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Improving the quality of strategic decision-making process in universities through employing expert systems: A case study from a developing country

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ABSTRACT

Strategic decisions represent the fundamental core of the strategic planning process and strategic management in universities and they are essential in shaping the universities' policies and achieving their strategic goals. Without those strategic decisions, the universities stand unable to achieve their strategic goals and mission; therefore, specialists realized the critical importance of improving the quality of strategic decision-making in the current complex fast-changing environment that its dynamism continuously increases and which is based on the use of cutting-edge information and communications technology (ICT). Undoubtedly strategic decision-making process requires processing a huge amount of information with different robust smart methods and the extensive use of experts knowledge. There are many discussions about the uses and applications of expert systems (ESs), which are evolving rapidly in solving real problems in many fields that require experienced experts with deep sound experiences, and despite these many applications in many different fields and domains. Literature reveals that there is a scarcity of scientific research on how to employ expert systems to raise the quality of strategic decision-making processes in universities. Thus the purpose of the research is to fill this research gap by investigating how expert systems will enhance the quality of the strategic decision-making process in universities. The research design is a case study applied in Ain Shams University as a model of public universities in a developing country. This research makes a new research contribution by suggesting a futuristic proposal for improving the quality of the strategic decision-making process in universities through employing expert systems that are based on the theoretical framework of the research and the results of the field study.

1. Introduction

Over the last decade, interest in strategic decision-making has increased dramatically (Papadakis et al., 2010; Ejimabo, 2015) because decision-making, in general, is one of the most influential factors in the lives of individuals, institutions, and even the future of nations. A decision represents a mental intellectual process that aims to wisely select the most suitable alternative from a group of alternatives to solve a certain problem or issue (Panpatte and Takale, 2019; Shim et al., 2002). As outlined in Nooraie (2014); strategic decisions in any institution represent the fundamental core of the management processes and they largely contribute to shaping its policy and achieving its goals. Therefore, institutions all over the world realized the critical importance of improving the quality of strategic decision-making, and universities are no exception as examples of information-intensive organizations, especially the environment in which universities are practicing their activities is undergoing tremendous changes in all aspects: Political, cultural, technological, economic and social, and these changes have great implications for strategic decision-making in higher education institutions (Hinton, 2012; Glass, 2014; Divjak, 2016; Ejimabo, 2015).

The strategic decision-making process in universities faces many serious problems, such as: dealing with huge volumes of educational and administrative data, delay in providing the system with the required data and information, lack of

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information accuracy, and the delay in taking a decision in a timely manner (Abdullah et al., 2006; Şuşnea, 2013; Singh and Gupta, 2016). Well-informed decisions are of great importance to institutions to improve their added value and economic results since it supports effective planning and enable institutions to make timely reactions to changing environment (De Leon et al., 2012). Kopeikina (2005) stressed the importance of the content and components of the decision-making process as factors determining its quality, and also emphasized the importance of the quality of information manipulated by a decision-maker with high capabilities and skills. In addition, Raghunathan (1999) stressed the need to increase the quality of decisions through using the new methods and means of supporting the decision-making process. With the availability of big data, business intelligence (BI), and expert systems for supporting strategic decision-making, the promise of increasing the quality of the strategic decision-making process in universities could be fulfilled. Applying expert systems in making strategic decisions has several potentials in improving its quality through merging related information with experts' knowledge to reach the best alternative solution to the problem and allow access to experts' knowledge to many users at the same time (Dašić et al., 2011). Many researchers (Ejimabo, 2015; Kabakchieva, 2015; Fahim, 2018; Wang, 2018; Tan et al., 2016; Monish and Kodipalli, 2017) have challenged the idea that expert systems (ESs) have the potentials for improving the effectiveness of decisions in many sectors and institutions of any type.

During recent years, Expert systems have been used extensively in many fields, such as Strategic analysis of complex business environments, strategic planning, and assessment, sensitivity analysis, risk assessment, business policy and financial analysis, security systems, etc. In Education expert systems are used in analyzing student performance, academic programs evaluation, predicting student performance, identifying characteristics of students, …etc. (Van Hecke, 2011; Kaur et al., 2014; Kuehn et al., 2017; Muntean, 2017). In addition, expert systems are used in decision support systems (Ramezani and Montazer, 2006), medical diagnosis (Innocent and John, 2004), military, education and training, engineering, manufacturing, etc. (Tan et al., 2016).

Expert systems play a very important role in the strategic decision-making process since they rely on artificial intelligence tools to identify problems through their knowledge bases, then provide many alternative solutions, and recommend the appropriate smart solution for the decision-makers and the reasons behind choosing it as well as answering any questions raised by the decision-maker (Dašić et al., 2011). In addition, expert systems overcome some of the challenges that face the strategic decision-making process based on human experts, such as it may be subject to many psychological variables that can affect strategic decision-making. As a consequence, expert systems become more reliable and objective in strategic decision-making away from special subjective considerations. Expert systems can also be used at any time and provide expert advice based on the results of analysis of a huge volume of information and data that represents a sustainable knowledge accumulation that the institution may lose when experts leave work or retire. Furthermore, expert systems can handle unconfirmed or incomplete information to reach conclusions (Shim et al., 2002; ArabChadegani and ArabChadegani, 2013; Akram et al., 2014; Singh and Gupta, 2016; Tan et al., 2016; Osipova et al., 2017).

The quality and accuracy of information have a significant impact on the quality of decision-making (Liberman-Yaconi et al., 2010). Dašić et al., (2011) pointed out that the aim of using expert systems in making strategic decisions is not to completely take the place of human decisions makers but to be used as an expert advisor for strategic decisions making processes to increase its efficiency and quality. One of the most important functions performed by expert systems is to build institutional memory, which includes documented knowledge and experiential learning practices (Tan et al., 2016). Thus, the institution preserves the knowledge and experience of its human capital. Expert systems are used by many decision-makers at different levels of management in the institution and in various functions, activities, and tasks such as strategic planning, financial resources management, … etc. Expert systems have the ability to process huge data and information by utilizing objective and systematic methods to facilitate decision-making and improve the quality of performance (Turban and Aronson, 2001; Tan et al., 2016).

