

Investigation of Criteria for Selection of ERP Systems

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Abstract: The application and introduction of ERP systems have become a central issue for management and operation of enterprises. The competition on market enforces the improvement and optimization of business processes at enterprises to increase their efficiency, effectiveness, and to manage better the resources outside of the company. The primary task of ERP systems is to achieve the before-mentioned objectives. For this reason the selection of a particular ERP system has a decisive effect on the future operation and profitability of the enterprise, i.e. the selection phase is highly relevant step within the introduction and implementation stage of an ERP system. The issues that are worth investigating are the criteria applied at the decision. The qualitative correlation between the size of enterprises, market position, etc. and the applied selection criteria for ERP systems could be analyzed as to whether which criteria are made use of at multinational enterprises or at SMEs. Our research is grounded in a literature review and case studies of everyday practice related to introduction, implementation and roll-out of ERP systems and it tries to provide answers for the above raised questions.

1 INTRODUCTION

Surveys and practical experiences have shown that all areas of enterprise operation have been affected by cost savings including the IT related fields; the main business objectives are modified to increase the economic efficiency in spite of previous business goals. The economic crisis has resulted generally in dramatic impact on IT budgets at enterprises (Thompson, 2010).

In spite of the enduring economic and financial crisis, the introduction and adoption of ERP systems continues. We have investigated the trends in a small EU member country (Hungary) empirically and by publications related to business management and economics. There are clear tendencies that even the small and medium enterprises (SME) that had data processing systems which had been previously developed individually or tailored to the specific requirements started projects to buy ready-made or commercially available Off-the-Shelf (*COTS*) products on the market. The main reason is that the previously developed, legacy systems cannot comply with the recent requirements related to information processing, namely cost-efficiency, staffing level and other labor conditions.

We conclude that there are **individually developed** and **standard systems** within the industrial sector specific solutions.

In this paper, an **ERP system** (Enterprise Resource Planning) is understood as an enterprise-wide, comprehensive information system involving all information processing activities that covers the human resource, production, commercial, planning, inventory, material planning, management control and monitoring business processes by placing them into a unified framework.

In next sections, we analyze the phases of implementation process and providing some answers for the raised issues.

2 RESEARCH METHOD

The research approach as a *methodology* was twofold. We have grounded our investigation in BSc. / MSc theses that were created on ERP at a Hungarian College as students' research project. There was an *empirical* research on architectural approaches of subsidiaries belonging to international companies and operating in Hungary (ELTE, 2010). The research was carried out by a consortium of

Hungarian Universities and Colleges. Beside companies situated in Hungary, the investigation covered practice of ERP introduction at several German companies either based on publications or *in-depth interviews* with managers responsible for ERP systems. There was a comprehensive literature review related to ERP introduction and implementation that we will discuss in detail.

3 CONCEPT OF ERP SELECTION

ERP selection is an important decision making problem of organizations and influences directly the performance. There are a lot of ERP alternatives in market (Wei, 2004). The failure in selection of ERP system firstly leads to the failure of ERP introduction or adaptation project or secondly to degradation of company performance (Liao, 2007).

Several research studies have been conducted to identify relevant factors having impact on success of implementation and introduction at ERP systems. The major part of studies have chosen the case study paradigm, i.e. many of them focused on single case study of "how we implemented ERP systems in our company" (Ang, 1995); (Bingi, 1999); (Mandal, 2002); (Wilson et al., 1994); (Yusuf, 2004). Furthermore, several studies that have measured ERP implementation success used only one or two factors of ERP implementation success (Ang, 1995, 2002); (Malbert, 2003); (Umble, 2003).

The literature research shows that problems with the implementation of ERP systems emerge for a number of reasons. We can summarize briefly the reasons as follows: (1) Generally there is a need for business process change or re-engineering for fitting together the business processes and information processes of an ERP system. Leaving out the required business process alignment could lead later operational problems. (2) Lack of commitment from top management, deficiency in data accuracy, and short of user involvement can attribute to system implementation failures appearing typically during the operation phase. (3) Education and training to make use of ERP system are frequently underestimated and are given less time due to schedule pressures. (4) The synergy demanded by cross-functional business processes are not understood properly.

