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STRATEGIC PLANNING MODELS FOR INFORMATION SYSTEMS

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ABSTRACT

A key to the success of the information system function in organizations is a comprehensive, effective planning system. According to R.V. Head's[1] pyramid structure of an Information system managers are classified into levels of strategic planning, management control and operational control. Managers at these levels are, respectively involved in long-range, medium-range, and short-range planning.

The information system function is similar to other organizational functions in that it is comprised of managers at various levels who must plan for the effective and efficient utilization of limited resources under their command in performing their activities. In this research project data was collected from the full population of middle and upper level management of a large organization in South Africa and models were developed to assist the middle and higher level management in their task of doing strategic, long- and medium range planning for information systems.

Keywords Strategic planning, information systems, control/monitoring of IS

1. INTRODUCTION

The information system planning process has to be an integral part of overall organizational planning. The information system function must constantly cope with changing requirements for its resources. Just as the organization has to devote resources to planning so that it can adapt itself to the changing conditions of its environment, so must information systems invest resources in planning so that they can respond to changes in their environment. Although the perspective of the two planning efforts may be different, it is imperative that the information system plans interrelate with the organizational planning system.

According to [2] p.7 without the correct properly planned supporting systems, information will be of limited use. Experience has shown that a lack of proper systems planning invariably leads to ineffectiveness and inefficiency. This can be attributed to:

- lack of necessary systems integration;
- poor adaptability of systems;
- lack of compatibility between information systems and the organization;
- lack of support of the organization's goals and strategies;
- inappropriate or inadequate supporting technology;
- lack of user training and orientation due to improper implementation of systems; and
- inadequately developed systems due to lack of funds caused by the absence of proper planning.

2. STRATEGIC INFORMATION SYSTEMS PLANNING

McLean & Soden [3, p.83] define the following sequence of steps involved in strategic planning:

1. A setting of the mission or charter of the MIS organization.
2. A formal environmental assessment to identify the MIS opportunities, threats, and risks of concern to the enterprise.
3. The establishment of MIS objectives that define the desired results to be achieved by the function, related as much as possible to the strategic objectives of the overall enterprise.
4. The development of MIS strategies, which are broad courses of action describing how the previously set objectives are to be achieved.
5. The definition of MIS policies as guidelines to be used in carrying out the strategy, giving particular importance to policies relating to the organization of the MIS effort, the allocation of scarce resources, and the setting of expenditure levels for the function.
6. The translation of these objectives, strategies, and policies into long-, medium- and short-range plans.
7. The implementation of the plans, the measurement of progress against them, and the recycling of the appropriate effort over time.

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The main objective of this study was to develop a model which could be used effectively for steps 2 and 3 in the planning process. The model should further be of such a nature that it could be used to monitor the progress of the I/S function over time i.e. step 7 in the planning process.

3. COLLECTION OF DATA

Past research work done by the author [4,5,6], recent work by Alloway [7] who studied importance and performance issues in the information systems activity of some twenty major US companies, research by Bailey and Pearson [8], the efforts of Pearson [9] and Ives, Hamilton and Davies [10] to develop comprehensive measures of I/S effectiveness, studies by Rochart [11] and Martin [12] on critical success factors for information systems and work by Doyle and Miller [13] have provided important validating criteria for this study.

On the basis of the research quoted above, a questionnaire was developed containing 38 aspects of information systems to be evaluated by user managers on a 7-point scale. In previous research projects [4,5,6,7] the 7-point scale was used with great success.

The questionnaire was divided into 5 sections. Section A contained 34 aspects of the I/S function of which the importance had to be rated on a 7-point scale. Section B addressed future needs for information systems. 4 Types of systems were defined and the importance of each had to be rated. Section C contained the same aspects as in section A but in this case the manager had to evaluate the organization's performance with these aspects. Section D contained the same as section B and had to be handled the same way as section C. The last section contained demographic data such as age, managerial level, etc. This section also contained one question in which the overall performance of the organization's I/S function had to be evaluated.

The questionnaire was sent out to the full population of middle and higher level management of the organization. A total of 375 completed questionnaires were collected representing a response of 80%.