The Decision-making process depends primarily on the existence of implicit and explicit knowledge, and the success of the strategic decision-making process depends greatly on the validity and accuracy of the information and the way in which it is analyzed and organized. One of the biggest problems facing strategic decisions makers in universities is to get timely, accurate, relevant, and reliable strategic information. The strategic decision-making process in universities is a significant area that requires more attention and study (Piri et al., 2020).

Past research has explored using expert systems in many areas of research, but to the best of my knowledge, no past research has examined how universities benefit from using expert systems in improving the quality of the strategic decision-making process. Thus, more exploration is needed to fill this gap in the existing literature. Accordingly, this study aimed at exploring how universities can benefit from using expert systems (ESs) to increase the quality of strategic decision-making process. The goal of this study can be achieved through answering the following main question:

RQ: How can universities benefit from using expert systems in improving the quality of strategic decision-making processes?

To answer RQ, the paper intends to answer the following sub-questions:

RQ1 What is the theoretical framework of the strategic decision-making process in universities?
RQ2 What are the possibilities of expert systems in improving the quality of the strategic decision-making process in universities?
RQ3 What is the status of the strategic decision-making process at Ain Shams University as a model of universities in a developing country?
RQ4 How can expert systems improve the quality of the strategic decision-making process in universities?

2. Literature review

2.1. Theoretical foundations of strategic decision-making

The concept of decision-making has its roots back in a timewhen man began to seek ways to guide his way, at that time he used the stars in the sky. Since then, man has tried to invent tools that enable him to make good decisions. In the 19th century, the development of mathematics supported the development of decision-making. The second half of the twentieth century witnessed the strong start of using computer technology to support decision-making, which coincided with the developments in research in the fields of human behavior and cognitive processes, in addition, the interest in the study of decision-making by many sciences such as sociology, psychology, political sciences, mathematics, and economics began to grow rapidly. In business, the term decision-making was first used by Chester Barnard in his book "The functions of the Executive" (Barnard, 1938). Since then, interest in decision-making by the most important scientists and researchers in the field of strategic management has increased (Buchanan and O'Connell, 2006). According to Conitzer (2010); three new factors have affected the evolution of strategic decision-making: (1) communication platforms, (2) increase in requirements of stakeholders, and (3) the continuous growth of advanced technology. Online communication platforms have increased the speed and effectiveness of communication whichpositively influenced decision-making in institutions because they primarily rely on direct and immediate customers feedback on assessing the quality of a product or service and comparing it with competing products and services. The internal and external stakeholders of an organization are considered as the driving force behind decision-making, determining the way decisions are made within the institution and the consequences of implementing decisions taken. Massive advances in technology are the last factor that has influenced the development of decision-making, perhaps the most important of these technologies are artificial intelligence and expert systems (Conitzer, 2010).

2.2. Strategic decision: Concept definitions and basic distinctive features

The definition of strategic decision has received great attention in management literature. Kennedy (1982) defined a decision as a choice among two or more options made after a thorough and in-depth study of the situation or problem to get evidence that enlightens the choice (p. 59). Hofer and Schendel (1978) and Mintzberg and Quinn (1996) further defined strategic decisions as those decisions that deeply affect the future of the institution through the responsiveness and compatibility of these decisions with the requirements of the internal and external environments. Papadakis and Barwise (1997) also shared this view, maintaining that strategic decisions are those that particularly important, since they have five characteristics that distinguish the strategic decisions from other decisions: (1) these decisions are usually risky and difficult to implement, (2) have long-term effects,(3) they usually represent the bridge between the deliberate and emerging strategy,(4) they can be a major source of organizational learning, and(5) they play an important role in developing the capabilities of managers (Papadakis and Barwise, 1997; Papadakis et al., 1998).

Shafie et al. (2017) pointed out that strategic decision covers a long period of time and is made by the strategic level leaders of the institution and it is usually related to complex and ambiguous issues as well as its impact is far-reaching and encompasses the whole institution (Hofer and Schendel, 1978). A strategic decision is a likely alternative from a range of possible alternatives studied in-depth in terms of their effectiveness and efficiency in achieving the objectives of the institution (Panpatte and Takale, 2019) and it is selected by those who are responsible for managing the strategy (Das and Teng, 1999), and they depend on many dynamic inputs and variables thus, this type of decisions is more complex than other types of decisions (Harrison, 1996; Nooraie, 2012).

On the basis of several aspects of the above-mentioned definitions of strategic decisions, the researcher can define the strategic decisions as very important, long-range and the most difficult type of decisions for the scarcity of information, uncertainty, increased risk, and dealing with the unknown. Strategic decisions direct the operational and tactical decisions, and they are the decisions chosen from a range of strategic alternatives influenced by the external and internal environments of the university. These decisions can change the objectives of the institution in the long term and its desired overall direction in the future, in other words, it is the decisions that determine what the university will be like in the future and its competitive position.

2.3. What are the similarities and differences between strategic decision-making and strategic decision-making?

The examination of the relevant research reveals that there is no significant difference between the researchers in their varied definitions of the decision-making process, although in some cases a difference in the form and the way of expression, but all definitions pertain to the same basic ideas. Dumler and Skinner (2007) described decision making as the process of making a choice from a range of competing alternatives, the application of the preferred alternative, and all decisions are characterized by a specific time frame and based on a cognitive process to achieve the highest added value to the institution in terms of its resource constraints (p.39). According to Harrison (1996) and Nooraire (2012) strategic decision-making is one of the senior management processes in all types of organizations and is based on the pillars of the different theories, approaches, and models of decision-making. Eisenfuhr (2011) defined the decision-making process on the basis of its three core components: (1) specific results that require the selection of a decision from a range of alternatives, (2) the decision-making process, which involves more than just taking the final decision, and (3) the results desired. Gomez-Mejia et al. (2005) argued that decision-making is a participatory process conducted by managers and employees of the institution to provide solutions to problems and identify the opportunities available for the institution. Based on the above ideas and considerations, the researcher adopts the view that decision -making process is an essential activity in universities that impacts its future and shapes its strategic direction. It is a systematic, psychological, mental, intellectual, and multidimensional process that reflects the mentality of top managers in universities. This process involves a set of practical successive steps that begins with the definition of the problem and ends with the implementation of the desired objectives to achieve a goal or set of goals within a given time period in the light of the given variables of the internal and external environment of the institution.