There are competing measurement approaches and concepts coming from research literature and practice. Some factors that can be encountered in the literature: (1) User satisfaction (Al-Mashari, 2003); (Anget, 1995; 2002); (Mandal, 2002); (Yusuf,

2004). (2) Intended business performance improvements (Al-Mashari, 2003); (Hong, 2002); (Mandal, 2002); (Markus et al., 2000); (Yusuf, 2004). (3) On time (Al-Mashari, 2003); (Hong and Kim, 2002); (Malbert, 2003). (4) Within budget (Al-Mashari, 2003); (Hong 2002); (Malbert, 2003). (5) System acceptance and usage (Ang, 1995; 2002); (Yusuf, 2004). (6) Predetermined corporate goals (Al-Mashari, 2003); (Umble, 2003); (Yusuf, 2004).

4 PHASES OF ERP INTRODUCTION

The reason why a decision may have been made to replace an operational system by an ERP solution can be concluded from several basic causes. One of the origins for such a decision is that the enterprise would like to save or strengthen its market position through acquisitions or internal growth. The IT/IS system can be adjusted to these changes flexibly if there is a "quantum leap" in IS service quality by introducing an ERP system considered as a "best practice" in the industry sector. The other important factor is the competition on the market. Beside the market competition there are other coercive requirements to optimize and to increase performance in enterprise governance and information processing.

The samples coming out of practice demonstrate that the introduction and application of ERP is a longstanding process (Feuchtinger, 2008). There is a seven phase model for ERP introduction: proposal for changeover, analysis, conceptual plan, short listing the potential solutions, selection process, decision for the designated one, and project closure (Zimmermann, 2010).

4.1 Modernization of Operational System

The companies frequently encounter a decision situation how they can modernize existing data processing system. There are three different ways: *development*, *package procurement* and *renting or leasing* the ERP services.

At the beginning it is difficult to decide whether a program package as COTS (Commercial off-the-shelf) should be procured or a vendor should be found to develop a customized solution and who can adapt its basic system to the company's requirement. The decision is hard as the package solution cannot cover all business processes at the enterprise. A

developed system may comply with requirements and it can be tailor made for specific business processes; however it requires more resources (Ayağ, 2007).

Before the decision between the package *solution* and *development*, an analysis should be carried out on potential solutions then after the analysis a management decision could be made.

The third opportunity is *renting* or paying a fee for all or some services of an ERP system. Most recently, the **ASP (Application Service Providing)** is an appropriate, cost-effective solution for micro and small enterprises. The software as a service can be accessed through the **Cloud Computing**.

4.2 Decision Making on the Introduction of an ERP Solution

The question emerges whether what the factors are that lead companies to consider replacing the operational legacy system fully or partially with a new information system.

A Hungarian Ltd. decided to adopt an ERP (ProFinance™) system, their justification contained three items on the grounds of the underdeveloped, legacy information processing system: (1) The rapidly developing enterprise owned old, legacy information processing system that did not cover all business processes. For this reason, the introduction and implementation of a more modern enterprise management system became the must. (2) In the region, the other, concurrent companies have adopted and will have implemented various management systems gaining competitive advantage. (3) There is intention to develop and to extend the retail branch of the enterprise. For this reason, the new information system should have a steady and reliable on-line connection between the retail shops and the wholesale units.

A company from Netherland had an AS/400 based system named TOTICS and had operated for 20 years. The question “Whether does the company need a new information system and if the answer yes then why?” has been responded as it follows: (1) The new system is pre-condition to realize the business strategy plan; (2) The new IS provides higher reliability and service level for customers; (3) Within the business group, the objective is to increase efficiency and to make more transparent the business processes; (4) The system should support the business planning and consequently the cost-efficiency and serving the consumers; (5) The new IS creates the opportunity for an integrated system. (Tóth, 2008).

