EXTENT OF USING QUANTITATIVE METHODS IN DECISION-TAKING AT THE UNIVERSITY OF BLUE NILE, 2014 – 2017

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ABSTRACT

This paper attempts to study the extent of using quantitative methods in taking administrative decisions at the University of Blue Nile, Sudan in the period 2014 - 2017. To achieve such an objective, the study followed an analytical descriptive approach. The data of the study were collected via primary sources (i.e. questionnaires) and secondary sources (i.e. references and magazines), ensuring the reliability and validity of the research tools. The subjects of the study were chosen from the University of Blue Nile, considering the representativeness of the sample to the study population. Based on the study findings, the study recommended to raise awareness of the quantitative methods and their applications in decision taking in addition to provision of required equipment, specialists and means of collecting data and information in the field of quantitative methods.

Keywords: Quantitative methods, decision taking, administrative performance.

INTRODUCTION

From the onset of 20th century onwards, quantitative methods have been significantly developed to the extent that these methods, undoubtedly, are characterized by scientific and systematic approaches. Such scientific and systematic approaches are capable of dealing with various problems to reach possible solutions because of their diversity, which provide major, effective and widely used potentials in the treatment of the most complicated administrative problems. Such characteristics of quantitative methods expand their effective use and applications in identifying and solving problems of all types of military and governmental organizations, business and non-profit organizations. The use of operational research in the past years has significantly developed to the extent that quantitative methods in operational research become tools that address many problems, such as maximization and minimization of profits, problems of transportation and recruitment, etc.

Problem Statement

In spite of Management Science use of quantitative methods in several different applications, it still encounters many difficulties in the use of such methods. To be specific, many administrative problems are characterized by a high degree of complexity that cannot be addressed and solved by building quantitative models. Therefore, we should employ quality models (i.e. descriptive) that are capable of matching the degree of complexity of such problems. The high degree of complicated problems and chaos in the environment necessitate the need for the qualitative approach in management. The degree of minimum complexity in problems and chaos in the environment increases the importance of quantitative approach. Such different degrees of complications of problems entail an

integrated approach of both quantitative and qualitative methods to solve the problems of the decision-making.

Significance of the Study

The significance of the study lies in its relevance to the core administrative process (i.e. decision-taking), particularly knowledge and awareness of the extent of using quantitative methods in institutions and companies that have a major role in providing diverse services for the community. Besides, this importance of the study stems from the size of the resources such institutions deal with. Therefore, identifying the methods of decision-taking in these institutions and working to drive these decisions towards quantitative methods lead to employment of these resources for the interest of community.

Objectives of the Study

The study attempts to achieve the following objectives:

1. To employ quantitative methods in taking administrative decision.
2. To tackle the difficulties that encounter the company in taking production decision.
3. To obtain information that address the present study problem.

Hypothesis

Extent of using quantitative methods in taking administrative decision

Resources of Data

Secondary resources: references, magazines, journals and websites
Primary source: Questionnaire & Case study

Previous Studies

Many conceptual and empirical studies investigated the area of quantitative methods in decision-making. In this section, the authors presented three revenant studies that devoted ample attention to quantitative methods.

Samarani (1999) studied the employees' views of quantitative methods' use in decision-making in Jordanian state sector. The study aimed to identify the situation of using quantitative methods in operational research in Jordanian state sector and the main obstacles that encounter using quantitative methods. He presented suggestions for development of decision making in a way that ensures the efficiency and effectiveness of decisions. He also demonstrated the need for using quantitative methods in the state sector, starting from universities, colleges and decision makers and ending with employees.

The author followed the descriptive method, which is based on a review of the most significant literature and empirical previous scientific studies on the area of his investigation. He collected the data of the study through a questionnaire distributed to 340 employees who work as directors and head of departments, and other leadership categories in the Jordanian state sector. The study revealed that the Jordanian state sector exhibited the following features: low level of knowledge and awareness of quantitative methods in decision-making

positions, control of traditional methods and the lack of knowledge and use of quantitative methods. Besides he found that the employees are willing to learn, but they don't know how to develop knowledge of quantitative methods. He also found lack of specialists in qualitative methods. The author recommended the need to enable the departments of operational research in ministries to improve the quality of the decision, use quantitative methods, appoint specialists in qualitative methods and carry out the development process through qualification and training to increase knowledge.