According to Srinivasan (2014), decision-taking means the decisive position in which a decision is taken, not the process that resulted in that decision (p.104). It should be clear that decision-taking focuses on the last aspect concerning the choice between alternatives. It ignores the long and complex process of exploration and analysis and other steps that precede the last one. On the practical level, the decision making process can be distinguished from the decision-making process. On the one hand, the decision-making process is a complex process that takes place across multiple stages, and has many different overlapping elements, on the other hand, decision-taking is the choice between available alternatives that are characterized by uncertain results, and it represents the final stage of decision-making and the epitome of information and ideas reached by the decision-makers. Hence, decision-making and decision-taking together are one decision-making process, but it is customary to refer to the decision-making process as the decision-making process.

2.4. Types of strategic decisions

Simon (1960) divided strategic decisions into two main types: (1) programmed decisions, (2) non-programmed strategic decisions. Programmed decisions are taken in terms of the institutions' policy and procedures, and do not require much consideration and discussion; because the decisions are not new and the challenges facing the institution are also not new. Unlike programmed strategic decisions, non-programmed decisions are unorganized and involve new situations, so in most cases, these decisions require more time to investigate the factors influencing them. From another perspective, Johnson et al. (2008) divided strategic decisions into three types: (1) strategic decisions, (2) administrative decisions, and (3) operational decisions. Strategic decisions are long-term and involve the organizations' future strategic plan, vision, and mission. Administrative decisions are often repeated and designed to simplify operational and strategic decisions, and operational decisions support the implementation of strategic decisions. Porter (1985) also identified two types of strategic decisions: (1) developmental decisions; (2) Non-developmental decisions. While non-development decisions do not aim at changing the goals of the institution, developmental decisions aim at changing the organization's core business.

2.5. Basic distinctive features of strategic decisions

The most important basic distinctive features that distinguish strategic decisions from other kinds of decisions are:

Centralization at the higher levels of authority

The senior management levels (senior management, board of directors) make strategic decisions because they are responsible for setting the future vision, policies, and strategic directions of the institution, and they are fully aware of the resources, capabilities, and surrounding environmental conditions (Nooraie, 2008; 2012; Divjak, 2016).

Comprehensiveness

Strategic decisions are characterized by a comprehensive impact of all units and activities of the institution (Shirley, 1982; Papadakis et al., 1998).

Long-term

The impact of strategic decisions extends over long periods of time, and some may extend over the

life of the institution (Shirley, 1982; Nooraie, 2012; Divjak, 2016), such as choosing a new site to establish a new of the university, or open a new study program.

Few and non-recurring

Strategic decisions are unprecedented, exceptional, and not repeated (Srinivasan, 2014), for example, an amendment of general policies of the university, or the introduction of new modern programs, methods, and models of work, and establishing a new branch in foreign countries.

Directive and binding

Strategic decisions are mandatory and instructive for all other administrative levels; since those decisions establish rules and foundations governing the decision-making processes and practices in all organizational units of the institution, administrative and operational decisions are derived from them (Shirley, 1982; Shivakumar, 2014; Srinivasan, 2014).

Allocation of resources

Strategic decisions are linked to the allocation of the necessary resources to implement them, thus necessitating the distribution of current and future enterprise resources among all organizational units of the institutions (Pearce et al., 2000).

Uncertainty

Strategic decisions are made in the light of uncertain information, mostly quantitative, not qualitative, and because they relate to the future with all its entanglements and complexities (Elbanna, 2006; Dayan and Elbanna, 2011; Divjak, 2016).

It cannot be delegated

Strategic decisions cannot be delegated to lower administrative levels and do not mean that they are not involved in making them, actually, they participate through providing the necessary information to the decision-makers (Shirley, 1982).

Concerned with the relationship between the institution and its external environment

Strategic decisions are closely linked to the external environment, where the institution depends on the external environment in obtaining its resources and providing its services and products (Shirley, 1982; Dayan and Elbanna, 2011).

2.6. Strategic decision-making process in universities

It is of great importance to understand how expert systems can improve the quality of strategic decisions -making in universities identifying all the stages of the process of strategic decisions -making to develop a framework that outlines how expert systems can be integrated with these stages to improve their quality.

The decision-making process goes through a series of successive and logical stages aiming at reaching the right decisions addressing the existing problems efficiently (Power, 2002; Baker et al., 2001; Schoenfeld, 2010).

Identify the problem

Clearly identifying the problem is one of the most important pillars of developing sound decision-making therefore, a distinction must be made between the phenomenon (s) and the real problem. The phenomenon may be an unusual symptom or deviation from the familiar situation. The problem is the real root cause (s) behind the phenomenon. It is important to distinguish between the phenomenon and the problem.If the phenomenon is considered to be a problem, this will lead to a solution that does not eliminate the real cause (the problem), and the phenomenon will disappear temporarily and then the problem (cause) will re-emergence and still unresolved (Power, 2002; Mettas, 2011; Baker et al., 2001). In order to accurately identify the problem, relevant information must be collected to identify the underlying causes of the problem.

