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Total Cost of ERP Systems Implementation in Danish, Slovak and Slovenian Companies

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ABSTRACT

Implementation of enterprise resource planning (ERPs) systems is probably the most laborious and rather costly part of the ERP system life-cycle. In the paper, we provide a percentage structure of total cost of implementation (TCI) from the end-user company's perspective. Having a grasp over TCI should be of interest to companies planning to implement ERP systems, since literature suggests that TCI can be three to five times higher than the software license alone. TCI is, in this paper, split into the following four parts: software license, programming of changes, organizational implementation, and hardware costs. ERP systems used to be a domain of large companies but at the moment, there is a still increasing number of small and mid-sized enterprises (SMEs) adopting them as well. Impact on individual parts of TCI of: company size, country, existence of formal information strategy, and IT department representation on the board level is analyzed. According to our data collected in Denmark, Slovakia, and Slovenia, the percentage spent on software license depends on company size, there is a significant difference between mid-sized and large companies, mid-sized companies spend about 45 %, while large companies spend only about one third of the TCI on software license. Probably an even better interpretation is that large compared to mid-sized companies spend much more on other parts of TCI. Programming of changes involves about 21 % and organizational implementation about 19 % of TCI regardless of our observed independent variables. The percentage of hardware costs on TCI depends on the country and on representation of the IT department on the board level. The percentage is lower in Denmark (10 %) than in Slovakia (24 %) and Slovenia (22 %); it is higher in companies with representation of the IT department on the board level (26 %) than in ones without (18 %).

Keywords: enterprise resource planning (ERP) systems, total cost of implementation, empirical research

1. INTRODUCTION

In order to be more efficient, many companies rely on extensive use of IT, often by installing enterprise resource planning (ERP) systems. (Olsen, and Sætre, 2007) The ERP system is an integrated set of programs that provides support for core business processes, such as production, input and output logistics, finance and accounting, sales and marketing, and human resources. An ERP system helps different parts of an organization to share data, information to reduce costs, and to improve management of business processes (Aladwani, 2001). According to Wier, Hunton, and HassabElnaby (2007), ERP systems aim to integrate business processes and ICT into a synchronized suite of procedures, applications and metrics which goes over firms' boundaries.

The implementation of an ERP is known to be a costly (and timely) undertaking. (Olsen, and Sætre, 2007; Jacob, and Wagner, 1999; Reda, 1998) A current review of Web of Science articles discussing selection criteria of ERP systems uncovered that price in the broad meaning of the word cost (cost of ownership, total costs, system cost, software costs, price affordability, average cost of packages, estimated cost of implementation) is the most frequently mentioned ERP system selection criterion (e.g. in (Ayağ, and Özdemir, 2007; Bueno, and Salmeron, 2008; Fisher, Fisher, Kiang et al., 2004; Keil, and Tiwana, 2006; Lall, and Teyarachakul, 2006; Rao, 2000; Umble, Haft, and Umble, 2003; Wei, Chien, and Wang, 2005; Yang, Wu, and Tsai, 2007). Total cost of implementation (TCI) can easily be three to five times the purchase price. The paper provides a percentage TCI structure from end-user company's point of view.

The paper is based on the questionnaire research conducted in Denmark, Slovakia and Slovenia. Denmark and Slovakia have a similar number of inhabitants (2007 mid-year population of Denmark was 5,468 mil. and 5,448 mil. of Slovakia), there were only 2,009 mil. inhabitants of Slovenia. Gross domestic product per hour in 2007 EKS$ was 44,46 in Denmark, 27,90 in Slovakia and 32,53 in Slovenia. The Networked Readiness Index (NRI) is a measure of the propensity of countries to exploit the opportunities offered by information and communications technology (ICT). The NRI tries to comprehend the impact of ICT on the competitiveness of nations. The NRI is a composite of three components: the environment for ICT offered by a given country or community, the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT, and the usage of ICT amongst these stakeholders. According to NRI 2006–2007 rankings (World Economic Forum, 2007), Denmark is the first with a score of 5,71, Slovakia 41st with a score of 4,15, and Slovenia 30th with a score of 4,41.