AL-Azzah (1989) studied the quantitative models in taking administrative decision, which aimed to explore the idea of using mathematical models as one of the means to attain effective decisions to address administrative problems. In his study, he reviewed the definitions of quantitative models, their characteristics and methods of their classifications. Besides, he shed light on mathematical models and methods of their construction and classification and areas of their use in addition to the main causes of error resulting from their use. He also explained in details three administrative problems of mathematical models to solve their problems, which includes a wide range of administrative work (i.e. Problem of specification and distribution, webs' problems, competitive cases). The author demonstrated the emergence of each administrative problem, the used mathematical methods, relationship between the administrative problems and the mathematical methods used to solve such problems in making different decisions. This article gave an idea of the importance of quantitative methods in decision-taking and wide areas of applications in a wide range of administrative fields in order to choose what is appropriate, depending on the nature of the administrative problem.

Darwish (1992) studied the situation of using quantitative methods in problem analysis and decision taking. It is an empirical study of the UAE state sector. The study aimed to demonstrate the use of quantitative methods in problem analysis and decision taking in the UAE state sector. The study attempted to identify the problems and difficulties that limit the use of quantitative methods and recommend solutions to address these problems and highlight the advantages of the use of quantitative methods and the dissemination of their use in this state sector. He used the descriptive approach in his investigation, which was collected through a questionnaire distributed to 300 employees of fifteen ministries. The author used descriptive statistical methods to analyze the results. Among the findings arrived by the author were: quantitative methods are not known by the majority of decision makers in the state sector. Only 12.3 of the participants know the quantitative methods. The use of quantitative methods is restricted to simple methods. He found that the problem of using quantitative methods are ascribed to lack of specialists, lack of directors' encouragement and lack of computer to analyze accurate data, Finally, the author recommended that quantitative methods should be taken into account in the decision-taking process by intensifying the training courses and qualifying the employees on how to use the quantitative methods. He also recommended employing specialists and qualified staff, using computer and quantitative methods' programs in taking decision in the UAE state sector.

Concept of Quantitative Methods

Quantitative methods are defined as a set of methods, formulas, equations and models that help solve problems on a rational and logical basis. It can also be defined as a mechanism through which the quantitative output can be implemented (AL-Fateh, 2009). Quantitative methods are a mathematical method in which economic, administrative and marketing problems are addressed, making a good use of available resources of data, tools and methods

that are used by decision makers to address such problems (Abdullah, 2007). It can be defined as "a set of methods, formulas, equipment and models that help solve problems on a rational basis" (Aboud, 2008).
According to the Operational Research Society of Great Britain (l962), it is the use of scientific methods to solve the severe problems in the management of large systems of manpower, equipment, raw materials, money in industry and state institutions and army (cited in Abu Ziab, 1986). The American Operational Research Society connects operational research with scientific decisions on how to design ascent systems, manpower according to terms required to be specified in limited resources "(Abdul-Ziyab, 1986). Khalifa (2006) defines quantitative methods as application of the scientific method in solving problems.

Development of Quantitative Methods

After the second war, the Industrial Operational Research (OR) Group was founded in the United States of America and the United Kingdom to transfer the new development and successful application of quantitative methods in the military field to the industrial filed. In fact, quantitative methods kept on developing in 1947 by George Dantzig, who developed a linear programming model, (Simplex Method), which is the most widespread method in decision-making problems. In 1950, Terrapur developed the theory of equipment replacement, network analysis (i.e. Critical Path Method 1056) and the method of evaluation and review of the project by Bert in 1958 in the United States of America.

The development and breadth of organizations have complicated the problems of decision-making, which lead organizations to use traditional methods in addressing problems of decision-taking, which are short of finding appropriate solutions. This situation entails the use of efficient, significant and easy- to -use methods that comply with the development of high-speed digital computers and development of computer systems and programs that are capable of facilitating the use of quantitative methods without the needs for experts in these methods. The introduction of quantitative methods and operational research into academic and university curricula since the late 1960s and its widespread use is a significant factor in trending towards the use of quantitative methods. Today, quantitative methods are one of the most efficient and effective means of helping decision-makers to reach the best solutions to the problems of taking decisions. It is also an important source of the major development of management science and its growing applications. (Al-Fateh, 2009).

