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Matching of an ERP System to a Public Organization

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ABSTRACT

Efficient planning and utilization of organizational resources have always been a top priority for executives worldwide and across industries. Private and public sectors are seeking efficient utilizations of their resources to realize cost savings, better quality and higher profits. In the case of public sector, planning leads to cheaper and better services. Consequently, many public sector organizations are also focusing on selecting and implementing Enterprise Resource Planning systems (ERP). This paper proposes a strategic model for managers to assist them in proactively identifying the best-fit ERP system for their organization. The model includes three broad categories of business process, technology diffusion, and critical success factors for ERP system implementation. The best-fit model is applied to six public sector organizations in the U.A.E. and five major available ERP systems as alternative choices. The results presented in this paper show that according to the model, each organization as well as each ERP system can be represented by its own unique graphical profile and, thus, by superimposing the profile of an organization to the profiles of available ERP system, the best-fit system for the organization can be identified.

Keywords: ERP, Diffusion of Innovation, Critical Success Factors, Public sector

1. INTRODUCTION

The United Arab Emirates was established as an independent state in 1971. Since then, the UAE has developed its own political and administrative structures that combines both modern and tradition systems. In particular, the public sector in the UAE has invested millions of Dirham during the last decade in information systems and technology such as e-government to enhance its service, reduce processes time and cut costs. Keeping in mind the difference between public sector entities and their commercial counterparts, many of the critical success factors (CSFs) of ERP system's implementation in the commercial sector are applicable to success in the public sector. The challenges occur when processes of decision-making and acquisition require a high degree of transparency which leads to risk-averse decision-makers. All of these issues make the success of ERP project harder and difficult to achieve (Thomsan and Jajodia, 2004).

The proliferation of ERP systems over the last few years has taken organizations worldwide by a storm, and is expected to gain more momentum in the next coming years. This increase in popularity has been largely attributed to the fact that computers and information systems have demonstrated their ability to administer a profound impact upon organizational success by providing more efficient, effective and accurate business processing. For example, Yasin (2005) reported that the United States federal government spending on ERP is projected to grow 33 percent between 2005 and 2010, when the market is expected to hit $7.7 billion.

It is important and rather critical for organizations aiming to implement ERP system to figure out if their ways of doing business will fit within a standard ERP package. Those organizations are forced either to change the business processes to accommodate the software which means deep changes in long-established ways of doing their business or to modify the software to fit the processes which will slow down the project and introduce customization to the package. Customizing an ERP solution is a critical step where organizations are trying to avoid because of its cost and update difficulties. Another critical challenge in ERP implementation has to do with first identifying gaps between specific organizational requirement and the ERP generic functionality, and then deciding how these gaps will be handled (Soh et. al. 2000, Volkoff, 1999). Organizations worldwide have defined ERP implementation projects as high-risk and high-cost project where 65% executives believe that ERP systems have at least a moderate chance of hurting their businesses because of the potential for implementation problems, (Aiken, 2000).

Due to the high percentage of failure in the ERP system implementations, a proactive methodology is needed to assist organizations in selecting the best-fit ERP system to suit its core business processes as well as the culture it created in its workforce. In the Gulf region where the UAE is located, firms have been attracted to the concept of ERP and its potential benefits but still are resistant due to its high cost and failure. Kerimoglu (2000) noted that people are making much effort trying to specify the factors that have direct effect on the success of ERP system's implementation. Many of the researched critical success factors of ERP system implementations may not be applicable to the public sector of the UAE. When buying an available ERP package, organizations are unprepared for changes and the unclear consequences that are associated with an ERP implementation.

The following sections describe a methodology and a tool that can be used by the managers to proactively analyze their organization's core processes as well the culture of their workforce and to use this analysis to choose the best-fit ERP solution for the organization. When adopting this tool, organizations can avoid the pitfalls in ERP systems selection as well as implementation. The presented model assists managers in minimize the risks inherited in the implementations of a major IT system such as the ERP.

