THE EXTENT OF USAGE OF QUANTITATIVE TECHNIQUES IN MALAYSIAN BUSINESS FIRMS

Ku Ruhana Ku Mahamud
Brigida M. Octovia

School of Information Technology,
Universiti Utara Malaysia.

ABSTRACT

A study was conducted to examine the extent of usage of quantitative techniques and the adequacy of computers as support tools in Malaysian business firms. Results indicate that 98% of the respondents used one or more quantitative techniques. These techniques are used in a broad array of functional areas. Lack of knowledge and familiarity among top management personnel were the most common reasons for low use. Findings of this study are related to comparable surveys in the United States and Hong Kong.

INTRODUCTION

Management quantitative techniques have been developed over the past five decades or so to support the complex task of managing business organizations. While these techniques have been extensively used in developed countries, the degree to which they have proliferated and actually been used in developing countries is not well known. In Malaysia, there has been no empirical study so far which can indicate the actual extent to which management quantitative techniques are being used by managers in business organizations.

In the United States (US), a number of studies have been conducted to assess the extent to which quantitative techniques were actually used by managers. The earliest study was conducted among manufacturing companies (American Management Association, 1957) and the results showed that only 50% of the respondents used quantitative techniques. In a similar survey by Hovey and Wagner (1958) of 158 companies in the United States and Canada, 68% reported the existence of an Operations Research Department. A follow-up survey by Schumacher and Smith

(1965) of 168 companies showed that 75% of the corporations engaged in operational research activities.

Turban (1972) conducted a study which included non-manufacturing companies. This study revealed that only 44% of the companies were engaged in operations research activities. He concluded that the figure should rise to around 60% within 3 years. However three years later, Gaither's (1975) study revealed that, still, only 50% of the American companies he surveyed actually used quantitative techniques. Alpander (1976) changed the scope of his study to cover American overseas executives only; results showed that quantitative techniques were used to a much lesser extent in international operations.

The most recent study (Kathawala, 1988) of 226 firms indicated an increase in the usage of quantitative techniques among US business firms. Only 3% reported that they were not using any quantitative technique at all.

Lam (1993) conducted a comparative study which involved 50 Hong Kong business firms. This study showed that there was much less usage of quantitative techniques in Hong Kong than in the United States. About 26% reported no usage of quantitative techniques in their business operations. Lam cited several barriers to the wide usage of quantitative techniques in the companies, namely: lack of understanding by managers, lack of top management support, lack of resources, and lack of ability to solve practical problems.

So far, no study has yet been conducted to assess the usage of management quantitative techniques among managers in Malaysian business firms. This study endeavours to fill this gap and provide a better understanding of the most suitable type of preparation and training in quantitative techniques required by managers today. The study will also compare the findings in Malaysia with those of Hong Kong and the United States.

METHODOLOGY

Survey questionnaires were sent to the operations managers of 258 firms, randomly selected from the top 634 firms listed in the Kuala Lumpur Stock Exchange. 45 firms responded, yielding a 17% response rate.

Table 1 shows the frequency distribution of the 45 firms, according to the industry to which they belong. The firms were directly asked, in the questionnaire, to indicate the industry that they were in.

Table 1
Industry Classification of the 45 Respondent Firms

Industry		No. of Respondent Firms
Manufacturing Comprising:		15
Chemicals	5	
Engineering	3	
Steel	2	
Auto	1	
Metal	1	
Paper	1	
Others	2	
Banking & Finance		8
Public Utilities		4
Agriculture		4
Property & Construction		4
Telecommunications		3
Food		1
Others		3
(No industry indicated)		3

The questionnaire contained 32 quantitative techniques, based on those used in Kathawala's (1988) US survey, and subsequently adopted by Lam's (1994) Hong Kong study. The respondent firms were asked to describe the extent to which they used each of the techniques. The extent of usage was rated in terms of a 5-step scale, starting from NO USAGE and moving up to EXTENSIVE USAGE.

The respondents were also asked to indicate the specific functional areas in which they used quantitative techniques, the reasons why they thought that quantitative techniques were not widely used in their company, and the level of computerization in terms of the number of personal computers, mini-computers, and/or mainframes installed in their organization.

