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Application and roles of management science tools and techniques to effective decision making in the academic settings

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Abstract

The major purpose of the study was to discover to what extent selected educational systems were using specified management science tools and techniques in their decision making processes. The familiarity of the administrators and the employees with such techniques, and which of the models were used the most were also studied. Finally, the purpose of study was to discover economic and managerial benefits provided by using MS. methods. The results indicated that although academic administrators of Southern California universities used management science models and techniques, but the models were used less than industrial and business organizations.

Keywords: Mathematical models, Linear programming, Simulations, Queuing theory, Forecasting.

1. Introduction

The scientific management of Fredrick Taylor, bureaucratic organizational model of Max Weber, and administrative management theory of Henri Fayol during the first quarter of the century all focused on qualitative methods rather than quantitative techniques of management in order to increase organizational effectiveness and make better decisions.

Since 1930, human relation theorists such as: Elton Mayo, Abraham Maslow, Douglas McGregor, and others have also concentrated on different types of qualitative or human aspects of enterprises to increase efficiency or productivity of institutions (Robbins, 1986).

2. Background and statement to the problem

As a result of system theory during the last two or three decades, computers have developed, and many technological innovations have taken place and more complex organizations have appeared. The operations of organizations have also become more complex and costly. It has therefore become more difficult and important for administrators to make effective plans and decisions. The organizational changes and institutional expansions have caused educational systems as well as industrial or business organizations to be confronted with many complex problems or many important decisions which can not be solved intuitively or merely by individual judgments. A contribution of the systems theory to administrative decision making or problem solving has been through different

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quantitative methods or tools which can assist educational as well as industrial or business managers in identifying the “best” possible decision or solution for their complex problems (Kreitner, 1986). It is worth noting that while these decision tools can assist managers, they can not replace the decision maker’s individual judgment.

Today, many of educational or administrative problems can be solved by using different computer programs, quantitative method of management science, operational research or mathematical modeling. The goal of management science methods is provide accurate information on which decisions can be based. Examples of such problems or decision in educational settings are: low educational quality, social problems in schools, tax payer’s discontent, resource allocation, transportation and routing of school buses or busing students to achieve racial balance, budget preparation, curriculum planning and controlling of educational needs survey, and many other similar problems.

For years, industrial and business systems have applied many of management science methods and techniques to solve organizational problems or to optimize utilization of their resource. The use of management science in industry, government, and the none-profit sectors has grown rapidly since World War II. Health care, criminal justice, traffic studies, engineering design projects, airports, supermarkets, and finally educational organizations employ management science techniques and models (Stoner, 1982). It is however, believed that while some of the educational organizations have used these methods, others might have never used them or they may have never been aware of such tools and their power. Therefore, the specific problem of this research deals with testing or measuring the extent of applying management science tools by educational organizations of Southern California in order to decrease organizational costs, solve complex problems and making more effective decisions.

The following tools, methods, or techniques of management science were included in this research for the purpose of finding the extent of their use by the selected educational setting: Mathematical or statistical models, linear programming, assignment problems, transportation, network analysis such as: Project Evaluation and Review Technique (PERT) and Critical Path Method (CPM), inventory model, computer simulation, waiting line models or queuing theory, forecasting, dynamic programming, decision probability and game theories.

3. Purpose of the study

One purpose of the study was to discover to what extent the selected educational systems were using the management science techniques and methods in their decision making processes. For this purpose, the methods used and types of problems or decisions applied were ranked according to their degree of applicability. The second purpose was to find –out administrators familiarity and understanding of such tools. The third purpose was to find-out the educational background and positions held by those persons using these techniques. The fourth purpose was to find-out economic and managerial benefits that application of management science tools and methods provided for the organizations. Finally, this study attempted to find-out what types of methods or models were appropriate or applicable to a certain problem, situation, or decision. It was hoped that this study provides a kind of bases for cooperation or coordination between different levels of the educational organizations in using of management science tools and methods.

