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MANAGEMENT SCIENCE IN MALAYSIA: A Sample Survey

AZIZ A. HAMID
HAMDAN ARIFFIN
RAJA NOORAINI RAJA SHAMSUDDIN
Universiti Kebangsaan Malaysia

SINOPSIS

Kajian ini membincangkan penemuan-penemuan satu tinjauan sample mengenai penggunaan teknik-teknik Sains Pengurusan dan Penyelidikan Operasi di Malaysia. Tujuan utama kajian ialah menentukan tahap penggunaan teknik-teknik tersebut pada masa ini dan pada masa akan datang. Hasil kajian menunjukkan bahawa pada masa ini teknik-teknik yang sering digunakan ialah teknik-teknik yang kurang memerlukan penggunaan matematik yang mendalam seperti model-model kewangan, teknik-teknik ramalan dan perancangan projek yang mudah. Teknik-teknik yang sama akan digunakan juga pada masa-masa akan datang.

SYNOPSIS

This study discusses findings of a sample survey on the application of Management Science and Operations Research techniques in Malaysia. The objective of the study is to determine the extent of current and future application of these techniques. The findings indicate that current applications are limited to the use of techniques which do not require adoption of advanced mathematical models, such as financial models, forecasting techniques, and simple techniques involved in project planning. Similar applications are forseen in the future.

INTRODUCTION

Scientific decision making through application of Management Science (MS) or Operations Research (OR) techniques has been gradually adopted in various organizations in developed countries over the last two decades. This is the result of (i) massive amounts of data generated by daily activities that need to be analyzed into useful information, (ii) the development of efficient techniques and algorithms, (iii) the increase in the number of personnel knowledgeable in the applications of these techniques and (iv) the advancement of generations of high speed computers. A number of surveys have been carried out to gauge the extent of use of the techniques in these countries.[1] We are not aware of any similar survey previously conducted in Malaysia.

Our objectives were to ascertain (i) what MS/OR techniques are being applied, (ii) who are using the techniques, (iii) in what areas are they being after applied, (iv) what opinions do users have after having applied the techniques

[1] For discussions on survey results, see Fabozzi, F.J and J. Valente, "Mathematical Programming in American Companies: A Sample Survey", *INTERFACES*, Vol. 7 No. 1, Nov. 1976, Muller, W. and C.B. Tilanus, "Linear Programming from a Management Point of View", *European Journal of Operational Research 2*, No. 4, July 1978, and Turban, E., "A Sample Survey of Operations-Research Activities at the Corporate Levels", *Operations Research 20*, 1972

and (v) respondents' opinion with respect to what the future holds for quantitative techniques in Malaysia. In January, 1980 we mailed 600 questionnaires to private enterprises and government departments and agencies. After a duration of one month, 104 responses were recorded, of which 79 came from private enterprises and 25 were from government departments and agencies.[2] The response rate was about 17%, which is similar to that of studies in other countries.

MS/OR TECHNIQUES BEING USED

We classified MS/OR techniques[3] into 10 borad categories as shown in Table 1. The respondents were asked to indicate all the techniques that they have used or are currently using. The results (see column 3) indicate that financial models are the most popular techniques. Forecasting techniques is the next group that recorded a good response. Growth rate appears to be the most popular in this group because, although not the most efficient in some applications, it is easy to compute. Among the inventory models, although EOQ is more analytic compared to ABC, our results do not show any special preference for a particular technique. Linear programming (LP) is the most popular technique among the mathematical programming models although its reported usage is low (9%) compared to the other techniques discussed above. LP is a relatively complicated technique and requires the computer for effective application. Not many organizations have access to LP computer packages.

USERS OF MS/OR TECHNIQUES

Table 1 indicates that percentage usage is generally higher in the government than in the private enterprises. Financial models are still the most used techniques in both categories of users. Of particular interest is the percentage usage of LP (20%) and CPM/PERT (36%) within government departments and agencies. The majority of government responses are from state development corporations which handle state development projects.

AREAS OF APPLICATIONS

Respondents were asked to rate for each of fifteen departments the degree of usage of MS/OR techniques. As shown in Table 2, finance departments recorded the most responses although the majority indicated either high or medium level of usage. This is of no surprise since the most highly used techniques are the financial models. The departments of accounting and cost and profit analysis also rank among the highest in the degree of usage. Any daprtment concerned with research and planning will most likely be involved with forecasting, simulation, project planning and other relevent models. As indicated in table 2, 7 organizations reported a very high usage of the techniques.

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[2] Eighty organizations requested a copy of the survey result.

[3] For a list of MS/OR techniques see, for example, Anderson, D.R., Sweeney, D.J. and T.A. Williams, *An Introduction to Management Science,* West Publishing Co., 1976, Cabot, A.V. and D.L. Harnett, *An Introduction to Management Science,* Addison-Wesley Publishing Co., 1977, Hillier, F.S. and G.L. Lieberman, *Operations Research,* Holden-Day, Inc., 1977, Second Edition, and Wagner, H.M., *Principles of Operations Research,* Prentice-Hall, Inc., 1975, Second Edition.