ANALYSIS OF RESULTS

Overall Level of Usage in Each Firm

In order to get an overall rating of how much (or little) a firm used quantitative techniques, a simple weighted average for each firm was computed. The weights assigned were 1 for NOT USED, 2 for LITTLE USE, 3 for

MODERATE USE, 4 for FREQUENT USE, and 5 for EXTENSIVE USE. For each firm, the weights for each of the 32 quantitative techniques, based on its responses, were then averaged. The weighted average would indicate the overall extent of usage of all the techniques by a firm. For example, a firm with a weighted average of 5.0 would mean extensive usage of all 32 techniques; one with an average of 3.2 would mean, generally, a moderate use of the techniques; and one with a low average of 1.2, would indicate, on the average, that there was almost no use of any quantitative technique. The results showed that the range of the average usage was from 1.1 to 4.0. This indicated that overall, quantitative techniques were not extensively used in the firms covered in the sample. The highest level of usage was in the FREQUENT USE category.

Table 2 describes the average usage in the firms, which have been categorized into five levels, to approximate the five levels initially used to describe the extent of use of each technique. As shown in this table, 64% of the firms indicated that, on the average, they made little or very little use of quantitative techniques in their business operations. A little over one-third, or 35% of the firms reported, on the average, a moderate or frequent use of the techniques.

Table 2
Frequency Count of a Firm's Weighted
Average use of all 32 Techniques

Weighted Average	Description	Number of Firms	Per cent (%)
1.0	No use	0	0
1.1 - 1.4	Very little use	11	24
1.5 - 2.4	Little use	18	40
2.5 - 3.4	Moderate use	11	24
3.5 - 4.4	Frequent use	5	11
4.5 - 5.0	Extensive use	0	0

Number of Quantitative Techniques Used by Each Firm

The extent of usage can also be described using another view, i.e., to show the number of techniques used by each firm. Table 3 presents this view. The number of quantitative techniques refers to those that are used at least moderately.

Only 2% of the firms reported that they had not used any quantitative technique at all. This was almost the same rate as that reported in the U.S.

study by Kathawala (1988), which was a 3% rate. In contrast, the Hong Kong study showed a much higher rate of 26%. This indicated that there was a higher level of usage of quantitative techniques among firms in Malaysia than in Hong Kong. The results in Table 3 also show that 31% of the Malaysian firms were low users, i.e., from 1 to 5 quantitative techniques only. Lam's (1994) study showed that 68% of the Hong Kong companies were light users, a rate that was more than double that of Malaysian firms. The percentage of Malaysian firms using 6 or more quantitative techniques, at least moderately, was a very high 67%. Hong Kong's rate, by comparison, was ten times lower, at 6%. The table indicates that around 34% of the firms used one-half or more of the techniques, at a moderate or frequent or extensive level. This is consistent with the view presented in Table 2, which attempted to obtain an "average" usage level for each firm. In that table, 35% of the firms obtained an average usage level of moderate or frequent.

Table 3
Frequency Count of the Number
of Techniques used by a Firm

Number of Quantitative Techniques Used	Number of Firms	Per cent %
None	1	2
1-5	14	31
6-10	6	13
11-15	9	20
16-20	5	11
21-25	6	14
26-30	4	9

Level of Usage of Each Quantitative Technique

Table 4 pinpoints which techniques are the most widely used. For each technique, the number of firms reporting their use for each level is listed. The USAGE RATING of a technique is computed by obtaining the percentage of firms that indicated moderate, frequent or extensive use of that technique. The format of the table is consistent with Lam (1994) in order to achieve easy comparability.

The two most widely used techniques were Break-even Analysis and Statistical Sampling, which were used by 89% and 71% of the firms,

respectively. The third most widely used techniques were Analysis of Variance, Measuring mean and Variance, and Moving Average, which were used by 64% of the firms.

