SELECTING ERP SOFTWARE: A MULTIPLE-CRITERIA DECISION MAKING APPROACH

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ABSTRACT

This empirical study evaluates seven elements and their relative importance in choosing ERP software among five selected industries using conjoint analysis. The results show that industries have different priorities in choosing ERP software, and not all are the same. Therefore, the results of this study shed lights on how the ERP software providers may form their strategies to compete in different industries more successfully.

INTRODUCTION

Today's global business environment is characterized by unprecedented competitive pressures and informed customers who demand speedy solutions. That, indeed, requires an in-depth, hands-on understanding and optimization of business processes that permit information sharing among different areas of an organization and throughout the supply chain. The evolution of MRP to MRPII and now to Enterprise Resource Planning (ERP) provides and permits information sharing to integrate standard record keeping among different areas of an organization and chain partners for managing the system more effectively. Nigel Slack and Michael Lewis [11] argue that use of ERP improves information management, integrates information, disintermediates stages in the supply chain, overcomes geographical constraints, and etc. Noteworthy, then, to say that, the importance of ERP software in today's competitive environments is growing and getting unprecedented attention.

Many potential ERP users are now involved in global competition and many others need the software to integrate their otherwise segregated processes. The question of "which software is right for us", is particularly important as these software cost millions of dollars and could take years to become fully operational. Even though cost and implementation period are very important, they are not the only factors for managers' consideration. If the others in the industry are implementing new ERP software, for example, it could be a matter of time before the improvement in their supply chain capability will put the survival of the prospective ERP user in jeopardy. Therefore, identifying the factors that influence managers' decision to choose a particular ERP software and the relative importance of those factors could be of paramount significance.

One approach to study the important factors that affect the choice of the ERP software is to ask the CIO of the prospective ERP users to rank them in order. However, for obvious reasons, it is extremely difficult for the managers to determine the quantitative significance of each factor compared to the others. In fact, selecting ERP software is a multiple-criteria decision-making (MCDM) problem, and literature present different methods for evaluating this kind of problem [1]. One of the existing methods is Conjoint analysis which helps managers to determine the relative importance of each factor through the ranking of hypothetical bundles of software, each with a particular combination of important factors.

The purpose of this study, is to develop a preliminary list of the relevant factors through a survey instrument. The list then will be used to design the hypothetical software which will be ranked by the managers of the prospective ERP users. The results of the study can be used to evaluate the relative importance of factors that affect managers' decisions in choosing ERP software.

CRITICAL FACTORS AND METHODOLOGY

Thomas Curran and Gerhard Keller [3] have listed flexibility, scalability, expandability, and cost as some of the major attributes related in choosing ERP software. Also, in the preliminary process of developing the survey instrument for this study many CIO's and managers added factors such as connectivity, industry specific applications, analytical content, software training and support, and acceptability as important factors in choosing ERP software. However, not only these attributes and factors change and vary among industries, but their relative importance within an industry is expected to vary for different market segments.

Initially, through an exploratory study, the critical and common attributes and factors that affect managers' choices for ERP software were identified. The results of this initial study are shown in Table 1. A survey instrument was then developed using the listed factors in Table 1 and administered to the managers of five selected industries: Consumer Products (Food), High Tech and Electronics, Chemicals, Retails, and Financial Services. From a total of 238 survey instruments administered to the CIO's and managers of the organizations in the listed industries, 185 responses were received.

ANALYSIS AND RESULTS

The conjoint analysis of refined data is usually performed using either monotone analysis of variance, MONANOVA [6], or ordinary least square (OLS) regression [2]. Green and Srinivasan [5] report that the full-profile method, using utilities estimated by OLS, is the most common type of application of conjoint analysis. In this study, OLS regression analysis is used to estimate the utility function of each respondent. A total of 185 responses were analyzed and 19 were discarded based on stress measure [4]. The estimated ranking for each respondent is compared to his or actual ranking and Kendall's tau (the stress measure) is calculated to determine the strength of association between the two. A cutoff value of 0.7 is used to remove noisy data [10]. After eliminating "bad" data (which could be due to fatigue or lack of understanding on the part of the respondents), a total of 151 usable responses are utilized. The calculated F statistics of 96.712, 96.18, 97.281, 97.157, and 96.891 (with p value = 0) verified the significance of the effect of the attributes on utility scores of the respondents.

