

Literature review of the Impact of the Use of Quantitative techniques in administrative Decision Making: Study (Public and private sector institutions)

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DOI: 10.29322/IJSRP.9.07.2019.p9166

<http://dx.doi.org/10.29322/IJSRP.9.07.2019.p9166>

Abstract- There are a weak proportion of private and public institutions that use quantitative techniques in decision making and problem solving, so the objective of this literature review is to clarify the impact of using quantitative techniques for decision making and problem solving in public and private sector institutions. The paper analyzed previous related research papers related to using quantitative techniques in decision making and problem solving in different organizations. The results show that the use of quantitative techniques is important in making administrative decisions and solving problems resulting in the development of the institution and making appropriate decisions.

Index Terms- Quantitative Techniques; Decision Making; Organization

I. INTRODUCTION

The various Organizations tend to use different and sophisticated methods to develop their activities and benefit from modern technologies (Anyanwakoro, 2009).

Any institution must take a set of decisions, and as long as there is a decision there are certainly alternatives that the decision-maker to choose between them to choose the best ones, and there are alternatives, there is a need for advance information is available and on a continuous basis, and there must be pre-plans to work and must be available pre-programs as well as potentials Material and human, and a variety of exercises, understanding and full understanding of what is available and this is what we call decision-making. If we have the ability to make decision it will be easy to make a decision about random (Hwang & Yoon, 2012).

The process of decision-making is difficult and complicated, but it is necessary to have a decision. Many different means have been developed to make the decision-making process easy in practical life, in personal decisions and decisions related to governments and institutions. Good and appropriate decisions are always welcomed and praised. Decision-making affects governments, institutions and individuals (Oyelere&Anene, 2007).

Decision-making is one of the most important processes within different organizations where decision-makers choose

between alternatives and work to make the right decisions that achieve the objectives of the institution (Prasad, 2004).

Decisions can be based on quantitative techniques. There are some situations that require the submission of quantitative elements in order to be supportive of judgment and taking appropriate decisions. Many of the decisions that must be taken in the organizations require many specific conditions that threaten to evaluate and choose among the alternatives and are able to make the appropriate decisions, hence the quantitative methods (Orga&Ogbo, 2012). Quantitative methods are used in different institutions, whether government, public sector or private sector, to help make appropriate and timely decisions. Decision makers must have knowledge of quantitative methods in decision making (Idemobi, 2012).

Enterprises and businesses have become more complex, competitors have increased, services and products have diversified, and the volunteers have changed. Businesses need to be effectively managed so that they can achieve the desired objectives. As a result, appropriate and correct decisions are more important than in previous times (Murdock, 2014).

Otherwise, Decision makers have great potential to access data. However, they must have the ability to convert data into information to take advantage of. This is one of the reasons why quantitative methods are of interest (Murdock, 2014).

Quantitative methods help to devise solutions and methods for decision making and crisis management. The most important quantitative tools are: indices, operations research, linear programming, role representation and results (Waters, 2011).

In addition to the above, the concepts of quantitative methods and their role in decision-making can be used to assist institutions and decision-makers and enable them to make the right decisions.

In our analysis, we will focus on three central questions:

- RQ1: To what extent have public and private sector institutions used quantitative techniques for decision making and problem solving, and how has this developed over time?
- RQ2: Which types of quantitative techniques that public and private sector institutions used for decision making and problem solving?

- RQ3: what the impact of using quantitative techniques for decision making and problem solving in public and private sector institutions?

This paper is organized as follows: Section 2 will provide a background on using quantitative techniques for decision making and problem solving in public and private sector institutions. Section 3 is a related work on using quantitative techniques for decision making and problem solving and the findings of these previous researches. Section 4, will outline methodology and analysis. Section 5 will discuss the results; the conclusion is found in Section 6.

1. Background

1.1 Quantitative techniques Concepts

Quantitative methods are defined as statistical techniques that lead to a numerical analysis of the variables that affect the decision-making process and the evaluation of different solutions and alternatives, leading to the adoption of appropriate decisions that achieve the objectives of the organizations” (Taha, 2006).

Quantitative methods are a scientific approach to managerial decision making where raw data is processed and processed to obtain valuable information (Render, stair, Jr and Hanaa, 2008:2).