Obtain adequate relevant data and information

Relevant information and data should be gathered to accurately identify the problem from the perspectives of all the stakeholders (employees of the institution especially those with influence, beneficiaries of the institution s services, units and divisions of the institution, other institutions related to the problem or its solution.) (Baker et al., 2001). The information-gathering process should cover all facts and data relevant to the diagnosis of the problem, its definition, limits, and framework, as well as the overall views and assumptions about it.

Identify alternative solutions

After carefully identifying and diagnosing the problem, alternative creative solutions or decisions should be considered, this phase focuses on a series of assumptions and predictions that must be evaluated in order to identify the expected results through the use of various methods (Power, 2002; Baker et al., 2001).

The researcher believes that after identifying alternative solutions, each alternative solution should be analyzed from several perspectives, such as:

- Does the alternative solution require more information and data to be more applicable?
- Can the alternative solution be merged with another alternative or deleted?
- Will the alternative solution be opposed by those concerned with the problem?
- Does the alternative solution look promising?
- Is there a new alternative solution to be proposed other than those that have been already developed?

Evaluation of alternative solutions

Alternative solutions should be evaluated according to a set of criteria, which are:

- Cost associated with the alternative.
- Time required for its implementation.
- Easy to apply.
- Suitability, feasibility, and flexibility (SFF

The suitability, feasibility, and flexibility (SFF) matrix is used as a criterion for evaluating proposed alternatives to solve a certain problem. Suitability refers to the appropriateness of the alternative itself to solve the problem away from any other considerations, and answers the question: Is the alternative appropriate to solve the problem? Or: Is this alternative practical? (Cost/time, etc.) Feasibility refers to the resources needed to implement the alternative, and to what extent this alternative will solve the problem, or is the alternative feasible? Flexibility refers to the ability of the institution to deal with the implications associated with the implementation of alternatives (Grant, 2011).

Choose the appropriate alternative

After evaluating the alternatives and determining the best one, the question remains. What is the appropriate alternative to solve the problem?

It is the alternative that solves the problem now and in the future realistic, consistent with the conditions and capabilities of the institution as well as can be implemented in a reasonable time and at an appropriate cost (Ahmed, 2011).

Putting the chosen alternative into practice

There are some alternatives that can be applied easily while others are difficult to implement, so it is necessary to take into account the necessary resources and requirements of implementing the strategic decision (Ahmed, 2011).

Follow up implementation and evaluate results

Progress in implementing the strategic decision during and after implementation should be measured in terms of resourcesallocated, implications of the decision and adherence to the timetable for implementation, using the necessary methods and approaches when conducting measurement, the results should be compared with the timetable or plan for implementation to identify corrective and preventive measures (Power, 2002).

Quality of strategic decision making

Some researchers refer to two approaches to define the quality of the decision: (1) the quality of the decision-making process, and (2) the quality of the decision itself by judging its consequences. The quality decision-making process usually results in quality decisions that lead to positive results and vice versa (Keren and De Bruin, 2003). Other researchers referred to three dimensions that can be used to judge the quality of the decision: (1) decision-making process quality, (2) content of the decision making, and (3) the internal adjustment of the decision with the institutional vision (Kopeikina, 2005). The view of alignment with the institutional vision is supported by Michie et al. (2006), who further explained in their study that the quality of the decisions occurred when they align with institutional strategic goals and objectives. In general, the quality of the decision-making process involves the systematic collection of relevant information about the decisions from reliable sources, and then the appropriate recruitment and systematic use of this information for decision-making (Allwood and Salo, 2014). Clark et al. (2007) defined decision quality as a function of efficiency and effectiveness in the decision-making process.

The quality of the decision has dimensions such as Correct predictions of the reactions of others, social acceptance of the decision taken (Allwood and Salo, 2014). Roberto (2013) suggested a proposal to measure the effectiveness and quality of strategic decisions through measuring the quality of the decision-making process. The researcher believes that there is a difference between the quality of the strategic decision-making process and the strategic decision quality. The quality of the strategic decision-making process involves the mechanisms and procedures through which the strategic decision is made, whether it was taken individually, collectively, or consultatively, based on high-quality information. As for the quality of the strategic decision taken, it means evaluating its consequences and its impact on solving the problem of concern.

Expert systems and improving the quality of the decision-making process

According to Jabbar and Khan (2015), expert systems are among the earliest sub-field of artificial intelligence that imitates the performance and work of human experts in some specialized fields and uses the human knowledge that has been stored to solve problems that usually require expert expertise. Decision-making and solving problems are the most important achievements of artificial intelligence (Mahmoodi et al., 2014). Hopgood (2000) and Mansiya et al. (2014) go further by stating that expert systems use artificial intelligence technology to formulate the expertise of experts according to certain rules and represent this expertise on the computer through the application of algorithms that simulate the way experts think to conclude a particular result in terms of available quantitative and qualitative data (Shiue et al., 2008; Tan and Kher, 2012). In the same line, Turban and Aronson (2001) defined an expert system as a computer system that imitates the behavior of experts in a well-defined specialized field, as it embodies knowledge and reasoning that experts have in a specific field. Some studies pointed out that expert systems are a type of knowledge-based systems and an advanced form of artificial intelligence sometimes called intelligence support systems that imitate the thought processes of human experts, and use reasoning to elicit facts that contribute to problem-

solving, error identification, and provide decision-makers with advice to reach an appropriate strategic decision. These systems also update their knowledge and methods of processing the flow of information and expertise. (Qu et al., 2008; Mansiya et al., 2014; Kaimal et al., 2014; Mahmoodi et al., 2014).

Expert systems are distinguished from other information management systems by their unique and distinct ability to explain the logic on which the decisions were made, and review the logic itself (Hetem, 2000), i.e. expert systems can answer why choosing this decision in particular, and its rationale? In addition, expert systems rely on the principle of the huge accumulated specialized knowledge that the expert or group of experts have (Tan and Kher, 2012) and can provide support to decision-makers in dealing with non-routine and unpredictable decisions and suggest alternatives to complex problems as well as it can predict the outcomes of these alternatives when applied (Luger, 2005). Furthermore, expert systems can also be used in the interpretation and justification processes of a decision that has been made to facilitate its implementation (Mansiya et al., 2014; Jabbar and Khan, 2015). To know how expert systems can improve the quality of the strategic decision-making process, it should investigate the current status of the strategic decision-making process in Ain Shams University as a model of universities in a developing country.