2. TOTAL COST OF IMPLEMENTATION

The most obvious part of TCI are license fees but according to Bingi, Sharma, and Godla, (1999), TCI could be three to five times the purchase price of the software, so it should be of interest to academics and professionals to have a grasp of the remaining part of TCI. According to Bingi, Sharma, and Godla, (1999), the cost of hiring consultants and all that goes with it can consume up to 30 percent of the overall budget for the implementation. The implementation costs would increase as the degree of customization increases. A review of existing literature on ERPs such as (Botta-Genoulaz, Millet, and Grabot, 2005; Esteves, and Pastor, 2001; and Shehab, Sharp, Supramaniam, and Spedding, 2004) shows that the main problem is the misfit between ERP functionality and business requirements. This also supports the need for customization.

These two estimates , the percentages of software license and consultant costs, are presented by Bingi, Sharma and Godla in 1999, and they have not published any newer estimates since that (Bingi, Sharma, and Godla, 1999). Since it would be better to have a more recent estimate at hand, we looked into

articles, which cited (Bingi, Sharma, and Godla, 1999). The rationale was that if somebody conducted a TCI survey, they might refer to (Bingi, Sharma, and Godla, 1999) in their references. Bingi, Sharma and Godla, (1999) was, according to EBSCO, cited 49 times in Business Source Complete database. But reading the 42 articles (Aloini, Dulmin, and Mininno, 2007; (Amoako-Gyampah, and Salam, 2004; Basoglu, Daim, and Kerimoglu, 2007; Bendoly, and Schoenherr, 2005; Blackwell, Shehab, and Kay, 2006; Bozarth, 2006; Brown, and He, 2007; Cagliano, Caniato, and Spina, 2006; Chang, Wu, and Chang, 2008; Dillard, and Yuthas, 2006; Ehie, and Madsen, 2005; El Amrani, Rowe, and Geffroy-Maronnat, 2006; Fuß, Gmeiner, Schiereck, and Strahringer, 2007; García-Sánchez, and Pérez-Bernal, 2007; Guo, and Sun, 2004; He, 2004; Ho, Wu, and Tai, 2004; Huang, Chang, Li, and Lin, 2004; Ifenedo, 2007; Karimi, Somers, and Bhattacherjee, 2007; Lee, Siau, and Hong, 2003; Light, and Wagner, 2006; Loh, Koh, and Simpson, 2006; Motwani, Subramanian, and Gopalakrishna, 2005; Nah, and Delgado, 2006; Pan, and Jang, 2008; Park, Suh, and Yang, 2007; Park, and Kusiak, 2005; Peslak, 2005; Peslak, 2006; Peslak, Subramanian, and Clayton, 2007; Sarker, and Lee, 2003; Solis, Putnam, Gemoets, Almonte, and Montoya, 2006; Somers, and Nelson, 2004; Wang, and Chen, 2006; Wang, Klein, and Jiang, 2006; Wang, Ying, Jiang, and Klein, 2006; Wu, and Wang, 2006; Wu, and Ong, 2008; Wu, Ong, and Hsu, 2008; Yusuf, Gunasekaran, and Wu, 2006; Zhang, Lee, Huang, Zhang, and Huang, 2005) and 7 abstracts (Jones, and Young, 2006; Kositanurit, Ngwenyama, and Osei-Bryson, 2006; Law, and Ngai, 2007; Lui, and Chan, 2008; Ma, and Loeh, 2007; Nah, Islam, and Tan, 2007; Tsai, Fan, Leu, Chou, and Yang, 2007) only brought up two additional estimates. The article by Karimi, Somers, and Bhattacherjee (2007) cites Sheer, and Habermann (2000) that states that "consultants are most often used as implementation partners at two to ten times the cost of the ERP software for the initial implementation". The cited article, i.e. (Sheer, and Habermann, 2000), was published in 2000 (i.e. shortly after (Bingi, Sharma, and Godla, 1999), and in our opinion, the interval (i.e. consultants account for two to ten times of software license) is too wide, so it was not used for testing. The second article Ehie and Madsen (2005) cites Mabert, Soni, and Venkataramanan (2001a), which provides the estimates presented in Table 1.