Quantitative methods include transforming the qualitative description of the decision-making process into a quantitative form, identifying variables and developing alternative options and solutions that lead to appropriate decisions (Lucey, 2007). It includes both statistical and programmatic methods that assist in making managerial decisions. Quantitative methods include the use of symbols, numbers and mathematical expressions in order to be able to express quantitative problems and to be able to provide suitable solutions and alternatives that lead to appropriate decisions that achieve the objectives of the institutions. Quantitative methods focus on the use of observation and scientific methods for decision making. Quantitative methods are necessary to provide solutions and possibilities that support the adoption of appropriate decisions (Anderson *et al.*, 2003). Quantitative techniques enable systematic and scientific study in any decision-making process as they analyze the factors and variables that fully reflect the situation and improve the decision-making process. Quantitative methods specify many different alternatives to enable decision-makers to choose the appropriate decision (Reddy, 2010). The proper application and use of quantitative methods leads to optimal use of resources and reduces the waste of available resources (Song, 2008).

Problem solving, decision making and relationship (Y.-y. Wu, D.-j. Yu, 2011):

- Problem Solving is a set of activities designed to systematically analyze a situation, create, apply, and evaluate solutions.
- Decision-making is a mechanism for making choices at every step of the problem-solving process.

Decision-making is part of solving the problem and decision-making occurs in every step of the coin solving the problem.

The most important characteristics of quantitative methods are (Marwaha, 2017):

- Attention to the problems or the system as a whole since activity in any part of the organization has an impact on the activities of the rest of the other parts. Any decision in a part must identify all the possible interactions of that part and determine its effects on the organization as a whole.
- Application of scientific methods in solving problems
- The use of computer in solving complex mathematical models
- Provide quantitative information for management to make use of appropriate decisions

1.2 Role of quantitative techniques in decision making

Decision-making is the basis of the administrative process in any institution, and resolution is a solution chosen from among several solutions (Render, stair, Jr and Hanaa, 2008).

Components of Quantitative Methodology for Problem Solving and Decision Making (Render, stair, Jr and Hanaa, 2008):

- Define the problem
- Build the model
- Obtain data entered
- Develop solutions
- Test solution
- Analysis of the results
- Apply results

Quantitative Methods Models

Quantitative methods are used as a mathematical input that helps decision-makers make effective decisions on a variety of means, the most important of which are the following (Render, stair, Jr and Hanaa, 2008):

- Probability theory
- Regression Models
- Theory of Decision Analysis
- Forecasting Models
- Linear programming
- Nonlinear programming
- Simulation Models
- Network Models

The importance of quantitative methods

The importance of quantitative methods is summarized (Eraydın&Ayda, 2011):

- A tool for quantitative decision making using modern scientific methods
- Quantitative methods of scientific methods are helpful in making decisions in a more precise and far-fetched manner than randomization resulting from trial and error
- This science seeks to search for new rules and foundations for administrative work, in order to reach the best levels in terms of total quality
- Helps to deal with complex problems analysis and solution, which are difficult to address in the normal image

- Helps to save the cost of solving various problems by reducing the time needed to solve

The use of quantitative methods in the decision-making related to solving the problems that exist in the work and institutions as they are effective to solve administrative problems, quantitative methods are important in decision-making, the reason is to (Zaborek, 2009):

- **Good control**

Use of quantitative techniques, Decision makers can move towards important factors to make sound decisions that meet the organization's objectives.

- **Better coordination**

Quantitative techniques are more useful in maintaining the status of the organization.

- **Better system**

Quantitative techniques focus on the use of modern methods of problem solving and decision-making, which analyzes data and building data repositories, which leads to the development of institutions and improved decision-making for the benefit of the organization.

- **Better decisions**

Quantitative techniques work to make the right decisions in a timely manner, leading to the development of the institution and achieve its objectives.

1.3 Importance of decisions taken by quantitative techniques

Quantitative methods have proven their importance in addressing the problems related to administrative decisions related to industrial processes and business, and the importance of decisions taken according to quantitative methods is attributed to the following reasons (Goczek, 2010):

1.3.1 Facilitate decision making

Quantitative methods facilitate the decision-making process and support decision-makers, enabling them to make appropriate decisions. The decision-making tree technology focuses on the systematic analysis of the problem. These techniques work to make decisions in correct ways and in different circumstances and support appropriate and timely decision-making. There are many problems that require appropriate decisions such as sales and service delivery where these problems can be addressed by making appropriate decisions using quantitative methods.