2. MODEL AND METHODOLOGY

MODEL DESCRIPTION

The model consists of three constructs consisting of a total of fifteen dimensions. The first construct is based on the various modules available in a typical ERP system aimed at addressing the organization's core business processes. The generic business processes considered are Analytical, Financial, Operations, Human Capital Management and Corporate Services.

The second construct is based on the Diffusion of Innovation theory summarized and presented by Moore (2001). The aim of this construct is for managers to asses how potential users' perceptions of the information technology innovation influence its adaptation within the organization's workforce. The dimensions adopted from this model are Relative advantage, Ease of use, Enhancing organization image, Compatibility, Results demonstrability, Support and Voluntariness of use, Need for technical change and Need for process change.

The third and final construct represents additional critical success factors such as Organization size, Organization flexibility, Organization communication and Organization structure.

2.2 METHODOLOGY

Somnath and Deshmukh (2001) proposed a methodology to match a given technology to a technology forecasting method. They presented twenty different dimensions based on which a graphical profile for the technology and graphical profiles for known forecasting methods was developed. The graphical profile of the technology was subsequently superimposed on the profiles of the forecasting methods in order to identify the best forecasting method for the technology.

In this paper, the proposed model described in the previous section is similarly used to develop graphical profiles for an organization as well as the available ERP systems. The developed graphical profile for the organization is

then compared to the graphical profiles for the available ERP systems and the best-fit ERP system for an organization is thus identified.

The first column in Figure 1 shows the fifteen dimensions discussed earlier. These dimensions are further broken down into more descriptive characteristics resulting in a total of thirty seven characteristics in the proposed model. The use of these characteristics in the development of the graphical profiles for the organizations as well as the ERP systems is described in the following steps:

Step 1: **development of the weighted importance of each characteristic**:

Working as a team, five managers from each organization were asked to participate in the study. First, the managers were asked to force-rank each of the fifteen dimensions relative to the remaining fourteen dimensions based on their perception of how important each dimension was relative to the other dimensions. The relative rankings were then normalized to estimate the weight of each dimension (w1). Second, the managers were asked to force-rank rank each of the characteristics based on its importance relative to the characteristics within the dimension itself For example, within the Financial dimension, the importance of the financial accounting characteristic was ranked from ranked from 1 to 8 since because were 8 characteristics in the Financial dimension. Again, these rankings were normalized to estimate the characteristics weight w2. The total weight for each characteristic is the product of the two weights (w = w1 x w2)

Step 2: **scoring the characteristic:**

In this step, each of the five managers from each organization was asked to independently score each characteristics based on its importance to the core business process of the organization and the culture of its workforce. The scores from all five managers were then averaged and this average was then multiplied by the weight w from step 1 to estimate the final score of each characteristics (s = w x average score).

Step 3: organizations graphical profiles:

The scores of each characteristic from step 2 were used to develop the graphical profiles for each organization by connecting the point plot of each characteristic in the proposed model as shown via the solid line in Figures 1. For example, Figure 1 shows that for organization "D", the strategic management process was more important than workforce analysis.

Step 4: ERP systems graphical profiles

Development of the graphical profiles for the ERP systems is based on the same methodology described in step 1 to step 3 above but required a different approach. Five leading ERP vendors were contacted and all agreed to participate in the exploratory study. In order to eliminate biases of opinions towards their own system, vendors were asked to score all the systems other than their own. Responses from the vendors' were averaged and multiplied by the weights developed in a similar way as the case for the organizations and graphical profiles for all the five ERP systems were developed.

Step 5: matching an organization to an ERP system

By superimposing the graphical profile of each organization on the graphical profiles of the five ERP systems, management can visually identify the best-fit ERP system for the organization. Figure 1 shows how the organizational profile of organization D is matched against ERP system d. For example, the ERP system d matches the analytical process need of organization D quite accurately. However, lacks in Financial Accounting and Financial Supply Chain management characteristics of the financial dimension. Similarly, this ERP system seems to over deliver on the "Relative Advantage" component of diffusion. Finally, as Figure 1 shows, the ERP system d also seems to require a lot more process change than what is considered reasonable by organization D.