4. PROCESSING OF THE DATA

A 4341-IBM Computer was used for the processing of the data. The statistical analysis of the data was done by means of BMDP statistical programs [14], SAS - [15], GDDM - [16] and user-written programs.

In the analysis the following techniques were applied: frequencies, factor analysis, stepwise linear regression, multiple linear regression and optimization models.

The aspects which were evaluated in the questionnaire are represented in Table 1 with the abbreviation used for each aspect.

The variable SUCCESS was used for the single question regarding the overall success of the I/S-function in the organization.

5.FREQUENCIES

5.1 Performance vs. Importance for all Aspects

In his study of US companies, Alloway [7] found an inverse relationship between performance and importance ratings. Those companies appeared to be doing best in areas they regarded as least important and vica versa. Overall mean scores for all respondents regarding relative importance and performance for all aspects were calculated. The trends appear to be in line with Alloway's findings.

Decision-support type systems are viewed as significantly more important than traditional transaction processing. However current achievements in the DSS area fall well short of achievements in the transaction processing area.

The mean scores for the aspects for each department were then calculated and it was relatively easy to find the aspects in each department where I/S underperforms i.e. the greatest difference in the mean importance and mean performance ratings.

Aspect	Abbreviation
1. Communications between I/S-personnel and managerial users.	COM
2. Quality and competence of systems analysts employed by IS-department.	QUALIT
3. Availability and timeliness of report delivery to users.	TIME
4. Volume of output information provided by the system.	VOL
5. Prompt processing of requests for changes to existing systems.	REACT
6. Currency (up-to-dateness) of output information.	CURR
7. Ease of access for users to computer facilities via terminals.	EASE
8. I/S support for users in preparing proposals for new systems.	SUPPORT
9. Charge-out of I/S-services to users.	COST
10. Use of a steering committee.	STEER
11. Efficient running of current systems.	RUN
12. Short lead time required for new systems development.	LEAD
13. A low percentage of hardware and systems downtime.	DOWN
14. Degree of technical competence of the staff in the I/S- department.	TECH
15. Improving of system development techniques.	BETTER
16. Effectiveness of training programs for users in general I/S-capabilities.	PROGR
17. User confidence in systems.	CONF
18. Accuracy of output Information.	ACCUR
19. Preparation of a strategic plan for developing I/S.	STRAT
20. The degree of personal control the user has over which I/S-services are received.	CONTR
21. User-oriented systems analysts who know user operations.	ANAL
22. User's feeling of participation.	PART
23. Flexibility of data and reports available from systems.	FLEX
24. Overall cost-effectiveness of information systems.	COSTEF
25. Top management involvement in defining and monitoring I/S-policies.	TOP
26. Application of modern database technology.	DATAB
27. Increasing the proportion of I/S-depart's effort expended in creating new systems.	EFFORT
28. Relevance of report contents.	RELEV
29. System responsiveness to changing user needs.	RESPONS
30. Setting of systems priorities to reflect overall organizational objectives .	PRIOR
31. User's understanding of systems.	UND
32. Completeness of output information.	COMPLETE
33. Data security and privacy.	SECUR
34. Attitude of I/S-personnel toward users.	ATT
35. Development of more monitor systems.	MONITOR
36. Development of more exception systems.	EXEPT
37. Development of more analysis systems.	ANALYS
38. Development of more inquiry systems.	INQUIRY

table 1

Aspects and Abbreviations

5.2 Regression Methods

In the further analysis of the data linear regression techniques were employed using BMDP- and SAS-programs.

5.3 Stepwise Linear Regression

Because of the fact that the views regarding the importance of aspects of higher level management would differ from those of middle level management, the data of the two groups was analyzed separately by means of a stepwise linear regression program. In this program the 34 aspects were used as independent variables and the single question regarding the overall success of the I/S- function (SUCCESS) used as dependent variable.

The first step in this analysis was an attempt to explain the success of the information system by means of an appropriate subset of variables. The criterion used in this case, was the part of the total variance of the dependent variable as a result of a linear combination of a given set of variables, also known as the squared multiple correlation coefficient (R^2). Considering the fact that a number of variables in the set resulted in an increased tendency in R^2 the adjusted R^2 (Ra^2) which takes this phenomenon into account, was more appropriate.