1.3.2 Scientific analysis

It provides a thorough analysis of the causes and results and evaluates the risks that exist in business. This is done through an objective and analytical approach. Quantitative techniques support decision makers through the use of logical thinking.

1.3.3 Identify resources

Quantitative techniques are useful for optimal use of enterprise resources.

1.3.4 Increase profit

There is a strong importance to quantitative methods in the preparation of alternative solutions that support the achievement of goals and profit by identifying the required resources and time and different methods leading to the adoption of appropriate decisions.

1.3.5 Cost reduction

Quantitative methods work to reduce cost.

1.3.6 Prediction

Quantitative methods for forecasting demand are used to support planning.

1.4 Use quantitative methods in business processes

There are many uses of quantitative methods, which are used to make decisions in business enterprises where problems related to routine work, quantitative methods are used in industry, agriculture and many other fields (Caniato, 2011):

1.4.1 Planning

Quantitative techniques are applied in the planning process where they are used to construct factories, locate and scale the plant and develop services and products.

1.4.2 Purchasing

Quantitative techniques are used to evaluate and develop vendors, develop logistics and develop sales.

1.4.3 Manufacturing

Quantitative methods contain many questions, for example how to monitor quality, what production plans are.

1.4.4 Marketing

Quantitative methods can be used to solve many marketing problems such as price competition, sales and planning problems.

1.4.5 Human resource management

Decision-making related to the planning process is supported by quantitative methods, where it develops many factors of interest such as wage structure, job evaluation and competency assessment.

1.4.6 Research and Development

The use of quantitative techniques is useful in processes related to research, for example research to create new products and services and to open new markets.

1.5 Classification of quantitative techniques

Quantitative techniques are defined as a set of methods that are used to analyze and formulate problems that need to be decided, and are classified as follows:

1.5.1 Mathematical techniques

Quantitative techniques use mathematics, differentiation, integration and numerical data, and also include the use of permutations, theorems and matrices.

1.5.2 Statistical techniques

Statistical techniques are techniques that are used to perform a statistical investigation in relation to a particular phenomenon, including all statistical methods that begin from data collection and analysis and until such data are interpreted. Important statistical techniques include ratio analysis, classification, data collection, probability, regression and correlation.

1.5.3 Programming techniques

The software technologies focus on building models, and decision makers use them and apply them in business to make appropriate decisions, where a model of the problem is used and applied to it to reach the appropriate decision, and the software techniques that are used linear programming, simulation and network programming.

II. RELATED WORK

There have been many studies and scientific research on the levels of several countries at the reality of the use of quantitative methods in decision-making and problem solving, the most important:

According to Acevedo (2014) Quantitative methods are used to obtain the best decisions that achieve the greatest chance of success and achievement of the goals. However, different areas of decision making, the use of quantitative methods leads to good results in decision-making.

Murdock (2014) conducted a study on the use of quantitative methods in decision making in the field of business. The results of the study showed that quantitative techniques use tests and experiments and collect data, making them suitable for making the right decisions that achieve the objectives of business enterprises in various fields.

Ighomereho (2013) Quantitative techniques are techniques used to make decisions and solve problems. It is a set of scientific and programmable rules that enable decision-makers at all levels to make the right decisions.

Ahsan (2012) conducted a study entitled "The reality of the use of quantitative techniques in making administrative decisions in the fuel sector in the state of Skikda, Algeria" In order to assess the degree of knowledge of managers in quantitative techniques. Among the results of the study was that the degree of knowledge of managers in using quantitative techniques was medium, and the extent of their use of quantitative techniques in administrative decision making is weak. One of the most important methods used is statistical analysis and prediction models; Areas of use of quantitative methods were the field of resource allocation, investment assessment, and demand forecasting and inventory management. The main obstacles to the use of quantitative techniques are the lack of training programs, the lack of specialized sections for quantitative techniques; data are not available for the application of quantitative techniques.

Orga and Ogbo, (2012) worked on the application of quantitative techniques in business management in Nigeria. It was pointed out that the theory of probability has wide application in small businesses.