Table 1. ERP System TCI Structure published in Mabert, Soni and Venkataramanan (2001a)

Cost Category	Average
Consulting	30 %
Hardware/Infrastructure	25 %
Implementation Team	15 %
Training	15 %
Software	15 %

The percentages in Table 1 are from 2001, so we checked 12 EBSCO articles (Bergström, and Stehn, 2005; Botta-Genoulaz, and Millet, 2006; Dery, Grant, Harley, and Wright, 2006; Grant, Hall, Wailes, and Wright, 2006; Jasperson, Carter, and Zmud, 2005; Kim, 2006; Mabert, Soni, and Venkataramanan, 2003; Mabert, Soni, and Venkataramanan, 2001b (only abstract); Martin, and Huq, 2007; Venkatesh, Brown, Maruping, and Bala, 2008; Wyk, 2004; Xue, Liang, Boulton, and Snyder, 2005), which cited (Mabert, Soni, and Venkataramanan, 2001a). But none of them contained any estimates regarding ERP system TCI structure.

TCI is, for purpose of this paper, split into the following four parts: software license, programming of changes, organizational implementation, and hardware costs. The phrase "programming of changes" is used instead of the term "customization" because in SAP terminology "customization" means

"parameterization", i.e. modifying the ERP system through settings, not through a modified/added code. Therefore, the term "customization" will not be used in the text from now on.
ERP systems used to be a domain of large companies but there are a still increasing number of small and mid-sized enterprises adopting them as well. There are some reasons for this trend, including a saturation of the market, as most large organizations have already implemented an ERP system, increasing possibilities and need for the integration of systems between organizations and the availability of relatively inexpensive hardware (Gable, and Stewart, 1999). Therefore, the article discusses impact of company size on individual parts of ERP system TCI.
Besides company size, influence of the country, existence of formal information strategy, and representation of the IT department on the board level on individual parts of TCI is analyzed.

3. DATA AND METHODOLOGY

The questionnaire research was conducted in May and June 2007. Questionnaire forms accompanied by cover letters were mailed to randomly selected companies in Denmark, Slovakia and Slovenia. Lists of addresses and information about the number of employees were retrieved from CD-Direct in Denmark, and from respective Statistical Bureaus in Slovakia and Slovenia. In each country, 600 questionnaires were sent to small, 300 to medium enterprises, and 300 to large companies. The number of questionnaires mailed to small companies was double the number of medium and large companies because small companies constitute the highest proportion of companies and based on our personal experience, they are less likely to respond. In total, there were 223 responses (21 from Denmark, 112 from Slovakia, and 90 from Slovenia); 112 of them (13 from Denmark, 50 from Slovakia, and 49 from Slovenia) replied to all questions needed for the analysis presented in this paper.
Dependent variables are software license, programming of changes, organizational implementation, and hardware costs. They are measured in percent.
Independent variables are country, company size, representation of the IT department on the board level and information strategy. The questionnaire research was conducted in Slovakia and Slovenia. Analyzed are small, mid-sized and large companies, where companies from 10 to 49 employees are considered to be small enterprises, companies from 50 to 249 employees are considers to be mid-sized enterprises, and companies with 250+ employees are considered to be large enterprises. This classification is compatible with (European Commission, 2008). Information strategy stands for formal information strategy and representation of the IT department on the board level means that there is a chief information officer (CIO) or alike director for IT represented at the board level.
The research model is presented in Figure 1.