To determine the relative importance of each of the seven critical factors, individual preferences (utility function) is aggregated. Since these respondents had relatively low stress, use of the additive conjoint measurement is appropriate [11]. This measurement displays the gap between the highest and the lowest responses among the respondents' utility preferences, which can be used to determine the relative importance of the listed factors in Table 2. To show the relative importance of the seven factors, the relative size of the utility ranges (the spread in utilities between the highest and the lowest rated levels of each factor) are measured in percentages and presented in the Table 2. This Table provides an indication of the relative importance of the listed seven factors in multi-criteria decision-making processes for selecting ERP software among the selected industries.

The results in Table 2 display different roles of the seven factors for selecting ERP software in each industry. In Consumer Products, cost is rated highest (33.24%) while scalability is scored second

(29.22%) and training is considered third (18.38%). It explains that in Consumer Products (ex., Food) industry ERP software must display capability to respond to variety of changes in items demanded and consumer needs. Knowing that some consumer products have low profit margins, cost then is found to be a major factor for managers to consider such an investment. Identically, cost is the most important element in choosing ERP software in Retail industry (26.13%). The differences among expandability, training, and scalability factors in this industry are not substantial. However, all three are considered major factors in choosing the ERP software.

In High Tech and Electronics industries, expandability and scalability are rated the highest, (23.15% and 18.13%). Since the products life cycles in this industry are considered relatively short, managers deem the expandability and scalability as important, while some also believe acceptability factor to be also important (15.08%). In contrast to the Retail and Consumer Products industries cost is not a major factor to choose ERP software in this industry (10.33%). Moreover, although the respondents in High Tech and Electronics show higher preferences for expandability, their responses on scalability and acceptability factors are quite similar.

Interestingly, in Financial Services, managers gave higher preferences to flexibility (25.79%) compared to other elements for choosing the ERP software. That is due to the detail and unforeseen circumstances, which may develop in response to the individual needs and corporations' policies. Also, scalability is rated high (19.47%), while expandability and training are rated next, and the difference among them is not extensive.

Chemical industry managers, due to the nature of their processes and homogeneity of their products, gave higher rates to scalability factor (22.66%) in choosing the ERP software. Also, they gave more attention to choosing ERP software in line with their long term corporate, business, and operations strategies (acceptability, 18.53%). The results in Table 2 also show that although analytical content, training, and acceptability are important factors for some industries to select the ERP software, they are not the most important elements.

CONCLUSION AND REMARKS

The objective of this empirical study was to develop a list of relevant factors in choosing the ERP software among different industries and to determine their degree of importance. Seven factors were developed and conjoint analysis was used to determine the relative importance of each factor in five selected industries.

The results in Table 2 signify that choosing ERP software is a multi-criteria decision-making process and it depends on several relevant elements which are used differently in each industry. Consumer Goods and Retail industries put more emphasize on cost of acquiring the ERP technology, while scalability and training elements play important roles too. Expandability is the major factor for High Tech and Electronics industry and scalability is the number one element in Chemical industry. The role of acceptability is found to be important in High Tech and Chemical industries, but not in others. Also, Table 2 shows that while analytical content, training support, and acceptability are not the number one elements for choosing the ERP software in any industry; they are important parts of their multi-criteria decision-making processes.

The results clearly show that no single element by itself is used in any industry to select the ERP technology. Rather, the choice relates to the combination of some elements that directly lock into the

operations and the role of the industry's supply chain activities. That faces the ERP software providers with the realities and challenges of customizing their products to the ever-changing needs of different industries. The results in this study can shed lights on how the demand for the ERP software is shaping and how the ERP software providers should configure their processes for the future success. Perhaps, their strategy should be more selective for addressing the needs of specific industries.

REFERENCES

Available upon request

TABLE 1

Critical Factors for Choosing ERP Software

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Flexibility – The ability to exhibit a high level of acuity and judgment

Scalability – The ability to shift to a different level of useful capacity quickly

Expandability – The modularity for future expansion without major costs

Cost – Financially justifiable (initial cost + maintenance)

Analytical Content – The extent to which it can cope with the increasingly complex task

Training and Support – Providing training and follow through for an extended time

Acceptability – How much it takes a firm toward its strategic objectives (product cost, quality, speed, etc.)

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TABLE 2

Relative Importance of Software Attributes

	Flexibility	Scalability	Expandability	Cost	Analytical Content	Training & Support	Acceptability
Consumer Products (Food)	4.72	29.22	4.39	33.24	5.51	18.38	4.54
High Tech & Electronics	9.95	18.13	23.15	10.71	10.33	12.64	15.08
Chemicals	10.4	22.66	15.45	13.24	7.95	11.77	18.53
Retails	2.55	16.03	21.55	26.13	8.71	16.37	8.68
Financial Services	25.79	19.47	14.06	13.06	4.93	14.89	7.81