The subsets which maximized Ra^2 in both the higher and the middle managers data were eventually selected as the best in their explanation of the dependent variable.

5.4 Success Factors for Middle Level Management

The following 9 factors (aspects) accounts for 46% of the variation of the success variable:

1. TIME — Availability and timeliness of report delivery to users.
2. VOL — Volume of output information provided by the system.
3. COST — Chargeout of I/S-services to users.
4. SUPPORT — I/S-support for users in preparing proposals for new systems.
5. FLEX — Flexibillty of data and reports available from systems.
6. ATT — Attitude of I/S-personnel toward users.
7. UND — Users understanding of systems.
8. RESPONS — System responsiveness to changing user needs.
9. TOP — Top management Involvement in defining and monitoring I/S- policies.

From the above mentioned aspects it was quite clear that these aspects addressed middle management needs i.e. more operational of nature than strategic.

5.5 Success Factors for Higher Level Management

The same procedure was followed with the data of the 101 top managers of the organization. 64% Of the variance of the dependent variable SUCCESS can be attributed to the following 7 factors

1. QUALIT — Quality and competence of systems analysts employed by I/S-department.
2. VOL — Volume of output information provided by the system.
3. LEAD — Short lead time required for new systems development.
4. DOWN — A low percentage of hardware and systems downtime.
5. ACCUR — Accuracy of output information.
6. ANAL — User - oriented systems analysts who know user operations.
7. SECUR — Data security and privacy.

The following linear regression model was found:

SUCCESS=1,37+,23(QUALIT)+,36(VOL)+,20(LEAD)-,13(DOWN)+,25(ACCUR)+,20(ANAL),14(SECUR)-(1)

5.6 Multiple Linear Regression

A multiple all-possible-subsets linear regression program was also applied on the two sets of data. All possible subsets of aspects were considered by the program and the "best" subset selected according to Mallow's Cp criterion. The subsets for the two groups of managers were exactly the same as the two models in the previous paragraph.

5.7 Optimization Model

It was decided to develop a model by making use of restricted regression methods. In BRUWER and HATTINGH [6] (1985) the methods and philosophy are described in full detail.

The steps that were followed are given below:

Step 1 The regression model used for further analysis was the one for higher level management i.e. equation (1).

Step 2 Restricted regression model. At different levels of thc variable DOWN minimum and maximum values for the dependent variable SUCCESS were calculated by means of linear programming techniques [15] and plotted in figure 1.