3. Materials and methods

The current research used qualitative and quantitative research approaches. A questionnaire was developed and conducted for achieving one of the objectives of the research namely the status of the strategic decision-making process in Ain Shams University. In addition, document analysis was used as an additional method of data collection. The Minutes of Ain Shams University Council from 2013-2018 and Central Statistics department and management information system procedures manual were critically analyzed. The statistics department and management information system is the main system responsible for supporting decision-making at Ain Shams University.

The research used a questionnaire divided into two main parts. The first part is about participants' demographic and professional characteristics (gender, professional experience, and position). The second part consisted of four sections: the first section included 8 sentences about the Awareness of the complex nature of strategic decisions and its requirements, the second section included 8 sentences about the current status of strategic decisions support systems, the third section included 10 sentences about how can expert systems can improve the quality of strategic decision making and the final section included 6 sentences about the resources available at Ain Shams University for supporting expert systems. Face validity was investigated by 11 experts who considered the difficulty, ambiguity, and inappropriateness of the sentences of the questionnaire, and limited changes were inserted in the questionnaire. The Cronbach's alpha is used to measure the questionnaire reliability. The present scale Cronbach's alpha of the questionnaire (α=0.839), indicates good internal reliability.

3.1. Tool of data collection

The researcher collected data to determine the current status of the strategic decision-making process in Ain Shams University by conducting careful analysis of the minutes of Ain Shams University Council from 2016-2019 since strategic decision-making is the responsibility of the University Council. It was concluded that the expert systems are not implemented and traditional methods, personal judgment, and advice are being used to support strategic decisions making. In addition, a questionnaire was conducted to analyze the status of the strategic decision-making process in Ain Shams University (Appendix A).

3.2. Target group and participants

The research community is the general directors of the nineteen general sectors of the administrative system at Ain (Ain Shams University is the third Egyptian university and it has made remarkable progress in the international rankings of universities in recent years (https://www.asu.edu.eg)) Shams University and the university four general secretaries. The research sample is an "intentional sample". The university general secretaries (4) individuals, representing 100% of the research community, and the general managers (19) individuals, representing 100% of the research community; since Ain Shams University has 19 general administrative sectors. Twenty-three questionnaires were distributed as shown in the following Table 1. The five-point Likert scale was chosen because it is considered one of the most used measures because it is easy to use, and each of the sentences listed in the questionnaire will be matched with a level of agreement, in addition to the necessity of giving each of the responses a score to be treated accordingly as shown in Table 1.

Table 1: The five-point Likert scale

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

3. 3. Statistical analyses

All the data was processed and analyzed for this research in SPSS version 23.To answer the sixth research question (What is the status of the strategic decision-making process in Ain Shams University?) Firstly, Kolmogorov-Smirnov Test was used to test if the data follow the normal distribution or not. The results are as shown in Table 2.

Table 2: The normal distribution test for the sections of the questionnaire

Sections	Sig.
1. Awareness of the complex nature of strategic decisions and their requirements.	0.184
2. The current status of strategic decision support systems.	0.170
3. The role of expert systems in improving the quality of strategic decision making.	0.191
4. Resources available at Ain Shams University supporting using expert systems	0.187

Table 2 shows that the value of "Sig" for all the sections of the questionnaire is greater than the level of significance (0.05), this indicates that all the sections of the questionnaire follow the natural distribution, therefore, SPSS parameter tests were used. Mean and standard deviation were computed to answer the sixth research question (What is the status of the strategic decision-making process in Ain Shams University?) Grading scale was calculated according to the Likert scale of (1-5), where (1) represents the lowest agreement, and (5) represents the highest agreement score. The agreement scores are shown in Table 3.

Table 3: Measure of agreement degrees

Agreement Degree	weight	Mean		Relative weight	
		From	To	From	To
Very low			>..		>..
Low			>..		>..
Medium			>..		>..
High			>..		>..
Very high			>..		>..

Relativity importance for each sentence of the questionnaire was calculated as follows:

- If the mean is from 4.21 to 5.00, then the degree of agreement between Sample individuals (Strongly Agree)
- If the mean is from 3.41 to 4.20, then the degree of agreement between Sample individuals (Agree).
- If the mean is from 2.61 to 3.40, then the degree of agreement between Sample individuals (Neutral).
- If the mean is from 1.81 to 2.60, then the degree of agreement between Sample individuals (Disagree).
- If the mean is from 1,00 to 1,81, then the degree of agreement between Sample individuals (Strongly disagree).

T-test for one sample to find out how high or low the responses of the study participants to sentences of the questionnaire, and to identify the standard deviation of responses for each of the sentences and its mean.

4. Results

4.1. Questionnaire section 1: Profile of participants

As regards the participants' demographic characteristics, it has been observed that male participants represented43%while, 57%of participants were female. As for the professional experience of the participants; the highest percentage was for >10 years of professional experience (65%), followed by 7-10 years of professional experience (22%), and the least proportion reported (13%) was for 4-6 years of professional experience. As for position; it was apparent that most participants (83%) are general managers. The general secretariat was (17%). Table 4 shows the distribution of the Demographic.

Table 4: Distribution of Demographic (N=23)

Variable	Sample Characteristics	Frequencies	Percentage (%)
Gender	Male		43%
	Female		57%
Professional Experience	1-3		0%
	4-6		13%
	7-10		22%
	>10		65%
Position	General Secretariat		17%
	General manager		83%
Total			

4.2. Part two: Awareness of the complex nature of strategic decisions and its requirements

Analysis of the participant's responses to the statements of the second part of the questionnaire: Awareness of the complex nature of strategic decisions and its requirements (sophisticated information systems, multiple computational methods, advanced technology, comprehensive and accurate information, analysis of the complex internal environment of the institution, as well as the external environment). Table 5 shows awareness of the complex nature of strategic decisions and its requirements.