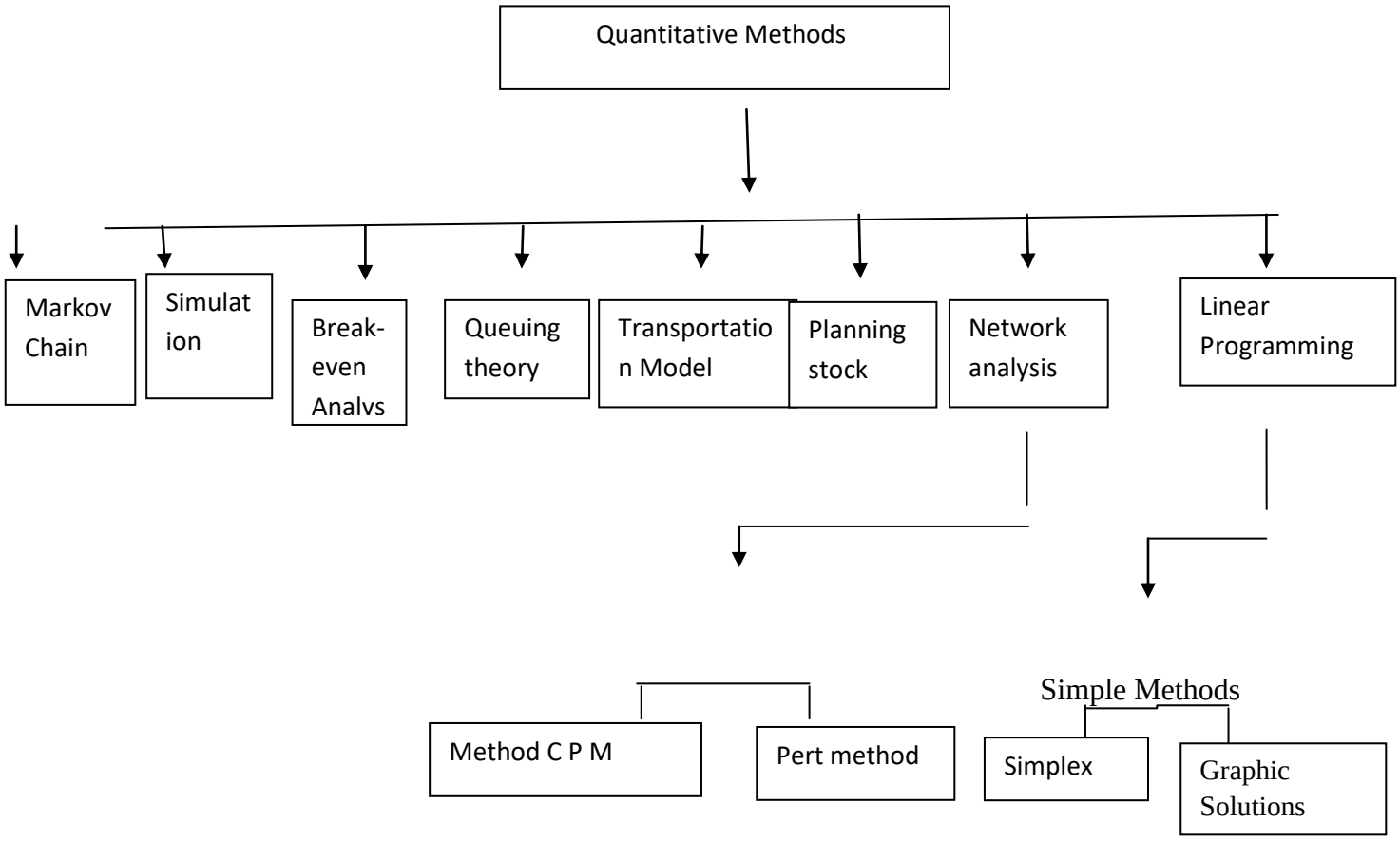
Importance and use of Operational Research