Okechukwu et al., (2012) conducted a study entitled "Evaluation of criteria for quantitative and qualitative decision-making in Nigeria". The paper aimed to assess the level of managers' use of quantitative methods in problem solving and decision-making. Among the methods mentioned in the paper were analyses of decoupling, critical path analysis, decision tree, correlation and regression analysis, simulation and transport models. In the process of using quantitative methods. The study recommended the need to qualify and train managers in the decision-making process based on quantitative methods because of the impact of these methods on improving the efficiency and efficiency of decision-making.

Hasona (2012) conducted a study entitled "The Challenges of Using Quantitative Methods and Their Relationship to the Quality of Administrative Decisions a Field Study of Banks Operating in Palestine". The study aimed to identify the obstacles to the use of quantitative methods and their relation to the quality of administrative decisions in the banks operating in Palestine by identifying the level of knowledge of managers in quantitative methods and the extent of their need to use these methods and their degree of application in their work. The study aimed to identify the most important quantitative methods used in Palestine. Make decisions and identify the sources of knowledge.

More so, Murugesan (2011), Quantitative techniques are used to qualify variables in different disciplines. This means that mathematics, statistics and operations research can be applied to understanding and solving problems.

Zainab (2009) did a study with title "Quantitative Methods in Decision Making: A Decision Tree Style Model". The study aimed at measuring the contribution of quantitative methods in administrative decision making by focusing on the decision tree. The study concluded that it is not necessary to draw the decision tree in stable and separate stages, but the administration can draw the final tree at the beginning and then follow the solution and selection. The importance of using the decision tree in institutions and the criterion for judging the success or failure of the administration is through the ability of the administration to reach sound decisions and find solutions to the administrative problems facing organizations.

Kansjol et al (2009) conducted a study with the title of: "Models and Quantitative Methods in Decision Making and Decision Making". The study aimed at identifying the importance of using quantitative methods in decision making and identifying many difficulties facing this process. A project case was reviewed through the decision tree of one of the specialized services specialized in road transport operations in Algeria. The results of the study showed that there is no ideal way to make decisions that suit all situations and situations. Problem solving and decision-making, along with the use of quantitative methods, requires creative thinking from the decision-maker.

Bosharb et al (2009) conducted a study with the title of: "Operational research and its importance in the management decisions". The study aimed at clarifying the importance of operations research as a mathematical input at the level of the

Algerian administration, and the importance of operations research as a sports portal. It is concerned with providing assistance to managers and officials in making administrative decisions. Decisions based on quantitative methods and mathematical models in choosing the optimal alternative to solve administrative problems are rational decisions. And effective, and the study showed in the results that there is no clear integration between specialists in quantitative methods and management.

Sayd(2009) made study with the Title of: "Quantitative input methods and their importance in rationalizing administrative decisions", the study aimed at showing the importance of quantitative input in the management decisions in Algerian institutions. The results of the study showed that the models and methods of the quantitative approach do not take into account the human emotions and self-desires in practice. There are many problems that are characterized by diversity, complexity and instability. The use of quantitative methods requires the skill and efficiency of choosing the appropriate method, ie, the precision in the use of qualitative methods and models that enables the decision maker to use his expertise and efficiency.

Fethi&Pasiouras (2009) made study with the Title of "Assessing Bank Performance Using Process Research and Artificial Intelligence". The study aimed to provide a comprehensive overview of 179 published studies from 1998 to 2008 from different countries of the world. The study of operations and artificial intelligence was used in evaluating the performance of banks. Many of the applications of operational research methods which were widely applied in the field of banking , And applications of other techniques used in recent years to predict banks' bankruptcy, banks' performance, banks' creditworthiness, and poor performance of banks. The authors found few studies that proposed a mix of forecasting models.

Lee et al (2008) conducted a study entitled "Operations research as a practical management tool for decision-making". The aim of the study is to support the idea of relying on quantitative methods as well as intuition in the decision-making process as an integrated model and not only to rely on intuition in the decision-making process in American institutions. Operations research is one of the most important administrative tools used by profit and non- Ford, Samsung and the US Armed Forces. Hence, this study is to emphasize the importance of using operational research as a tool for decision making. The study showed many results, including decision making, one of the most important administrative skills for the ability to exploit the most available resources And to make every effort to achieve optimal performance with high efficiency. Small and less complex institutions rely on decision making on the intuition and minimum use of quantitative methods to achieve the objectives of the organization. Institutions operating in the more complex and larger environment use both quantitative and qualitative methods, and there is a need to use intuition and personal experience to make economic and peaceful decisions.