It is evident from Table 5 that (Sig) value is less than the significance level (0.05), this indicates that the mean is statistically significant, and has not reached the degree of neutrality (3). The calculated value of (T) is greater than the tabular value of (T), and they were all positive, that is, the mean of the sentences of section 1 and the total score for its sentences was greater than the degree of neutrality (3). The level of agreement on the nature of strategic decisions came with a degree of high agreement with a relative weight of 68.339%.In general, most of the sentences came with a degree of high agreement, as it is clear that the participants are aware of and understand the nature of strategic decisions and their requirements (sophisticated information systems, multiple computational methods, advanced technology, comprehensive and accurate the information, analysis of the complex internal environment of the institution, as well as the external environment). Table 6 shows the current status of strategic decisions support systems.

It is evident from Table 6 that (Sig) value is less than the significance level (0.05), this indicates that the mean is statistically significant, and has not

reached the degree of neutrality (3). The calculated value of (T) is greater than the tabular value of (T), and they were all positive, that is, the mean of the sentences of section 2 and the total score for its sentences was greater than the degree of neutrality (3). The level of agreement on the current status of strategic decisions support systems came with a degree of high agreement with a relative weight of 71.294%. Table 7 shows the role of expert systems in improving the quality of strategic decision making.

Table 5: Awareness of the complex nature of strategic decisions and its requirements

Item	M	SD	(T) value	Sig.	Relative Weight	Rank	Agreement degree
1. Strategic decision covers a long period of time and is made by the senior leaders of the university, usually related to complex and ambiguous issues.	3.259	1.019	3.037	0.003	65.175	6	Medium
2. Strategic decision impact is far-reaching and encompasses the university as a whole, and is not limited to a certain part of it.	3.231	0.909	3.035	0.003	64.615	8	Medium
3. Strategic decisions depend on many dynamic inputs and variables, so this type of decision is more complex than other types of decisions.	3.245	0.936	3.127	0.002	64.895	7	Medium
4. What distinguishes strategic decisions from other decisions is that they change the commitment and scope of the institution.	3.420	1.017	4.934	0.000	68.392	4	High
5. Strategic decision-making process is based on logical rules, frameworks, procedures, comprehensive information, and unlimited cognitive abilities.	3.357	0.891	4.785	0.000	67.133	5	Medium
6. Strategic decisions are based on the analysis of the complex internal environment of the institution, as well as the external environment, which includes all political, economic, social, and other variables.	3.566	0.827	8.190	0.000	71.329	3	High
7. Strategic decisions require sophisticated information systems, multiple computational methods, and advanced technology to improve their quality and effectiveness.	3.678	0.861	9.424	0.000	73.566	1	High
8. The more comprehensive and accurate the information, the better the quality of the strategic decisions.	3.580	0.907	7.652	0.000	71.608	2	High
Awareness of the complex nature of strategic decisions and its requirements	3.417	0.506	9.860	0.000	68.339		High

The value of *T at freedom degrees (142) and significance level (0.05) equals (1.98); The value of *T at freedom degrees (142) and significance level (0.01) equals (2.36)

Table 6: The current status of strategic decisions support systems

Item	M	SD	(T) value	Sig.	Relative Weight	Rank	Agreement degree
9. There are dynamic, systematic systems that can be used to frame the relationships and bargains between and among powerful groups.	3.322	0.893	4.308	0.000	66.434	7	Medium
10. There are advanced smart technological systems to support strategic decision-making at the university.	3.343	0.889	4.610	0.000	66.853	6	Medium
11. The strategic decision-making support systems used are modern and kept up to date.	3.538	0.955	6.742	0.000	70.769	5	High
12. The strategic decision-making support systems in use enable a flexible exchange of information between the users of the system.	3.643	0.974	7.896	0.000	72.867	4	High
13. The programs used are characterized by enabling many users to communicate together simultaneously.	3.692	0.866	9.561	0.000	73.846	3	High
14. The programs used cannot perform frequent operations.	4.056	0.837	15.081	0.000	81.119	1	High
15. The software used does not have the ability to quickly retrieve information.	3.699	0.957	8.738	0.000	73.986	2	High
16. There are strategic decision-making support systems in every sector of the university.	3.224	0.982	2.726	0.000	64.476	8	Medium
The current status of strategic decisions support systems	3.565	0.542	12.454	0.000	71.294		High

The value of *T at freedom degrees (142) and significance level (0.05) equals (1.98); The value of *T at freedom degrees (142) and significance level (0.01) equals (2.36)

It is evident from Table 7 that (Sig) value is less than the significance level (0.05), this indicates that the mean is statistically significant, and has not reached the degree of neutrality (3). The calculated value of (T) is greater than the tabular value of (T), and they were all positive, that is, the mean of the sentences of section 3 and the total score for its sentences was greater than the degree of neutrality (3). The level of agreement on the role of expert systems in improving the quality of strategic decision-making came with a degree of high agreement with a relative weight of 69.720%. Table 8 shows resources available at Ain Shams University for supporting expert systems.

It is evident from Table 8 that (Sig) value is less than the significance level (0.05), this indicates that the mean is statistically significant, and has not reached the degree of neutrality (3). The calculated value of (T) is greater than the tabular value of (T), and they were all positive, that is, the mean of the sentences of section 4 and the total score for its sentences was greater than the degree of neutrality (3). The level of agreement on Resources available at Ain Shams University for supporting expert systems came with a degree of high agreement with a relative weight of 68.438%. Results can be summarized as follows:

1. All the sentences of section 1 of the questionnaire (Awareness of the complex nature of strategic decisions and its requirements) received a relative weight of 68.339%, which is (high).