Kalipha (2006) cites seven points in which he demonstrates the importance and uses of Operational Research:

1. Assisting in making quantitative decisions through using modern scientific methods.
2. Operational research is one of the scientific tools that assists in making decisions accurately, avoiding randomization resulting from trial and error.
3. Operational research is both an art and science. It relates to the efficient allocation of available resources as well as their new applicability in reflecting the concept of efficiency and uniqueness in applied mathematical models.
4. It seeks to search for the rules and new foundations of administrative work in order to reach the best levels in terms of comprehensive quality, and standards of International Organizations Standardization (ISO).
5. Assisting in addressing complicated problems that are difficult to address manually through analysis and providing solutions.

6. It helps to save the cost of solving various problems
7. Assisting in focusing on the important characteristics of the problem without delving into details of characteristics that do not affect the decision. In doing so, it identifies the appropriate elements of the decision and employs them in making the best decisions.

Types of Quantitative Methods in Operational Research



Cited in Abdullah, 2007, p. 17)

Selection of appropriate alternative among alternatives
Weight items

This method is based on an attempt to compare between alternative solutions by comparing them quantifiably with regard to the common items among alternatives. In other words, we can say that we are looking for common items among alternative solutions that serve as a basis for comparison between these alternatives, and then the comparison is converted into a simple quantitative form. To be specific, the method of weights consists of the following procedures:

1. Identifying common items that will be used in assessment of alternatives. For example, if we compare between alternative locations for a small factory, hoping to determine the most suitable location. To do the comparison adequately, the common items in assessment of alternative locations considered: the cost of land, proximity to raw materials and market,

labor supply in different locations, the availability of electricity, water and sewage network, and proximity to commercial, financial and technical services.
2. Giving each item a weight, which means giving a value for the item according to the relative importance of each item of the comparison. In order to accurately determine the weights of the items, there is a need for reviewers of opinion and experience. When reviewers judge the case and give values for the items, the mean values area taken.
3. Giving each alternative a score, which can be done by looking at one of the items, and then comparing between the different alternatives to see the availability of the item in the alternative to give this alternative a certain score .
4. Selecting the most suitable alternative and this is conducted by collecting the scores obtained by each alternative, and the alternative that gets the highest score is the appropriate alternative (Maher, 2014).

Break-Even Analysis

Break even analysis is one of the methods in which a decision maker depends on in challenging an appropriate decision. The total expenses (Fixed and varied) and total income are considered in taking a sound decision among alternatives. Choosing the sound alternative that prioritize the goal is what we seek to achieve. The break-even point helps us to achieve the right alternative. This method determine the point where the total expenses are equal to the total income (i.e. the point where there is no profit or loss and such point is preceded by a loss or followed by a profit.

Return Table

Return table is a method for demonstrating the possible returns that result from using several alternatives to solve a problem under different circumstances and conditions. Let us assume that the top managers at a television and video production higher administration have decided to add a new line of production, but they do not know the level of their competitors' products in the market. In addition, they are not sure of the economic conditions. They cannot determine the demand for their new TV product. Based on their experience, they predict three alternatives of the demands. Each alternative has three possibilities of the size of sales (low, medium and high). The managers can produce different quantities of the new product based on actual level of demand and previous information available to them. If the administration decides to choose the low level of production and the level of demand is also low, the returns will reach one million pounds. If the decision of production is at average of demand or under the average, a million pounds will be gained. If the administration has additional information on the probability of achieving each case (demand levels), it can take an additional step by calculating the risk associated with each case, which enables administration to choose the best (the least risk) situation. For example, research and economic forecasting can demonstrated some of the unknown details of the consumers. If the probabilities of each case are calculated and multiplied by the previous financial values, we obtain the expected values for each strategy under each case of demand, and then we can collect the expected values for each strategy (Maher 2014).

Decision Tree

Decision tree is another method of decision making that assists managers to solve their problems, which is similar to the previously mentioned methods of return table. The idea of

'decision tree' is to identify the situations that encounter the decision-maker and the possibility of achieving each situation.