Ayash (2008) The study aimed to identify the extent to which the NGOs applied quantitative methods in solving problems, making decisions and sources of knowledge in these methods. The study also aimed to identify the obstacles that prevent the use of quantitative methods. The study concluded

that the knowledge of employees in non- The study revealed that education and study are the main way to obtain specialized knowledge using and applying quantitative methods. The most applied models are financial models and project management if specialists are available in these methods. The awareness of the importance of using quantitative methods in decision-making and staff training on the application of quantitative methods and the need to increase interest in teaching quantitative methods in universities.

Rahim & Selim (2008) conducted a study entitled "The use of quantitative methods in rationalizing and making decisions to grant credit in commercial banks". The aim of this study is to provide a modern approach in rationalizing the decision making of credit granting to commercial banks by using the priority objectives programming model, based on a hypothetical case study. The aim of the program is to plan a plan for the problems of multi-standard decision or objectives, where the target function is set to minimize deviations from the objectives. The process of trade-off and selection of loans is based on the Bank's strategy and the extent of its preference for one criterion over another. Is characterized by a practical flexibility to make changes and transfers in the pattern of priorities or model parameters, especially in an economy characterized by rapid and random shifts.

Masreque (2006) conducted a study entitled "Methods of research operations and their applications in decision-making and problem solving in industrial or service institutions in the Syrian Arab Republic". The study included a sample of (21) institutions of public and private institutions working in the fields of industrial and service. The study found that 90.8% (19 out of 21) of the institutions surveyed applied one of the methods of operations research to assist in decision making. The most important methods used are: statistical analysis, financial models, revenue and cost analysis. The application of operations research methods is limited to limited areas, mainly: project scheduling, accounting procedures, and resource allocation. And that the main obstacles to the use and application of methods of research operations in the Syrian institutions are: that the main decisions are taken by the higher guardians, and the lack of computer and the availability of specialists.

Gedily(2004) made study with the Title of: "The reality of using quantitative methods in problem analysis and decision making - a field study of the governmental sector in the Gaza Strip", The purpose of the study is to demonstrate the extent to which quantitative methods and methods are used in problem analysis, decision making in the Palestinian government sector, and the role that quantitative methods, especially the different process research methods, can play in problem analysis and decision making in the government sector. Of the use of quantitative methods in the Palestinian government sector. 240 questionnaires were distributed randomly to the specific categories of department managers, heads of departments and others who participate in decision-making in the various ministries. The number of forms used for analysis was (82.8%) in decision-making positions, the majority of users of quantitative methods use a limited number of these methods and may be due to lack of knowledge In other quantitative methods, the study shows that the most important obstacles to the use of quantitative methods are: lack of specialized persons, lack of encouragement

from supervisors in work, lack of adequate funds and lack of accurate data.

Al-Hindi & Al-Hamali(2003) The study aimed to identify the reality of the use of quantitative methods in decision making by government agencies in Riyadh by identifying the level of knowledge of managers in quantitative methods, and the extent to which they need to be used in their work. The aim was to identify the most important quantitative methods used in decision making, And to identify the sources of knowledge and the desire to know the quantitative methods and identify the methods of decision-making in government agencies, and the study has reached a number of results and indicators that reflect the reality of manager's use of quantitative methods. The study sample has medium knowledge of quantitative methods and the majority uses statistical analysis considerably in their work, and there is a large proportion of the study sample has a desire to know and quantitative methods used in their business.

According to Nickels, McHuhg and McHugh (2002), Good decision-making depends on the appropriate data. It is essential that decision-makers have the ability to analyze and analyze important data so that they can choose the best decision from the set of alternatives to achieve the organization's goals.

Furthermore, Chen& Wei (2002) conducted a study titled "Applied Operations Research in Taiwan". The study included 2000 industrial and service establishments. The study found that about three quarters (76.7%) of the establishments used methods of operational research and management science. And that: the analysis of return and cost, statistical analysis and prediction are the most widely used methods. Project management, production management, operations and marketing management are the most frequently used areas of operational research and management science. And that the two main reasons for not using operational research methods and management science are that they are not necessary and not known. And that the most important constraints to use are: lack of data, and the difficulty of identifying the problem and non-realistic models.