Table 4
Most Widely Used Quantitative Techniques

Quantitative Technique	No Use	Little Use	Mod. Use	Freq. Use	Ext. Use	USAGE RATING	Rank
Break-even Analysis	2	3	11	15	14	89%	1
Statistical Sampling	9	4	10	14	8	71%	2
Analysis of Variance	8	8	5	15	9	64%	3
Measuring mean & variance	13	3	13	12	4	64%	3
Moving Average	12	4	5	13	11	64%	3
PERT/CPM	16	1	9	14	5	62%	4
Inventory Models	14	6	12	7	6	56%	5
Decision Trees	15	9	5	12	4	47%	6
Computer Simulation	17	7	8	7	6	47%	6
Probability Analysis	17	7	9	7	5	47%	6
Measuring Correlation	16	8	8	10	3	47%	6
Assignment Problem	18	8	9	7	3	42%	7
Linear Programming	23	4	8	7	3	40%	8
Linear Regression Analysis	18	9	7	6	5	40%	8
Cluster Analysis	25	3	9	6	2	38%	9
Exponential Smoothing	22	7	10	5	1	36%	10
Goal Programming	23	7	8	6	1	33%	11
Statistical T-test	22	8	6	5	4	33%	11
Cross-Tabulation Analysis	20	10	5	6	4	33%	11
Factor Analysis	26	5	5	6	3	31%	12
Discriminate Analysis	25	7	9	3	1	29%	13
Transportation Model	26	7	8	2	2	27%	14
Multiple Linear Regression	25	9	3	7	1	24%	15
Queueing Theory	27	7	5	6	0	24%	15
Game Theory	30	5	4	3	3	22%	16
Non-Linear Regression	30	6	5	3	1	20%	17
Non-Linear Programming	31	7	4	3	0	16%	18
Dynamic Programming	28	10	4	1	2	16%	18
Integer Programming	34	6	4	0	1	11%	19
Markov Chain Analysis	38	2	3	2	0	11%	19
Log-Linear Analysis	34	6	2	3	0	11%	19
Nonparametric Statistical Test	33	8	1	2	1	9%	20

The Hong Kong study yielded slightly different results. The most widely used techniques were, in descending order: Measuring Mean and Variance (68%), Moving Average (24%), and Break-even Analysis (22%). In the Malaysian study, Statistical Sampling emerged as the second most widely used technique (with 71% of the firms using it), but in Hong Kong, it was only 5th in rank (with 16% usage). A more pronounced difference was in the ranking of Analysis of Variance. Among Malaysian firms, it was the 3rd most widely used technique (64%), but among Hong Kong firms, it was ranked 14th, with a very low 4% of the firms using the technique.

The results in Table 4 are more consistent with the US experience. Based on Kathawala's study, the two most widely used techniques were Forecasting (92%) and Break-even Analysis (80%). However, in the US, Statistical Sampling had a lower proportion of users (16%) than in the Malaysian firms, which had a very high 71% rate.

As shown in Table 4, all techniques were used by the Malaysian firms. Even its least used technique, Nonparametric Statistical Test, was still used by 9% of the firms. In contrast, the Hong Kong study showed that 16% of the techniques were not used at all by the companies in its sample. In the US study about half of the techniques were virtually unused by the firms that were surveyed. Table 4 shows that in the Malaysian sample, all techniques were used, with each technique used by 9% to 89% of the firms. The Hong Kong study indicated that only 16 techniques were used, with each technique used by 4% to 68% of the firms. This suggests that there are considerably more quantitative techniques used by Malaysian firms than by Hong Kong and US firms.

Areas of Use

Table 5 lists the areas in which the quantitative techniques were used, and the number of firms which reported usage in each area.

As indicated in the table, quantitative techniques were used in a broad array of functional areas. At least half of the firms used these techniques in any of the following six (6) areas: forecasting, finance/accounting, inventory, marketing, quality control, and production. A small number of the firms reported applying the techniques in non-traditional areas such as strategic planning and information systems. In general, a higher proportion of Malaysian firms reported usage of the techniques in more areas than the Hong Kong firms. In the latter, only two (2) application areas, forecasting and finance/accounting, were reported by at least half of the firms. Sixty-four (64%) of the firms used the techniques in forecasting, and 52% used them in finance/accounting applications.

Table 5
Functional Areas where Quantitative Techniques were used

Functional Area	Number of Firms	Per cent (%)
Forecasting	39	87
Finance/Accounting	37	76
Inventory	28	62
Marketing	27	60
Quality Control	25	56
Production	24	53
Personnel	19	42
Maintenance	14	31
Research & Development	3	7
Project Management	3	7
Strategic Planning	1	2
Information Systems	1	2

Level of Computerization

The firms were asked to indicate the extent of their computerization. Computers are well known to have greatly facilitated the use of quantitative techniques. Thus, the level of computerization of the firms would provide information on whether the tools to carry out the computational aspects involved in the use of quantitative techniques were adequately in place. Table 6 presents the findings. It shows that, in general, the level of computerization of the firms was very high.

Table 6
Level of Computerization of the Respondent Firms

Type of Computer	Number of Units Installed	Number of Firms	Per cent (%)
Personal Computer	10 - 500	40	89
	500 - 1,000	1	2
	Over 1,000	4	9
Minicomputer	0 - 50	44	98
	51 - 100	0	0
	Over 100	1	2
Mainframe	0 - 1	39	87
	2 - 3	4	9
	Over 3	2	4

Reasons for Low Usage of Quantitative Techniques

Table 7 presents the reasons given by the firms for the low usage of quantitative techniques, if they perceive themselves as low-level users.