The concept of decision –taking

Decision-taking is the core of the administrative process for any project. Generally, it is defined as a conscious selection that is based on validation and accounting of the selection of the appropriate alternative among the alternatives available in a particular situation. In other words, the decision-taking is not a spontaneous, direct and unconscious response. Instead, it is a conscious selection, depending on the management and accounting of the details of the objective to be achieved and the means to be used. From the administrative and practical point of view, there is a difference between decision making and decision taking. Decision taking is explained above, while decision-making is now the focus of scientific research to make rational decisions that result from making the decision. Decision-making has inputs that lead to outputs, meaning the study of the decision inputs in order to be sound and enforceable in line with prevailing production conditions, which include all the stages that lead to the decision-taking process. In view of the importance of defining the concept of decision-taking, many specialists in administrative sciences, especially the field of organizational behavior and human resources pay due consideration to determination of the scientific concept of a decision that can be (in) consistent with the common concept of the decision mentioned earlier (Abdu- Al-Hussein, 2006).

Stages of Decision-Taking

1. Identification the problem: the problem is accurately diagnosed in order to make it easy to develop appropriate solutions to that problem.
2. Identifying the objectives to achieve in order to guide the decision to the right direction that ensures its achievement.
3. Collecting facts and information: it is necessary to collect as many facts as possible about the decision within the time limit.
4. Searching for alternatives. After the previous research of the alternative decisions, they should be evaluated in order to choose the most appropriate alternative.
5. Selection of the best alternative. It is the stage of decision-taking, which is perhaps this most difficult stage due to its importance that lies in selecting the right alternative.
6. Implementing and following up. We should not forget the implementation and assessment of the decision. In implementation stage, it is common to neglect explaining the decision to the participants in decision taking, which is not right since they will be the supporter of our decisions. (Abu Muammar, 2000).

Types of Decisions

1. Decisions of improving the strategic objectives, policies and the control of the overall performance of the organization. Such decisions are taken by senior administration, which shows a high degree of uncertainty.
2. Tactical decisions: Such decisions are taken by mid- level managers, which entails a degree of efficiency and effective use of the resources and assessment of the performance of organizational units in the organization (Freund, 2003).
3. Operating decisional: These decisions are taken by the lower level management, which includes the decision - making processes associated with the day-to day

operations of the organization. Such decisions need specific information available to the organization since they are decision of high degree of certainty that deal with short periods of time (Anderson, et al., 2000).

Research Questions

Many questions arise, which consequently justify the need to conduct this study. The central questions for which the study aims to provide empirical data are as follows:

1. To what extent the participants are aware of the quantitative methods in decision taking?
2. What is the degree of the participant's application of the quantitative methods in administrative decision taking?
3. What is the participants' viewpoint regarding the order of the role of awareness of quantitative methods in decision taking?
4. What is the participants' viewpoint regarding the most common problems that hinder the application of quantitative methods in decision taking?
5. What are the possible solutions that solve the problems that hinder the use of quantitative methods in taking administrative decisions?
6. Do you like to learn quantitative methods that you do not know or cannot apply? If yes, why?

Research Methodology

The study employed various approaches to attain the objectives of the study:

- Historical approach in presentation of the previous studies and its findings.
- Inductive approach in determining the nature of the problem of the present study.
- Analytical descriptive approach in testing the hypotheses of the present study.

Participants

50 participants were taken randomly from the University of Blue Nile, who work as faculty members and staff. To ensure the clarity, Table (1), (2) and (3) show the characteristics of the sample in terms of gender, age and hob.

Table (1) below shows that the sample of the study covered males and females of different percentages, which demonstrates that the institution employs both males and females. See Table (1) below.

Gender	No	Percentage
Male	35	%70
¦female	15	%30
¦Total	50	100.0

As for the year of experience, Table (1) shows that the majority of the subjects' ages are 35-45. As for 45-55, they constitute the second highest parentage of the sample. It is clear that the subjects' ages range between 35 and older, which means that the subjects are able to understand the questions and answering them with a high degree of accuracy and practicality. See Table (2) below.