The graphical profiles are also useful for comparing the same ERP systems for multiple organizations. This situation arises when, for example, the same state enterprise owns two different organizations and wishes to

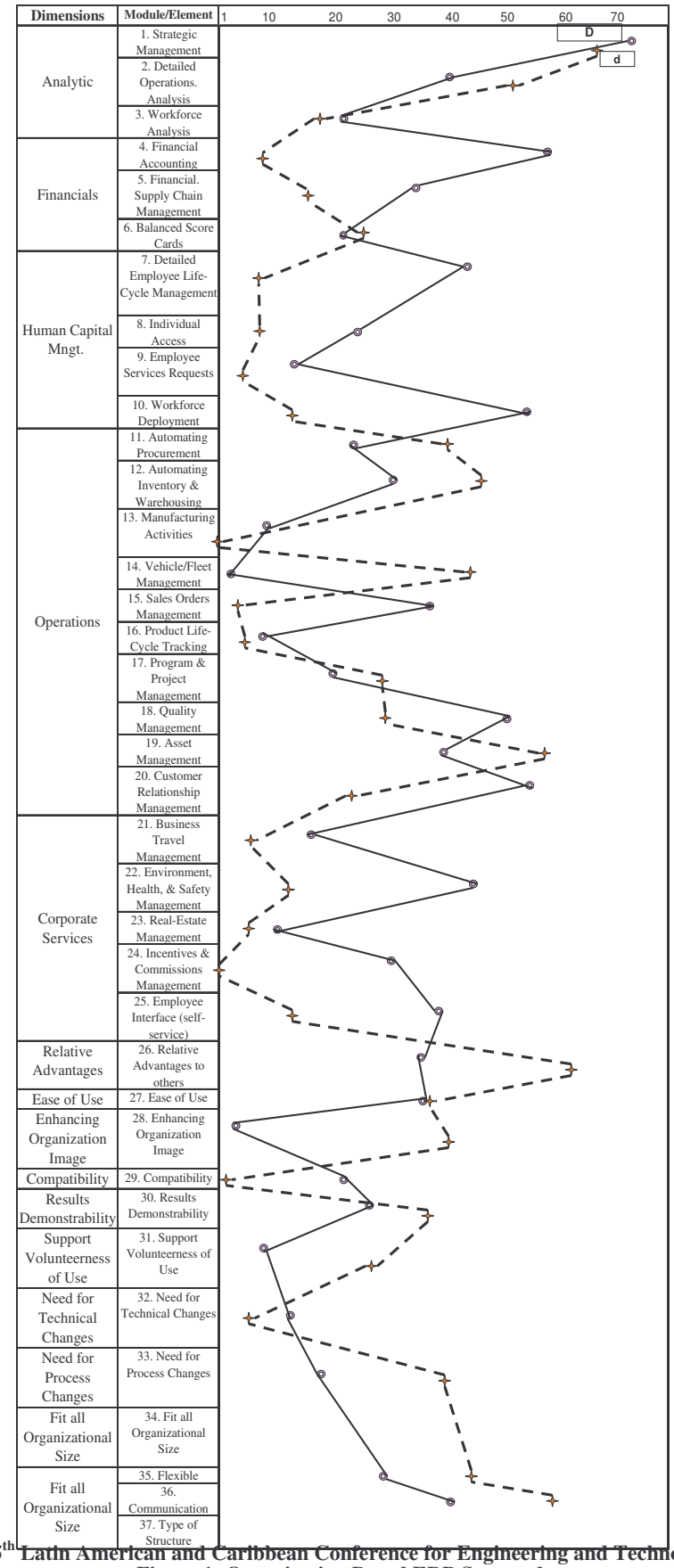

Figure 1: Organization D and ERP System d

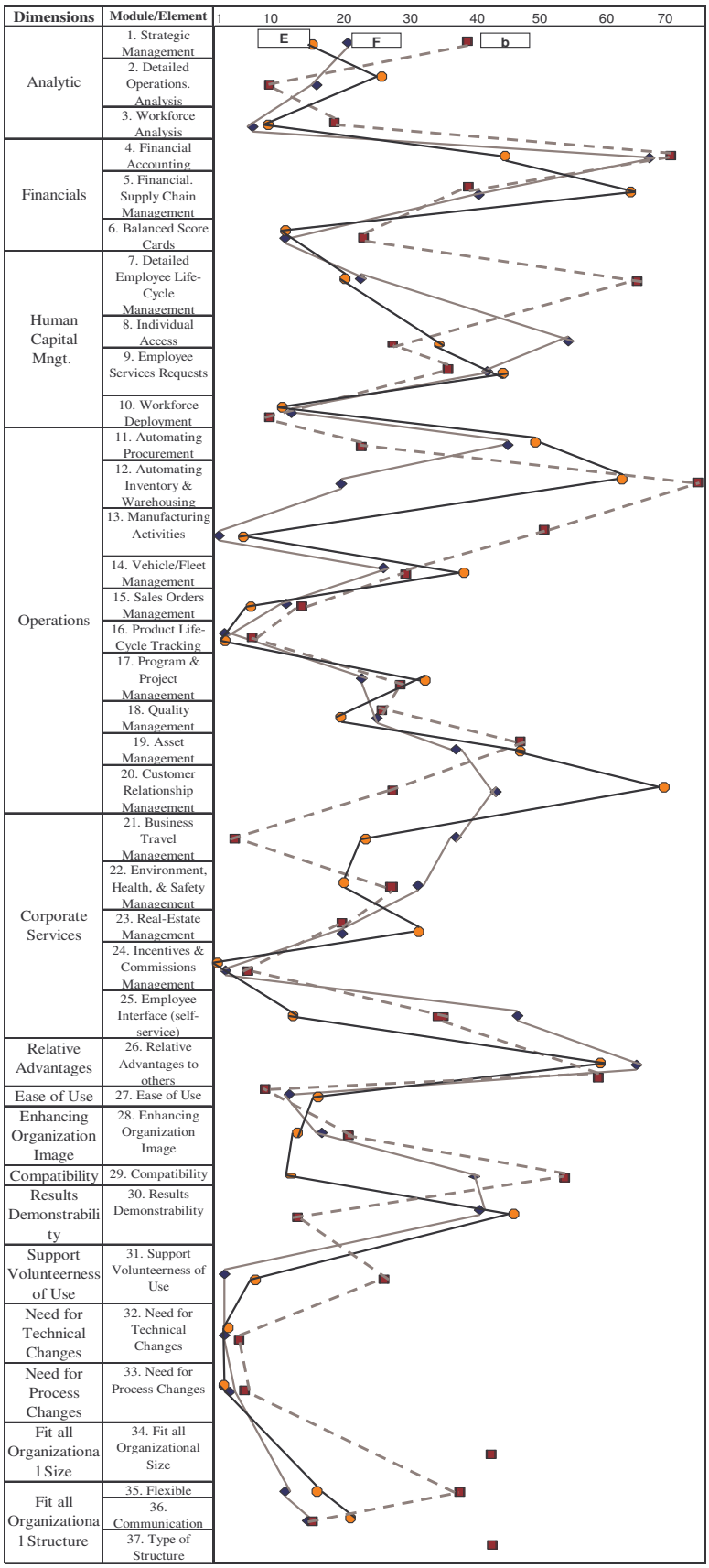

Figure 2: Organization E&F and ERP System b

standardize on the same ERP system. Figure 2 shows how the ERP system b compares against two different organizations (E and F). In this specific instance, it would seem that the same system is quite suitable for both these organizations

In addition, the difference between the score of each characteristic for the organization and the same characteristic of the ERP systems can be calculated and the best-fit system that provides the least deviations is identified as the best-fit system. This study used the sum of the absolute deviation as the bases for rankings the ERP systems from most suitable to least suitable system. Table 1 shows a summary of the absolute deviations for each of the six organizations and the resulting rankings of the five ERP systems for each organization.