Table 1

MS/OR Techniques and Users

TECHNIQUE	USERS					
	1 PRIVATE ENTERPRISE (79)		2 GOVERNMENT AGENCIES (25)		3 TOTAL (104)	
	Freq.	%	Freq.	%	Freq	%
A. MATHEMATICAL PROGRAMMING	**12**		**11**		**23**	
1. Linear programming	5	6.3	5	20.0	10	9.6
2. Dynamic programming	1	1.3	2	8.0	3	2.9
3. Goal programming	2	2.5	–	–	2	1.9
4. Multiple Objective Linear programming	1	1.3	1	4.0	2	1.9
5. Integer programming	–	–	1	4.0	1	1.0
6. Non-linear programming	1	1.3	–	–	1	1.0
7. Other	2	2.5	2	8.0	4	3.8
B. FORECASTING TECHNIQUES	**44**		**31**		**75**	
1. Growth Rates	16	20.3	8	32.0	24	23.1
2. Simple Regression	10	12.7	9	36.0	19	18.3
3. Moving Average	13	16.5	6	24.0	19	18.3
4. Multiple Regression	2	2.5	5	20.0	7	6.7
5. Exponential Smoothing	2	2.5	2	8.0	4	3.8
6. Box-Jenkin	1	1.3	–	–	1	1.0
7. Other	–	–	1	4.0	1	1.0
C. INVENTORY MODELS	**22**		**10**		**32**	
1. Economic Order Quantity	6	7.6	6	24.0	12	11.5
2. ABC Approach	8	10.1	3	12.0	11	10.6
3. Production Lot Size	8	10.1	–	–	8	7.7
4. Other	–	–	1	4.0	1	1.0
D. TRANSPORTATION MODELS	**6**		**3**		**3**	
1. Transportation Technique	2	2.5	2	8.0	4	3.8
2. Assignment Technique	2	2.5	–	–	2	1.9
3. Other	2	2.5	1	4.0	3	2.9
E. PROJECT PLANNING MODELS	**32**		**20**		**52**	
1. CPM/PERT	15	19.0	9	36.0	24	23.1
2. Unit Scheduling	5	6.3	3	12.0	8	7.7
3. Job Shop Scheduling	3	3.8	3	12.0	6	5.8
4. Mass Scheduling	2	2.5	3	12.0	5	4.8
5. Batch Scheduling	3	3.8	2	8.0	5	4.8
6. Other	4	5.1	–	–	4	3.8

Table 1 (Continued)

TECHNIQUE	USERS					
	1 PRIVATE ENTERPRISE (79)		2 GOVERNMENT AGENCIES (25)		3 TOTAL (104)	
	Freq.	%	Freq.	%	Freq.	%
F. **FINANCIAL MODELS**	**103**		**65**		**168**	
1. Cashflow Analysis	26	32.9	13	65.0	39	37.5
2. Net Present Value	21	26.6	12	48.0	33	31.7
3. Payback Period	18	22.8	13	52.0	31	29.8
4. Internal Rate of Return	18	22.8	12	48.0	30	28.8
5. Capital Budgeting	15	19.0	12	48.0	27	26.0
6. Capital Asset Pricing Model	4	5.1	2	8.0	6	5.8
7. Other	1	1.3	1	4.0	2	1.9
G. **SIMULATION MODELS**	**7**		**3**		**11**	
1. Monte-Carlo Method	3	3.8	1	4.0	4	3.8
2. Computer Simulation Languages	3	3.8	1	4.0	4	3.8
3. Other	1	1.3	1	8.0	3	2.9
H. **QUEUING MODELS**	**7**		**1**		**8**	
1. Queuing by Simulation	4	5.1	–	–	4	3.8
2. Single Channel Queue	2	2.5	–	–	2	1.9
3. Multiple Channel Queue	–	–	1	4.0	1	1.0
4. Other	1	1.3	–	–	1	1.0
I. **MARKOV MODELS**	**3**		**1**		**4**	
1. Replacement Policy	2	2.1	–	–	2	1.9
2. Other	1	1.3	1	4.0	2	1.9
J. **GAME THEORY & DECISION ANALYSIS**	**7**		**2**		**3**	
1. Decision Tree Analysis	6	7.6	1	4.0	7	6.7
2. N-Person Game	1	1.3	–	–	1	1.0
3. Other	–	–	1	4.0	1	1.0