Age	No	Percentage
Less than 35	5	%10
35-45	25	%50
45- less than 55	15	%30
55 –older	5	%10

As for the job of the subjects, Table (3) shows that the majority of the subjects are assistant professors and lecturers, which is indicator for the of the subjects' sufficient experience, which ensures the subjects' understanding of the questionnaire and enhance the confidence in their responses. See Table (3) below.

Job	**No.**	**Percentage**
Manager	1	%2
Assistant manager	1	%2
Associate Professor	3	%6
Assistant Professor	15	%30
Lecturer	20	%40
Accountant	5	%10
Staff	5	%10
Total	**50**	**100.0**

Data Analysis & Findings

This section was structured mainly around the research questions. It provides systematic presentation and analysis of the results. The first question concerns the extent of the subjects' awareness of quantitative methods in taking administrative decisions. The descriptive statistics was used to determine whether the mean response rate reached the medium level (mean), which equals 3 or not. See Table (4) below.

Table (4)

No	Item	Mean	Test Score	Sig.	Order
1	Theories of Decisions	4.30	6.00	0.000	3
2	Decision Tree	4.29	5.92	0.000	4
3	quantitative methods	4.43	6.17	0.000	2
4	Game Theory	4.25	5.92	0.000	6
5	Linear Programming	4.44	6.27	0.000	1
6	Transportation Models	4.25	5.92	0.000	6
7	Assignment Models	4.28	6.08	0.000	5
8	Business Network	4.25	5.92	0.000	6
	Total	4.32	6.22	0.000	

Table (4) demonstrates that there are significant statistical differences among the mean of the items of the questionnaire (P ≤05). Besides, the mean items were 4 out of five which means high degree of respondents' agreement of the contents of the items of the questionnaire.

Here, it is worth-mentioning that the items that get the highest degree of agreement, is item (5), namely linear programming', followed by statistical methods and then 'theories of decisions. Generally, it is clear that the (M=4.32), test score(S=6.22) and statistical significance (p=0:00). Therefore, the statistical significant differences among the items of the first questions were found (P ≤05). Besides, the mean scores of the students' responses about average was 3, which means the subjects' agreement of the items of the first question, which revealed the subjects' awareness of the quantitative methods in taking administrative decisions(i.e. linear programming, statistical methods and theories of decisions).

The second question concerns the degree of application of quantitative methods in taking administrative decisions. See Table (5) below.

Table (5)

No	Item	Mean	Test score	) Sig(.	Order
1	Theories of Decisions	4.20	6.00	0.000	7
2	Decision tree	4.23	6.08	0.000	6
3	Statistical methods	4.33	6.17	0.000	2
4	Game Theory	4.24	5.93	0.000	5
5	Linear programming	4.45	6.22	0.000	1
6	Transportation Model	4.26	6.11	0.000	4
7	Assignment Models	4.17	6.00	0.000	8
8	Business Network	4.30	6.00	0.000	3
	All item	4.30	6.17	0.000	

Table (5) above shows statistical significant differences among the items of the second questions (P ≤05). Besides, the mean students' responses were higher than 4 out of 5. The mean ranged 4.17-4.45, which showed the high degree of the respondents' agreement of the items of the second question. Not that the items that received the highest degree of respondents' agreement are linear programming (M= 4.45), statistical methods (M= 4.33) and business networks (M=4.30).

Generally, the mean students' responses (M=4.30) and the test score(S=6.17) and statistical significance (sig. =0.00) show the higher degree of the respondents' agreement for the second question. Besides, the mean of the items of the second question is higher than the average (3). Such figures indicates the subjects' agreement of the items of the second question and consequently the answer of the second question (i.e. Degree of application of quantitative methods in taking administrative decisions) is proved, which revealed the subjects' awareness of the quantitative methods in taking administrative decisions (i.e. linear programming, statistical methods and theories of decisions).

As for the third question, it deals with the order of the role of awareness of quantitative methods from the perspective of the sample. See Table (6) shows percentage of weights of the perspective of the sample regarding: role of awareness of quantitative methods.