Table 7
Reasons Cited by the Firms for the Low Usage of Quantitative Techniques

Reason	Number of Firms	Per cent (%)
Lack of knowledge and familiarity	4	9
Not regarded as helpful, relevant or necessary	3	7
Limited use only	1	2
Lack of ability to present the techniques in an easy to understand manner	1	2
Lack of tools	1	2
Inadequate skilled manpower	1	2
(No reason given)	36	

The high proportion of firms (80%) that did not cite reasons for low usage suggests that these firms did not perceive their organizations as low-level users of quantitative techniques. This does not support the previous results presented in Table 2, where only about 35% of the firms were found to be moderate or frequent users. The explanation rests on the likely gap between a firm's perception and reality. For instance, a firm using half of the techniques at a moderate level and using none of the other half at all might already perceive itself to be a moderate user. However, if its weighted average were taken, it would obtain a rating of only 2.0, which falls into the LITTLE USE category. Thus, if we use the results of Table 2 as the more realistic assessment of the average usage level of a firm, it would mean that approximately 64% of the firms have not yet reached a moderate level of use. Using Table 7, out of the 64%, about a third (or 20%), correctly perceived themselves as low-level users.

Table 7 shows that the most cited reason for the low usage of quantitative techniques was lack of knowledge of the techniques. If we scrutinize the next most cited reason in the table above, some questions would arise. Is it possible that the reason why the firms regarded the quantitative techniques as "not helpful, relevant or necessary" was that they did not fully understand how and where to apply the techniques in their business

operations? Or is it because they simply had not looked into it more closely, given the lack of skilled persons to do it (as seen in the other reason given, which is "inadequate skilled manpower")?

If those possibilities were true, then in effect, the most plausible reason why quantitative techniques were not widely used might be that there was lack of knowledge and familiarity with them. It was not so much the lack of tools, as indicated by the low proportion (2%) of firms which cited this reason, and corroborated by the findings on the high level of computerization shown in Table 6. The findings above strongly imply the need for a more effective type of training for managers in the use of quantitative techniques.

CONCLUSIONS AND RECOMMENDATIONS

This study is a pioneering effort that determined the extent of usage of 32 identified quantitative techniques, the functional areas where they are applied, and the adequacy of computers as support tools, among 45 firms in Malaysia. The reasons for a perceived low-level use of quantitative techniques in a firm were also obtained.

The study indicated that, in general, a high proportion of the firms, 98%, used quantitative techniques, at moderate, frequent or extensive levels. About 34% used half or more of the techniques, while 64% used less than half of the techniques. Only 2% of the firms reported not using any technique at all. This shows that Malaysia's usage level was at par with the US, based on Kathawala's (1988) study which showed that 97% of the US firms used the techniques at least moderately. Hong Kong's rate was lower, at 74%.

All techniques were used by the Malaysian firms at moderate, frequent or extensive levels, with varying combinations. This familiarity with a much broader array of techniques was not seen in the US and Hong Kong studies, where almost half of the 32 techniques were not used at all.

The most common reason for the low use of quantitative techniques was lack of knowledge. This presents strong implications on the need to train Malaysian managers in the use of quantitative techniques.

The most appropriate training should be done at two levels. The first level of training can be provided as early as at tertiary education. In universities or colleges, students in business administration programmes should be given not just a textbook-type course in Quantitative Techniques, but one that is highly practical, with a substantial dose of real-world application problems. Some of the firms regarded quantitative techniques as "not relevant or helpful". This may stem from a lack of knowledge in bridging the gap

between theory and application. Managers may be acquainted with the theory, but insufficiently trained in applying the theory to their daily business operations.

The second level of training would be in-house training. Here, both the middle-level and top-level managers must be given training in quantitative techniques, with the same applications orientation as in the first level. The emphasis of the training should be in explaining clearly how the techniques can be applied in the functional areas of the business organization.

The findings on the usage rating of the quantitative techniques can provide guidelines for the selection of techniques to focus on. Techniques such as break-even analysis, statistical sampling, analysis of variance, moving average, PERT/CPM, inventory models, measuring correlation, computer simulation, decision trees, and probability analysis need to be covered intensively, as the probability of their being applied by the managers would be higher than that of the other techniques.

A training of trainers is also necessary, in view of the apparent lack of trainers who can effectively bridge the gap between theory and practice. These trainers must be equipped with the proper perspective and real hands-on experience in the use of quantitative techniques.

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