The subsidiary of a multinational oil company in Hungary used to employ JDE (J.D. Edwards) ERP system. The company has roughly 100 subsidiaries world-wide and they had applied a wide variety of ERP systems. The company decided to eliminate the heterogeneity of systems. The enterprises wanted one integrated solution. Considering the opportunities, the top management of multinational company made the decision for a project called Global SAP, GSAP project (Kulcsár, 2008). The Dutch company settled to introduce SAP R/3 as well.

In one of our empirical research, we have met the following approach (ELTE, 2010); (Molnár, 2011): some business administration functions are centralized at some regional headquarters as e.g. invoice processing and payment. The customization primarily meant specific parameters that reflect the country specific legal environment. Consequently, a business function is covered totally by a single ERP module introduced during the changeover.

4.3 Objectives of ERP Selection and Practical Approaches

The difficulties in selection of ERP system did not originate from the fact that too few ERP systems is available on market, in spite of it there are multitude of ERP systems. There are hundred vendors beside the major players in Germany (Grandjean, 2010). The primary vendor selection could be based on the market position within the specific ERP sector. (Meyer, 2011).

The investigation of potential ERP solution should take into account business and financial consideration beside the information technology viewpoints (e.g. software and programming environment, information system function etc.). A Hungarian Ltd. had as selection goals for ERP the following criteria: (1) The system supplier should be a *domestic* vendor, the vendor should commit itself for satisfying the users’ request for change; (2) User friendly system, easy handling of user interface and ability for customization; (3) Capability for *integration* and *interoperation* with other systems; (4) The IT *stability* of IS should be high. (Csete, 2008)

4.4 Business Case

One of the major objectives during ERP selection is to mitigate the risks inherent in the selection process. Besides the business and technical criteria and risks there are financial ones too. Evaluation methods

include Net-Present-Value, Cost–Benefit Analysis, Payback, Return on Investment, etc. To assess the financial parameters one of the analysis models is the ROI (Return on Investment) that can be applied.

There is an elaborated method that consists of several hundred questions. However, the extensive questionnaire does not solve the problem deriving from lack of information at stakeholders. There is a dearth of reliable information on the following subjects (Gronau, 2010): (1) Knowledge of the actual functions within the ERP system; (2) The applied software and –generally – information technology; (3) The market position, the economic capability, viability of the potential vendor; (4) The comprehensive view of the alternative, competing solutions existing on market; (5) The potential improvement of information processing; (6) The comparative analysis of references for alternative solutions and their implemented instances. ROI is a good compromise for assessing the financial risks of an ERP adaption process and other socio-technical viewpoints. (Lindemann, 2007).

The comparison of the potential alternatives as procuring, renting, leasing or paying per usage for services through Cloud Computing can be carried out by TCO approaches. At a Hungarian Ltd. the TCO model was employed to analyze the costs for introduction and operation (Csete, 2008).

4.5 Soft Criteria for Selection

Besides the service quality and financial criteria, there are lots of other objectives that should be taken into account during the selection process. The compliance to the requirements of the company is one of the most important criteria. To clarify and to define accurately the compliance criteria, a business process modeling exercise should be carried out to discover and to map the whole business process that will be involved in the ERP introduction. To explore the discrepancies between the existing processes and the processes of potential ERP systems, a *gap analysis* should be performed. T

The new ERP system may fulfill the recent requirements; however the ERP system should be prepared for future demands (Lotto, 2006). The *stability* of information systems means the adaptability to changes of technology, business processes and business environment.

The experiences shows that if the set of functions to be automated is minimized for several reasons – financial, compliance, project timing, resources etc. – then later on, the enhancement and evolutionary development to react to the changing environment

may cause extra costs and other operational difficulties as against of maximization of set of functions for automation (Grandjean, 2010).