4. Methodology

This study was implemented using a questionnaire . The questionnaire was carefully designed to measure the actual application of management science techniques and methods in selected educational system of Southern California. The questionnaires measured the success and failure of organizations in using these methods for quality decision making and solving their educational or administrative problems. It was sent to the community college districts, community colleges and the state or none-state universities of Southern California. A letter accompanied the questionnaire explaining the purpose of study. The population of the study included all of Universities of

California (UC), California State Universities (CSU), community collages (CC) and community college districts (CCD). First, California was divided in to two parts geographically and the research samples all were selected from Southern parts of California. 5 UC's, 9 CSU, 10 DCC'S and 50 CCD's, were selected respectively. Since the first two universities had larger student population, two questionnaires was sent to each one. Therefore a total of 88 questionnaires were sent to 74 educational organizations. The management Science models and techniques that mostly were used in the industrial or business organizations according to several articles studied were used as the base in the survey. These techniques were as of the following: Linear programming, network analysis, Inventory models, forecasting, Computer Simulation, Queuing or waiting line model, and Transportation or assignment problems.

5. Research questions

1. Describe the familiarity of your personnel and administrators (including you) with management science tools or technique.
2. Explain the advantages or disadvantages that your organization has received from using such methods (economical, managerial, increase of quality, productivity etc).
3. Indicate which of the following techniques of management science or models have been or is currently used by your organization. Show frequency of their use in front of each one.
4. Explain the techniques used in your organization in above question, was intended to solve what type of educational or administrative problem or applied to what kinds of decision making process.

6. Analyses of data

Question #1 - The results indicated that among the educational administrators surveyed 5 had high familiarity with MS. technique and models, 12 had moderate familiarity and 10 were not familiar with such techniques. Although, familiarity of administrators with these models was more than the personnel's, they all were not that much familiar with these models.

To find out relationship between familiarity level of administrators with types of universities, the familiarity was considered as dependent variable and each of four kinds of the universities were considered as independent variable . By computing the regression analysis, it was resulted that personnel of those universities that had more students registered were more familiar with the techniques compared with others. So in this order UCs, CSUs, CCs, and finally CCDs administrators and personnel were more familiar with the models accordingly.

Question #2 – Among the respondents, 20 persons indicated that they have used these tools, 6 persons never used them and 15 of 20 indicated that they used the models for solving their problems and for reaching better decisions. 5 persons indicated that applying these techniques helped them to enhance their educational quality, 4 others said that the models had managerial benefit and some others utilized them for economic benefits and saving in their costs. Majority of them believed that by applying such models, their economic benefits exceeds their costs.

Table 1.Question #3 – The frequency of using different techniques and models is shown in the following orders.

MS. Models	F	MS. Models	F
1.Forecasting	16	6.Waiting line	4
2.Linear Programming	7	7.Inventory Models	3
3.Simulation	6	8.Others	3
4.PERT/CPM	6	9.Transportation	2
5.Decision Analysis	6		

Table 2. Question #4 – The optimal purpose of using MS models is shown in the following order.

Purpose	F	Purpose	F
Long Tern Planning	14	Controlling/Evaluation	5
Budgeting	13	Library Service	4
Short Term Planning	13	Social Science	4
Class-Room cheduling	10	Test Design	3
Resource-Allocation	8	Computers Planning	3
Financial-Allocation	8	Training	2
Academic/Instructional	7	Consulting	1
Executive Management	6		

7. Conclusion

This survey has examined the most management science techniques and models in the academic organizations of Southern California. These techniques had been mostly applied in the business, industrial, and military institutions. The result indicated that although the models had many managerial and economic benefits for the universities, so that could help administrators and personnel for solving their problems, making decisions, decreasing costs and increasing productivity, planning and etc; but not all of the administrators were familiar with such tools, therefore, the models were not used in the universities as much as of in the other types of organizations. Finally among the models forecasting, linear programming and simulation were used the most.

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