2. All the sentences of section 2 of the questionnaire (The current status of strategic decisions support systems) received a relative weight of 71.294%, which is (high).
3. All the sentences of section 3 of the questionnaire (The role of expert systems in improving the quality of strategic decision making) received a relative weight of 69.720%, which is (high).
4. All the sentences of section 4 of the questionnaire (Resources available at Ain Shams University for supporting expert systems) received a relative weight of 68.438, which is (high).

Table 7: The role of expert systems in improving the quality of strategic decision making

Item	M	SD	(T) value	Sig.	Relative Weight	Rank	Agreement degree
17. Expert systems can provide accurate and appropriate alternatives and solutions for the problem.	3.427	0.876	5.823	0.000	68.531	7	High
18. Expert systems can minimize the use of personal judgment at the time of decision-making.	3.643	1.003	7.672	0.000	72.867	2	High
19. Expert systems can provide information at the right time.	3.524	0.918	6.832	0.000	70.490	3	High
20. Expert systems can differentiate the accuracy of the proposed solutions.	3.413	0.850	5.803	0.000	68.252	8	High
21. Expert systems have a distinct ability to explain the logic on which the decisions were made, and review the logic itself.	3.350	0.898	4.656	0.000	66.993	9	Medium
22. Expert systems deal with uncertainties associated with unstructured problems.	3.329	0.977	4.023	0.000	66.573	10	Medium
23. Expert systems can determine the real problem more quickly.	3.427	0.953	5.352	0.000	68.531	6	High
24. The integration of expert systems with the current information systems can increase the speed, accuracy, and quality of expert systems outputs.	3.503	0.855	7.044	0.000	70.070	4	High
25. The methods of managing information and data in light of the application of expert systems differ from those applied in the current decision support systems, which results in a difference in the nature of the procedures applied.	3.434	0.997	5.201	0.000	68.671	5	High
26. Expert systems will contribute to improving the quality of strategic decision-making on structured problems, as well as dealing with uncertainties that accompany informal problems.	3.811	0.934	10.385	0.000	76.224	1	High
The role of expert systems in improving the quality of strategic decision making	3.486	0.747	7.782	0.000	69.720		High

The value of *T at freedom degrees (142) and significance level (0.05) equals (1.98); The value of *T at freedom degrees (142) and significance level (0.01) equals (2.36)

Table 8: Resources available at Ain Shams University for supporting expert systems

Item	M	SD	(T) value	Sig.	relative weight	rank	agreement degree
27. There are suitable advanced computers and applications to run expert systems.	3.364	1.091	3.985	0.000	67.273	5	Medium
28. There are experienced knowledge engineers.	3.455	1.012	5.371	0.000	69.091	2	High
29. Availability of financial costs of expert systems.	3.448	1.059	5.052	0.000	68.951	3	Medium
30. There is accumulated experience of experts in many specified fields that leads to accuracy in strategic decision making.	3.524	0.941	6.667	0.000	70.490	1	High
31. There are safe ways to protect expert systems software from sabotage.	3.385	0.978	4.702	0.000	67.692	4	Medium
32. The computer network at the university is modern and commensurate with the requirements of expert systems management.	3.357	0.915	4.662	0.000	67.133	6	Medium
Resources available at Ain Shams University for supporting expert systems.	3.422	0.781	6.456	0.000	68.438		High

The value of *T at freedom degrees (142) and significance level (0.05) equals (1.98); The value of *T at freedom degrees (142) and significance level (0.01) equals (2.36)

5. A futuristic proposal for improving the quality of strategic decision-making process in universities through employing expert systems

The futuristic proposal is based on the following pillars:

- Quality of strategic decision making greatly depends on the quality of the information and data used.
- Expert systems do not make strategic decisions instead of end-users but help to support and strengthen the decision-making capabilities and increase the quality and effectiveness of the decision-making process, to reach sound decisions, leaving taking the final decision to the human user.
- Expert systems greatly depend on knowledge engineering.

5.1. The purpose of the futuristic proposal

The futuristic proposal aims at providing a general framework for designing and implementing an expert system to support the strategic decision-making to increase its quality in public universities according to the following stages:

A. Investigation stage: The decision-making process begins when the decision-maker recognizes that there is a need for particular decision-making. In general, the need for decision-making occurs when there is a problem that needs to be solved, an

opportunity to be grasped, or target performance does not match actual performance. In this case, the most important thing decision makers need is the analysis of the internal and external environment of the institution, and then classify the problem by identifying, and demonstrating its seriousness through the knowledge base, which is one of the most important components of the expert system.

B. Design phase: During the design phase, decision-makers develop alternatives as possible solutions, each of which includes a set of actions to be taken and test the feasibility of their application to solve the problem. The quantitative methods and design tools available in operation research and model building are usually used to predict the possible outcomes of each alternative. It is also assumed during the design phase that all the data needed for further analysis are available and therefore the information system that supports this phase is expected to include planning and forecasting models, so expert systems can provide many mathematical or quantitative models that help in identifying alternatives solutions to the problem and predicting their outcomes.

C. Selection phase: At this stage, the decision-makers face many alternatives to choose from which. The alternative chosen is a decision that entails a combination of actions and actions. Expert systems at this stage develop and evaluate alternatives to solutions and propose an appropriate solution where expert systems have the logic that helps to do this.

D. Implementation phase: At this stage, the solution reached is put into practice, where this stage often requires certain changes required by this solution such as Reallocation of available financial resources, staff training, organizational changes, and since the implementation of the chosen decision requires persuasion of the persons responsible of implementation, communication processes are required between those persons. Decision support systems can be used to make these communications through computer networks, and expert systems can be used in the interpretation processes associated with the decision.

5.2. The requirements of the application of expert systems

In order for expert systems to be applied to improve the quality of strategic decision-making at the university, the following set of requirements must be met:

A. Awareness: Holding specialized workshops in expert systems to show their impact on improving the quality of decision-making.