Table 2

Degree of Departmental Uses of MS/OR Techniques

Department	Number of Organizations Responding:				Total No. of Org.
	Very High	High	Medium	Low	
1. Finance	2	14	12	4	32
2. Cost and Profit Analysis	5	14	9	1	29
3. Research and Planning	7	7	7	5	26
4. Accounting	2	11	9	3	25
5. Inventory Control	4	7	7	3	21
6. Management/Administration	2	6	9	3	20
7. Marketing	1	7	7	3	18
8. Sales	1	7	8	2	18
9. Production	5	9	–	2	16
10. Transportation	2	4	2	3	11
11. Risk Analysis	1	3	4	4	12
12. Personnel	–	1	3	1	5
13. Polution and Safety Control	–	1	3	1	5
14. Public Relations	–	–	2	1	3
15. Military	1	–	–	1	2

We also asked whether organizations have staff departments specializing in MS/OR applications. A total of 79 organizations responded and 70 indicated having either one of the departments. Table 3 summarizes the distribution of the departments.

Table 3
Specialized Departments in Applications of MS/OR Techniques

Department	Frequency
1. Corporate Planning	25
2. Research and Development	22
3. Systems	15
4. Operations Research	4
5. Management Science	4
6. Other	9
TOTAL	79

Table 4
User Specialization

Area of Specialization	Frequency	%
1. Accountancy	71	34.5
2. Economics	33	16.0
3. Business Administration	25	12.1
4. Mathematics and Statistics	18	8.7
5. Industrial Engineering	12	5.8
6. Management Science	8	3.9
7. Chemistry	7	3.4
8. Chemical Engineering	6	2.9
9. Operations Research	5	2.4
10. Other	21	10.2
TOTAL	206	100.0

The educational specialization of employees in the departments listed in table 3 is shown in Table 4.

USERS OPINION ON QUALITY OF RESULTS

We requested the users to indicate their opinions regarding the effectiveness of the MS/OR techniques used in their organizations. Table 5 indicates that over 88% of the users indicated having very good to fair success in their usage.

Table 5

Quality of Results

Degree of Success	Frequency	%
1. Very good	5	11.4
2. Good	19	43.2
3. Fair	15	34.0
4. Póor	5	11.4
TOTAL	44	100.0

REASONS FOR NOT USING MS/OR TECHNIQUES

Kespondents not using MS/OR techniques were requested to indicate the particular reasons. We listed 4 likely reasons and each respondent may specify one or more reasons that suit his/her particular case. As Table 6 indicates, the prominent reason is there is no necessity for using. Note that each respondent may specify more than one reason.

Table 6

Reasons For Not Using

Reasons	Frequency	%
1. No necessity	48	54.5
2. Lack of Qualified Personnel	13	14.8
3. Too costly	13	14.8
4. Lack of understanding by Top Management	11	12.5
5. Other	3	3.4
TOTAL	88	100.0

PLANS FOR FUTURE USE

We asked respondents to indicate techniques that they would most likely use in the future. The respondents for this particular question include both current users and non-users. As Table 7 indicates, forecasting techniques appear to be the most favourite among future users, followed by financial models and project planning models. Markov Models and queuing models are the least favourites. Generally there appears to be a strong indication that MS and OR models will be increasingly employed in various organizations in Malaysia in the future.

In order to have an effective use of MS and OR techniques computers are necessary. Out of seventy one organizations which reported using computers, 44 used their own computers while 27 employ computer service bureaus. Only 10% of all applications reported having models developed by external consultants. The models in the remaining applications were developed by employees within the organizations.

Table 7

Future Usage of Techniques

Techniques	Frequency	%
1. Forecasting models	51	49
2. Financial models	45	43
3. Project planning models	42	40
4. Inventory models	32	31
5. Decision analysis	18	17
6. Mathematical programming	14	14
7. Simulation	13	13
8. Transportation models	11	11
9. Queuing models	5	5
10. Markov models	5	5

SUMMARY AND CONCLUSION

The most frequently used MS/OR techniques practised in Malaysia are the ones that are easy to compute but nonetheless very important in decision making. These techniques include financial models, easy to understand

forecasting techniques such as growth rates, simple regression and mowing average, and CPM/PERT in project planning. With the exception of linear programming, mathematical programming techniques have not found much usage in this country. Encouraging reports were received from users indicating that good results have been obtained from their applications. Although the percentage of non-users is still high and a majority of them believe that there is no necessity for using the techniques, a large number of organizations indicated that they are planning to use them in the future. One reason for non use is the lack of qualified personnel. Our results indicate only 6% of the personnel involved in the applications of the techniques are specially trained in Management Science and Operations Research. The demand for the techniques is evident but the supply of personnel knowledgeable in applications is still lacking. The responsibility of reducing the slack falls on the institutions of higher learning in this country. Institutions offering courses in business administration, accountancy, economics, mathematics, computer science and industrial engineering should be able to contribute towards producing not only individuals who can appreciate the usefulness of MS/OR techniques but also individuals who can effectively use them for making better decisions.

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