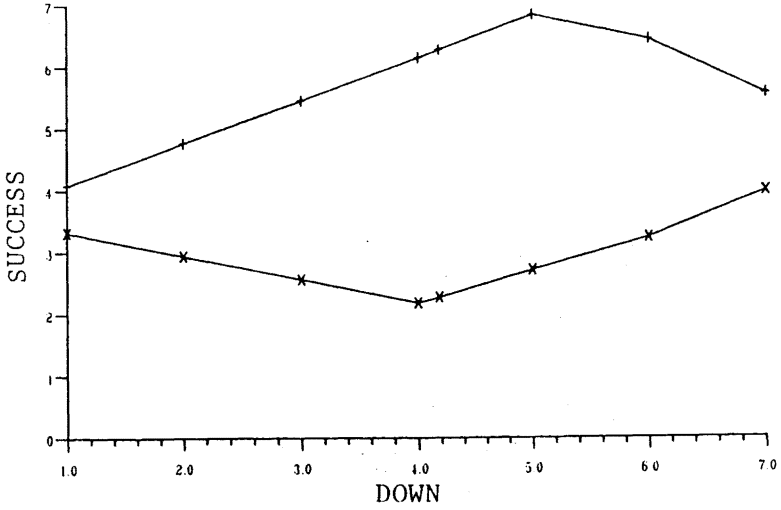

figure 1

Minimum and Maximum Levels of Success

The Interpretation of this figure for this specific case is as follows: At each level of DOWN on the horizontal axis, the minimum and maximum values of SUCCESS can be found in the graph. The solution of the other decision variables are given by the linear program for the specific values of DOWN. Table 2 contains the optimum solutions of the decision variables when DOWN is restricted to the values, 1, 2, 3 ... 7. The meaning of the graph and table is the following: The variable DOWN represent higher level management's view about the organization's performance with systems downtime. In the model this variable is restricted to the values 1, 2 ... 7 and a linear program solved twice for a specific value of DOWN. In the first place SUCCESS is minimized and the optimum values of the other variables calculated. Secondly, for the same value of DOWN SUCCESS is maximized and again the optimum values of the other variables are calculated.

5.8 The Specific Organization's Case

Overall mean scores for higher level management regarding the seven independent variables and overall success of the I/S-function are given in Table 3.

The second column of figures in Table 3 was found by applying the model and solve the problem with DOWN restricted to 4,18 (the mean score of DOWN for the organization).

The results in Table 3 are quite interesting and of great importance because the difference column directly indicates priorities of the variables. In priority order to raise the level of success of the systems in the organization, attention should be given to the following aspects:

1. User-oriented systems analysts who know user operations.
2. Lead time for development of new systems should be shortened drastically.
3. Serious attention should be given to the privacy and security of the systems.
4. Attention to the accuracy of the information users receive.
5. Quality and competence of systems analysts employed. This point directly relates to 1.
6. Correct volume of information provided by the systems.

From the graph it is clear that DOWN could not improve dramatically to raise the level of success. The level of DOWN in the organization is 4,18 and on a level of 5,0 the maximum level of SUCCESS are found.

VAR	DOWN = 1 min	max	DOWN = 2 min	max	DOWN = 3 min	max	DOWN = 4 min	max
QUALIT	5,00	5,00	4,67	5,25	4,33	5,5	4,00	5,75
VOL	2,0	3,0	2,67	3.75	3,33	4,5	2,0	5,0
LEAD	1,0	2,0	1,33	3.00	1,67	4,0	2,0	5,0
ACCUR	5,0	5,0	4,00	5,50	3.0	4,0	2,0	6,6
ANAL	4,0	5,0	3,30	5,50	3,67	6,0	2,0	6,5
SELUR	5,0	5,0	4.30	5,50	3,67	6,0	2,0	6,5
SUCCESS	*3,32*	*4,77*	*2,94*	*4,77*	*2,57*	*5,46*	*2,19*	*6,15*

VAR	DOWN = 5 min	max	DOWN = 6 min	max	DOWN = 7 min	max
QUALIT	4,5	6,0	5,0	5,0	5,0	6,0
VOL	3,5	6,0	3,0	7,0	5,0	5,0
LEAD	3,0	6,0	4,0	6,0	4,0	6,0
ACCUR	3,0	7,0	4,0	7,0	6,0	6,0
ANAL	3,0	7,0	4,0	7,0	3,0	5,0
SECUR	3,0	7,0	4,0	7,0	3,0	7,0
SUCCESS	*2,72*	*6,85*	*3,24*	*6,45*	*4,00*	*5,58*

table 2

Solutions for Decision Variables

Var	Value	For maximum level of success the values should be	Difference
DOWN	4,18		
QUALIT	4,78	5,8	1,02
VOL	4,60	5,4	0,80
LEAD	3,31	5,18	1,87
ACCUR	5,18	6,59	1,41
ANAL	4,43	6,59	2,16
SECUR	4,92	6,59	1,67
SUCCESS	*4,39*	*6,28*	*1,89*

table 3

Mean Scores for Seven Variables and Success

6. CONCLUSION

The seven factors that were found to be most important in the explanation of the success of the I/S-function in the organization were prioritized with the optimization model. These factors are of strategic importance for the organization and can well serve as a basis for points 2 and 3 in the strategic planning process (p.3). The factors that emerge from the analyses of the middle management data can serve as a basis for operational planning purposes as the aspects addressed needs of middle management.

The advantage of this methodology is the fact that it could be repeated yearly or every second year to monitor the progress of I/S-function in the organization.

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