, for the reason that e-learning represents a qualitative leap in the education process, as it provides solutions and resources to facilitate the education process and improve students' cognitive skills. This paper presented the determinants and key factors that contribute to e-learning implementation. First, we reviewed the literature in regard with e-learning characteristics and the solutions that it provides to the learning process. Then, we identify 10 variables from our literature review in order to perform a Structural Analysis Methods (ISM-MICMAC) to determine the most important factors in the success of e-learning implementation process. Results shows that digital infrastructure, budget allocation, institutional strategy, the protection of privacy, innovative learning method and digital tools are the most influential factors on the implementation of e-learning. Furthermore, digital activity and social media and online collaborative activities contributes directly in the success of the digital leaning process which enhancing students' efficiency.

This study has practical implications that may help practitioners effectively implement E-learning. First, this study pointed out the importance of institutional strategy, technology infrastructure and the budget allocated to digital education, which means that the government must attach great importance to digitization and modernization of technology infrastructure in its future strategy, especially in the higher education sector, and a significant budget must be allocated to the development of E-learning. Moreover, the results of the study indicate that the success of the E-learning process is linked to encouraging professors and students to engage in various digital activities, along with devising creative methods for teaching such as online collaborative activities, as well as the use of social media for the purpose of learning, which requires digital tools in educational institutions, or providing them in the market at an affordable cost. In addition, the study concluded that there may be concerns regarding user privacy issues given the intense digital activity accompanying the e-learning process. Therefore, it is important to pay attention to the security and legal aspects of using the Internet and networks, so that the appropriate and secure environment is available for the success of e-learning. In conclusion, the success of e-learning requires the synergy of everyone's efforts, whether they are administrators, professors, or students, by being flexible to get used to e-learning methods, and accepting

the use of technology in the education process. In addition, it is clear that time is a critical factor for mastering the e-learning process.

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