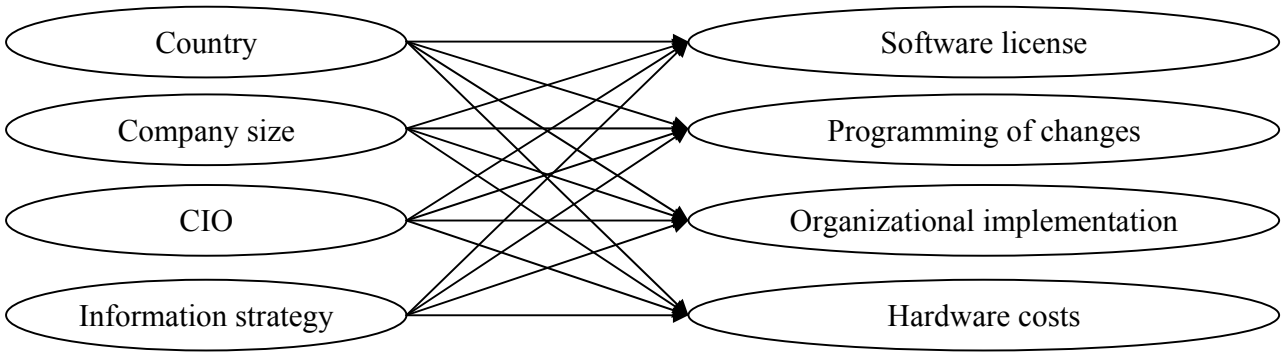


Figure 1. Research model

Analysis of variance (ANOVA) is used to test impact of independent variables on dependent variables; a multivariate approach is used. In addition to that, t-test is used to test whether software costs are 15%, as suggested by Mabert, Soni, and Venkataramanan (2001a), or fall within one fifth and one third of TCI, as suggested by Bingi, Sharma, and Godla, (1999); whether organizational implementation accounts for 30% or less of TCI, as suggested by Bingi, Sharma, and Godla, (1999); and whether hardware costs equal to 25%, as suggested by Mabert, Soni, and Venkataramanan (2001a). Results are commented on confidence level $\alpha = 0,05$.

4. RESULTS

We conducted ANOVA of collected data on percentage of software license, programming of changes, organizational implementation, and hardware costs on ERP system TCI. It would be non-trivial to present the outcomes in a research model like in Figure 1, so we rather use provide results in Table 2.

Table 2. Relation between dependent variable and independent variable and their p-values

Dependent variable	Independent variable	P-value
Software license	Country	0,230
	Company size	**0,027**
	CIO	0,895
	Information strategy	0,796
Programming of changes	Country	0,203
	Company size	0,522
	CIO	0,304
	Information strategy	0,445
Organizational implementation	Country	0,128
	Company size	0,321
	CIO	0,190
	Information strategy	0,272
Hardware costs	Country	**0,022**
	Company size	0,670
	CIO	**0,008**
	Information strategy	0,699

Percentage of software license on TCI depends on the company size (p-value = 0,027), it is higher in mid-sized than in large companies. Impact of the remaining independent variable was not found significant (p-values were higher or equal to 0,230).

There was no significant relationship found that would influence percentage of programming of changes on TCI (p-values were higher or equal to 0,203), nor percentage of organizational implementation on TCI (p-values were higher or equal to 0,128).

Percentage of hardware costs on TCI depends on the country (p-value = 0,022), the percentage on hardware costs is lower in Denmark than in Slovakia and Slovenia; and on representation of the IT department on the board level (p-value = 0,008), the percentage on hardware costs is higher in companies with CIO. Impact of the remaining independent variable was not found significant (p-values were higher or equal to 0,670). The reason for difference in hardware costs may be explained by CIOs

planning hardware for future, while companies without CIOs trying to increase return on investment by minimizing investments into hardware.
Table 3 offers actual percentages of ERP systems TCI in a framework based on the ANOVA results.