The flexibility of ERP systems is a success criterion within the corporate and SME world (Feuchtinger, 2008). In this context, the *flexibility* is an overarching concept that involves the simultaneous use of various languages carrying out even the same task, at the same time, furthermore adaptation to the changing business and market environment. The top management at the center of enterprises has various opportunities to find a satisfactory solution among the potential ERP systems (ELTE, 2010); (Molnár, 2011). The concrete implementation is situated in the centralization-decentralization continuum - both horizontally and vertically according to the Zachmann architecture - to provide the support that is required the top management of enterprises.

Other uncertainty factor is the structure of business processes and organization and the capability for adjustment to the processes provided by an ERP system. The ERP system adaptation and transformation of business processes has as outcome a solid market position. The ERP system adaptation may have as a side-effect stronger market position, efficient internal business processes and a profound transformation of whole activities in the enterprise.

On selecting an ERP system to support globalized business activities, so-called country specific features should be taken into account. Such features include as follows: Custom and excise handling; Tax, revenue handling; Commercial code; Financial and cost accounting; Banking, rules for bank accounts; Local legal environment, jurisdiction.

The potential ERP system may or may not contain the above listed, country specific features. The required customization needs extra implementation effort generally.

Some examples for the difficulties that occurred (Contini, 2010): Country specific, compulsory Chart of Account (Belgium); Accounting the transfer prices (Brazil); Handling and accounting the billing credit (Bulgaria); Country specific Payroll (Chile).

5 FUTURE RESEARCH DIRECTIONS

The future research should deal with the changing IT environment, especially the proliferation of *Cloud Computing*, the Software as a Service (SaaS), the application as a service, namely the ERP system

Table 1: Factors effect on ERP implementation.

Factors effect on ERP implementation	Occurrence in case studies						
	weak positive impact	average positive impact	strong positive impact	Neutral	average negative impact	weak negative impact	strong negative impact
Top management support	8	5	6	6	2	3	3
Company-wide support	8	5	4	4	4	4	4
Business process reengineering	1	2	6	6	6	6	6
Effective project management	7	7	7	3	3	3	3
Organizational culture	1	2	4	4	9	6	7
Education and training	2	7	12	3	3	3	3
User involvement	1	2	6	6	6	6	6
User characteristics	2	3	7	3	3	7	8
ERP software suitability	8	8	12	2	1	1	1
Information quality	8	8	12	2	1	1	1
System quality	8	8	12	2	1	1	1
ERP vendor quality	2	8	12	7	1	2	1
Total :	56	65	100	48	40	43	44

services. in this situation, it will be worth investigating how the notion of asp (application service provider) changes and what the particular features may have regarding the erp services.

6 CONCLUSIONS

The multiple case studies and financial analysis models presented in this paper provide assistance for the decision making processes at enterprises where the changeover issue is reviewed.

The results of research can be summarized in a table as a conclusion (Table 1). The assessment of each single factor (Table 1.) is grounded in working up the in-depth interviews, BSc. / MSc theses and other reports, overall 40 companies were involved in the research.

The project management during implementation and introduction typically followed the traditional pattern, the disciplined project controlling and efficient team organization was a pre-condition of success. The commitment from the top management considered generally a crucial aspect along with a comprehensive support from personnel of the organization.

The result of re-engineering is evaluated by stakeholders with mixed feelings. Nevertheless, the education and training is regarded as having positive influences on the final success of ERP implementation. The user characteristics and education are intimately related so that the technical and business skill of staff contributes to the success of projects. The high level of information quality at the customer organization makes easier the introduction of ERP system as the organization has

been already accustomed to provide accurate, timely, reliable and consistent data.

The ERP vendor quality appears in the form of services that are provided together with ERP system implementation and long-term operation. These services includes response time of help desk; knowledgeable consultants with experiences in both enterprise's business processes and information technology including vendor's ERP system. The participation and support of vendor's consultant in implementation and introduction is a significant factor. The services provided by consultants can be characterized by the level of knowledge in both customer's business processes and functions of the particular ERP system.

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