Table (6)

Item	1	2	3	4	Frequency	Relative weight	Percentage	Order
University education	28	12	5	5	50	10%	%41.7	First
Self –reading	22	8	12	8	50	9%	%36.2	Second
Training course	21	22	5	2	50	7.9%	%28.5	Third
Direct instruction	17	13	15	5	50	6.5%	%26.3	Fourth

Table (6) shows the relative weights of the subjects' responses. The students' responses revealed that the most methods of awareness of quantitative methods in taking administrative decisions is university education with relative weight (10%), followed by self-reading(9%), training courses(7.9) and finally direct instruction (6.5%).

The fourth question concerns the order of the problems and difficulties that hinder the use of quantitative methods in the University, Table (7) shows the subjects' perspective of problems and difficulties that hinder the use of quantitative methods in the University.

Table (7)

Items	**1**	**2**	**3**	**4**	**5**	**6**	**Frequency**	**Relative weight**	**Percentage**	**Order**
Lack of computer	28	10	0	2	5	5	50	6.5%	%48	First
Lack of specialists in quantitative methods	20	5	10	7	8	0	50	3.6%	%25	Second
No need to use quantitative methods in the department	22	8	10	8	2	0	50	3.2%	%23	Third
University management does not encourage the use of quantitative methods	21	20	5	0	0	2	50	3.2%	%23	Fourth
Collecting and analyzing data are time-consuming	17	10	15	5	0	3	50	3.1%	%22	Fifth
High cost of using quantitative methods	20	10	5	0	10	1	50	%2.9	%20.8	Sixth

The findings of the study revealed that the most problems and difficulties that hinder the use of quantitative methods in in the University according to their order as reflected in the relative weight of the students' responses were:

1. Lack of computers(6.5)
2. Lack of specialists in quantitative methods (3.6)

3. No need to use quantitative methods in the department(3.2)
4. University does not encourage the use of quantitative methods(3.2)
5. Collecting and analyzing data are time-consuming(2.9)
6. High cost of using quantitative methods(2.5)

The fifth question concerns the possible solutions that facilitate the problems and difficulties the hinder the use of quantitative methods in taking administrative decisions. The subjects' answers were as follows:

1. Training of specialist in computer programs.
2. Providing qualified cadres in quantitative methods.
3. Offering computers and quantitative methods' computer programs
4. Reducing the costs of using quantitative methods
5. Encouragement of the University presidency to the use quantitative methods.
6. Offering Courses on quantitative methods
7. Encouraging the use and quantitative methods and its applications.
8. Creating an appropriate working environment for application of quantitative methods.
9. Devoting ample attention to scientific research and assisting those interested in disseminating research awareness of the field of quantitative methods.
10. University Presidency encouragement to application of quantitative methods as they contribute to taking right decisions.

The sixth question deals with the respondents' willing to learn quantitative methods and apply them in the decision-making process**.** The percentage of the students' yes- responses reaches 100%. The respondents' justification for their willing to learn and apply quantitative methods were as follow:

1. Due to their development of decisions though taking the right decisions
2. For awareness and knowledge
3. To keep up with technological development that assists in decision taking
4. To provide a range of excellent decision-taking solutions
5. Assisting in improving performance to achieve comprehensive quality
6. Quantitative methods are essential and necessary for decision making
7. Assisting in improving the efficiency of institution performance

Major Findings

1. The subjects' knowledge and awareness of some quantitative methods (linear programming, statistical methods, decision theory)
2. Degree of application of quantitative methods in administrative decision-making has been achieved, namely linear programming, statistical methods, and business networks.
3. The most familiar methods of knowledge of quantitative methods were "university education, self-reading, training courses and direct instruction.
4. Difficulties in the application of quantitative methods in the university were lack of computer, lack of specialists in quantitative methods, lack of "university administration encouragement for use of quantitative methods, time consuming of data collection and analysis and high costs of using quantitative methods.

RECOMMENDATIONS

1. The need for awareness and knowledge of all quantitative methods

2. All methods of using quantitative methods should be applied in decision-taking
3. Necessity of providing sufficient computers to universities and the like to practice and apply quantitative methods
4. The need for specialists in quantitative methods
5. Encouragement of university administration for using quantitative methods and provision of sources of data and information collection.

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