Table 3. ERP System TCI Structure (in %)

		Average
Software license	Small	43,15 %
	Medium	45,00 %
	Large	33,42 %
Programming of changes		20,85 %
Organizational implementation		18,54 %
Hardware costs	Denmark	10,31 %
	Slovakia	23,98 %
	Slovenia	22,32 %
	With CIO	25,65 %
	Without CIO	18,31 %

The least percentage of TCI on hardware was spent in Denmark. This could be because of a higher wages in Denmark than in Slovakia and Slovenia, which made the other three parts of TCI relatively more expensive and hardware relative cheaper in Denmark. Assuming that similar ERP systems are used in all three countries, assuming that these systems require the same hardware regardless on the country, and assuming that market equalizes the prices of that hardware on all the markets, one might want to look into the TCI structure without hardware costs.
In this case, percentage of software license on TCI depends on the company size (p-value = 0,049), it is higher in mid-sized than in large companies. Impact of the remaining independent variable was not found significant (p-values were higher or equal to 0,084).
There was no significant relationship found that would influence percentage of programming of changes on TCI (p-values were higher or equal to 0,328), nor percentage of organizational implementation on TCI (p-values were higher or equal to 0,184).
In both cases, there were significant differences in TCI structure in percentage spent on software license. So, it can be generalized that the main difference is in how much more spend companies of different sizes in addition to the software license, i.e. on programming of changes and on organizational implementation.
Bingi, Sharma, and Godla, (1999) suggest that the software license part of TCI is one fifth to one third. Percentage of software license on TCI in medium companies is significantly higher than 1/3,i.e. also than 1/5 (p-value = 0,018); there was no significant difference found in small (p-value = 0,081) nor large companies (p-value = 0,969).
According to Mabert, Soni, and Venkataramanan (2001), the average percentage of the software license on TCI is 15 %. There is a significant difference between 15% and the actual percentage spent on software license in small, mid-sized and large companies (p-value < 0,001 for each group). Companies of different sizes, from our sample, spent much more than 15 % of TCI on software license.Bingi, Sharma, and Godla, (1999) state that the percentage of organizational implementation on TCI is less than 30%. Our findings are consistent with this statement.
According to Mabert, Soni, and Venkataramanan (2001), the percentage of hardware costs on TCI is 25 %. We found that the percentage of hardware costs depends on two factors – on representation of the IT department on the board level and on the country. Therefore, we compare the estimate of 25 % to our

companies grouped by these two factors. There is no significant difference between 25% and the percentage acquired from our companies with representation of the IT department on the board level (p-value = 0,808). But there is a significant difference between 25% and the percentage of TCI spent on hardware in companies with representation of the IT department on the board level (p-value < 0,001). Regarding the countries, there is a significant difference between 25% and the percentage of TCI spent on hardware in Danish companies (p-value < 0,001). No significant difference in hardware is found between 25% and Slovak and Slovenian companies (p-value = 0,709 and 0,197 respectively).

5. CONCLUSIONS

Although off-the-shelf concept of ERP systems might imply that software license is the only implementation cost, the actual cost of implementation, according to our findings, can be two to three times the price of software license (according to Bingi, Sharma, and Godla, (1999), it was three to five times the software license a decade ago). Besides software license, the research conducted in Danish, Slovak and Slovenian companies has looked into costs related to programming of changes, organizational implementation, and hardware.

While small and large companies fit into the interval suggested by Bingi, Sharma, and Godla, (1999) for software license, the percentage in mid-sized companies was significantly higher. The estimate of 15 % coming from Mabert, Soni and Venkataramanan (2001a) does not hold for neither company size.

When it comes to hardware costs, it seems that companies with representation of the IT department on the board level spend about 25,5 %, i.e. compared to 18,5 % in companies without the representation, 7 percentage points more. The percentage suggested by Mabert, Soni, and Venkataramanan (2001a), i.e. 25 %, holds only for hardware costs in companies with representation of the IT department on the board level. The probable reason is that companies with representation of the IT department on the board level plan hardware for future (so they are sure that they will not need to upgrade it in the near future), while companies without representation of the IT department on the board level try to increase return on investment by minimizing investments into hardware.

When hardware is excluded from TCI, the only statistical difference between mid-sized and large companies is in how many percent they spend on software license.

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