Table 1: Absolute Deviation and best-fit ERP

Organization		ERP System				
		a	**b**	**c**	**d**	**e**
A	$\sum \lvert error \rvert$	610	603	619	488	730
	Rank	3	2	4	1	5
B	$\sum \lvert error \rvert$	583	582	538	639	559
	Rank	4	3	1	5	2
C	$\sum \lvert error \rvert$	679	719	596	671	629
	Rank	4	5	1	3	2
D	$\sum \lvert error \rvert$	453	596	512	603	595
	Rank	1	4	2	5	3
E	$\sum \lvert error \rvert$	735	503	654	573	631
	Rank	5	1	4	2	3
F	$\sum \lvert error \rvert$	624	437	575	676	612
	Rank	5	1	4	2	3

Table 1 also shows that ERP system "d" was the best choice for organization A because it had the smallest sum of squares error. The same ERP system ranks second for both E and F organizations. Table 1 shows that despite the fact that all organizations were public, the choice of the best ERP system varied quite widely. The Table also shows that ERP system b is identified as the best-fit system using the model for both E and F companies shown in Figure 2.

3. DISCUSSION AND CONCLUSION

This research attempted to investigate two important concepts concerning public sector organization's requirements and its best-fit ERP solution. The study postulated that any public sector organization can be categorized with regards to its business processes, how the technology is diffused within its culture as well as some organizational factors that affect the successful implementation of a technology such as an ERP solution. This study also postulated that by using the graphical profiles, organization's management can identify, either visually or by using one of the standard error measurements, can identify the best-fit ERP solution for the organization.

This exploratory study has shown that the proposed model consisting of the three constructs can be used as a useful tool to create a unique graphical profile for each organization and this graphical profile can be used to identity the best-fit ERP solution for the organization.

The developed graphical profiles for all six public organizations show distinct differences that identify clearly the business focus each organization. Analysis of the graphical profiles of all six organizations show that the B-Web Typology construct is the largest differentiating factor between the profiles of the seven organization followed by the Diffusion of Innovation construct and finally the organization construct which seem to be not as critical as the other two constructs.

This exploratory study has shown that the proposed model can provide organizations' managers with a useful tool they can use to proactively evaluate the available ERP systems and to choose the best-fit system for their organization. The developed graphical profiles for the organizations as well as the graphical profiles for the ERP systems can serve as an aid for managers to visually detect the capability of the ERP systems in meeting the needs of their organization's core business processes as well as the culture of the organization's workforce

4. REFERENCES

Aiken, Peter. (2002). *Enterprise resources planning (ERP) considerations*. Richmond, VA: VCU/Institute for Data Research

Kerimoglu, O. (2000). CSF affecting the success of an ERP system implementation. *Bagazici University Department of Management of IS Press*, Istanbul, Turkey

Soh, C., Kien, S., Tay-Yap, L. (2000), "Cultural fits and misfits: is ERP a universal Solution". Communications of the ACM, Vol. 43, No. 3, pp.47-51.

Somnath, M., Deshmukh V., Vrat B. (2001) "Matching of Technological forecasting technique to a technology", Indian Institute of Technology, New Delhi, India

Thomsan, G.A., and Jajodia, Shyam. (2004, Summer). "Commercial off-shelf enterprise resource planning software implementation in the public sector", *The Journal of Government Financial Management*.

Volkoff, O. (1999), "Using the structural model of technology to analyze an ERP implementation", Proceedings of Academy of Management '99 Conference,.

Yasin, R. (2005), "Federal ERP Market to Reach $7.7 B", *AMR Research,* Retrieved May 20, 2006, from http://amrresearch.com