Ahmed (1998) prepared a study entitled "The reality of using quantitative methods in decision-making". It is a field study of industrial and service establishments in the Hashemite Kingdom of Jordan. The study included a sample of (150) establishments from industrial and service establishments with a minimum of three organizational levels registered at the Jordanian Chamber of Commerce and Industry, which is expected to use quantitative analysis methods , And the study found that (32.2%) of the institutions of the study sample applied quantitative methods to assist in decision-making. And those quantitative methods are not well known to the vast majority of decision makers in the sample study institutions. And that the most important sources of access to this knowledge are university study, practice and application. The most important methods used are: statistical analysis, inventory models, and linear programming. The main obstacles to the use of quantitative methods in Jordanian industrial and service institutions are: lack of knowledge of these methods, lack of specialists, and inadequate and accurate data required.

Kao, Lee & Chen (1997) made a study with the title of "an overview of the application of operational research in Taiwanese companies".The study concluded that the analysis of computer decision, statistical prediction, other probability

models, network analysis and linear programming are the most widely used methods, and that production and operations function are the most widely used methods of research operations, followed by information systems. And that about one-third of the institutions under study had never used operational research methods. The main reasons were: lack of knowledge of operational research and unnecessary. The lack of data is the most important impediment to use, followed by the communication gap, lack of resources, and very complex methods. And that senior management support is very important for the wider use of operational research in institutions.

Ehie& Smith (1994) conducted a study titled "Operational Research in Nigeria".The study included 954 industrial organizations. The study concluded that statistical analysis, decision analysis, simulation and network analysis are the most important methods used. Production scheduling, capital allocation, project planning and workforce planning are the areas where operational research methods are used. The lack of trained personnel, the need to develop appropriate information programs, and the lack of adequate and accurate data are the most difficult to use in operational research methods.

III. METHODOLOGY

In order to satisfy the objectives of this paper, a literature review approach is adopted. The primary step of a literature review issues assortment of relevant literature. For this purpose, we scanned Scopus and Web of Science (WoS) databases. To be sure that the search does not exclude possible helpful findings from different fields, we did not limit the search to a specific field or index. In addition, besides journal articles, we also included conference papers as recommended source for literature reviews.

1.6 Analysis

After collecting the data from the previous studies and analyzing them, we found that most of the results from the previous research indicate that the percentage of the use of quantitative methods in making decisions in institutions is weak due to the lack of sufficient knowledge about the use of quantitative methods in managers and responsible persons Decision-making, problem-solving, lack of training, quantitative awareness, use and importance.

IV. RESEARCH FINDINGS

The use of quantitative techniques is necessary in various organizations in order to take appropriate decisions and solve problems, which leads to the achievement of the objectives of the Organization and its development.

V. CONCLUSION

The use of quantitative techniques has been developed in many fields as it has many benefits in terms of making the right decisions at the right times and its usefulness in solving problems which supports institutions and achieves their objectives. It also supports decision makers from the ability to analyze data and use them in comparing different alternatives, this study found that the

use of quantitative techniques in government and private institutions helps them to develop and solve many different problems and make good decisions for institutions.

VI. RECOMMENDATIONS OF THE STUDY

In light of the results of the study, and emphasizing the importance of using quantitative methods in decision-making and problem solving in public and private sector institutions, the study suggested the following recommendations:

Develop awareness of the importance and advantages of using quantitative methods in decision making by holding seminars, lectures and open meetings between academics and decision makers in institutions, in which practical cases that illustrate the methods used and the benefits achieved as a result of using these methods should be published.

Interested in the training of relevant employees in using quantitative methods and increase their knowledge of the fields of computer use and related programs in order to ensure the formation of integrated teams.

Increase the number of specialists in quantitative methods and create their own departments or administrative units to serve as planning and control groups.

Providing an integrated information system as a vital component of the use of quantitative methods. Integrated management information systems provide the right data and information in a timely manner for decision-making. They provide the necessary support for the decision-making process through special decision models through their programming, Decision support.

Increasing the awareness of institutions in their external environment, so that they can adapt and continue, and this requires increasing administrative awareness and developing methods and procedures in a way that increases the speed, ease and accuracy of decisions taken.

Developing administrative methods related to reducing the degree of centralization and routines and organizing channels of communication in order to organize the information network within the organization.

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