B. Funding**:** Availability of the necessary financing.

C. Infrastructure:

- Assignment of special servers for expert systems to save information and retrieve it in no time.
- Updating the protection systems of expert systems constantly.
- Continuous improvement of expert systems.
- Sufficient and trustworthy information.
- Accessible knowledge-based systems.

D. Qualified specialists:

- Qualified and trained knowledge engineers.
- Develop an intensive and continuous training program on how to use expert systems to improve the quality of the strategic decision-making process.
- The existence of engaging experts in the target fields.

E. Administrative requirements:

- Develop policies and strategies that support using expert systems in the strategic decision-making process.
- Establishing a department specialized in expert systems**.**
- Partnership between the general managers.
- The cooperation of the expert system users.
- The highest management level support.
- Make the necessary changes at the level of the administrative and organizational structure.
- Managing the change process in the university to manage the negative expectations of the existence of the expert systems.

6. Conclusions, recommendations, and future research

Expert systems are essential foundations in increasing the quality and effectiveness of strategic decision-making through its enormous potential in storing and processing a huge amount of qualitative and quantitative information and data in a disciplined and structured manner by building institutional memory that brings together the expertise, capabilities, and knowledge of the human capital of the university and the best experts in the field of interest.

Overall, the analysis of the results indicates that there is a positive perception of participants regarding the uptake of expert systems in making strategic decisions to enhance its quality in the university. According to the results of the study, the researcher suggested a futuristic proposal for improving the quality of the strategic decision-making process in universities through employing expert systems.

Finally, an in-depth dialogue should be opened among all the stakeholders in the university on the great importance of the uptake of expert systems to enhance the quality of strategic decisions making by adopting supportive policies and strategies and the best practices and reference cases developed in developed countries. Future research is needed as regards the institutional factors which influence the uptake of expert systems in making strategic

decisions in universities, as well as exploring the strategic decisions makers' perceptions of making strategic decisions via expert systems, in order to better understand expert systems potentials and limitations.

Appendix A. Questionnaire on the level of agreement about the status of the strategic decision-making process and its current and future support systems at Ain Shams University

Instruction: Please specify your response by placing a checkmark (√) under the response that corresponds to your response using the following scales:1=Completely disagree to 5=Completely agree.

Part one: Personal Information
Direction: Please tick the circle that best corresponds to your answer for each question below:

Gender: Male□ Female□
1. Professional experience: 1-3□ 4-6□ 7-10□ >10□
2. Position: General Secretariat□ General manager□

Part two: The status of the strategic decision-making process and its current and future support systems at Ain Shams University.

Please tick [√] the most suitable choice for each of the following sentences

Section 1: Awareness of the complex nature of strategic decisions and its requirements Level of Agreement: Strongly Agree 5□ 4□ 3□ 2□ 1□ Strongly Disagree
1. Strategic decision cover a long period of time, and is made by the senior leaders of the university, usually related to complex and ambiguous issues.
2. Strategic decision impact is far-reaching and encompasses the university as a whole, and are not limited to a certain part of it.
3. Strategic decisions depend on many dynamic inputs and variables, so this type of decisions is more complex than other types of decisions.
4. What distinguishes strategic decisions from other decisions is that they change the commitment and scope of the institution.
5. Strategic decisions-making process is based on logical rules, frameworks, procedures, comprehensive information, and unlimited cognitive abilities.
6. Strategic decisions are based on the analysis of the complex internal environment of the institution, as well as the external environment, which includes all political, economic, social and other variables.
7. Strategic decisions require sophisticated information systems, multiple computational methods, and advanced technology to improve its quality and effectiveness.
8. The more comprehensive and accurate the information, the better the quality of the strategic decisions.
Section 2: The current status of strategic decisions support systems Level of Agreement: Strongly Agree 5□ 4□ 3□ 2□ 1□ Strongly Disagree
9. There are dynamic, systematic systems that can be used to frame the relationships and bargains between and among powerful groups.
10. There are advanced smart technological systems to support strategic decision-making at the university.
11. The strategic decision-making support systems used are modern and kept up to date.
12. The strategic decision-making support systems in use enable a flexible exchange of information between the users of the system.
13. The programs used are characterized by enabling many users to communicate together simultaneously.
14. The programs used cannot perform frequent operations.
15. The software used does not have the ability to quickly retrieve information.
16. There are strategic decision-making support systems in every sector of the university.
Section 3: The role of expert systems in improving the quality of strategic decision making Level of Agreement: Strongly Agree 5□ 4□ 3□ 2□ 1□ Strongly Disagree
17. Expert systems can provide accurate and appropriate alternatives and solutions for the problem.
18. Expert systems can minimize the use of personal judgment at the time of decisions-making.
19. Expert systems can provide information in the right time.
20. Expert systems can differentiate the accuracy of the proposed solutions.
21. Expert systems have distinct ability to explain the logic on which the decisions were made, and review the logic itself.
22. Expert systems deal with uncertainties associated with unstructured problems.
23. Expert systems can determine the real problem more quickly.
24. The integration of expert systems with the current information systems can increase the speed, accuracy and quality of expert systems outputs.
25. The methods of managing information and data in light of the application of expert systems differ from those applied in the current decision support systems, which results in a difference in the nature of the procedures applied.
26. Expert systems will contribute to improving the quality of strategic decision-making on structured problems, as well as dealing with uncertainties that accompany informal problems.
Section 4: Resources available at Ain Shams University for supporting expert systems Level of Agreement: Strongly Agree 5□ 4□ 3□ 2□ 1□ Strongly Disagree
27. There are suitable advanced computers and applications to run expert systems.
28. There are experienced knowledge engineers.
29. Availability of financial costs of expert systems.
30. There is accumulated experience of experts in many specified fields that leads to accuracy in strategic decision making.
31. There are safe ways to protect expert systems software of sabotage.
32. The computer network at the university is modern and commensurate with the requirements of expert systems management.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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