

# ERP SYSTEMS IMPLEMENTATION: FACTORS INFLUENCING SELECTION OF A SPECIFIC APPROACH?

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## Abstract

*Implementation, in the form of deployment, of enterprise resource planning (ERPs) systems is both complex and costly. Implementation of ERPs could be done in different ways, in this paper we categorize these different ways into three different approaches for implementation of ERPs: slow phased, pilot project and big bang implementation. An interesting question to investigate is then if and how different factors influences actual selection of approach for implementation. In order to do so the paper discusses five factors: growth, organizational size, IS/IT strategy, CIO, and country, could be seen as influential on which implementation approach an organization may choose. The discussion is made from a survey investigation conducted in Slovakia, Slovenia and Denmark using the categorization of implementation approaches. From the investigated factors, on how they influence the selection of implementation approach, some conclusions can be drawn and some further research directions are presented. The main conclusion from the analysis is that there is no clear significant relationship between the suggested factors and the selection of implementation approach. However, despite that the analysis give indications on some interesting findings, for instance there are indications that whether the organization have an IS/IT-strategy or not influence which approach that are selected. The same can be said about whether the IS/IT department have presence or not in the board of the organization. So, the main conclusion is that occurrence of an IS/IT strategy and whether the IS/IT department have presence in the board influences the selection while growth, organizational size, and country do not seem to influence selection of a specific approach. Further research is needed to better explain these findings.*

**Keywords:** Implementation, Enterprise resource planning system (ERPs).

# ERP SYSTEMS IMPLEMENTATION: FACTORS INFLUENCING SELECTION OF A SPECIFIC APPROACH?

## Introduction

Implementation of enterprise resource planning (ERPs) systems is an endeavour that is both complex and costly (Davenport 1998). One reason for the complexity in implementation of ERPs could be related to the basic idea of ERPs. The basic idea of ERPs could be described as an ERP paradox, being a software package at the same time as it should be adjusted to the implementing organizations specific business processes. It can be said that this paradox results in problems that come from the fact that ERPs aim at being a standard software package at the same time as it aims at being a unique resource in its usage in different organizations. The problem also comes from the fact that ERPs, in most cases, have a development chain that consists of at least three parties – the developer, the distributing partners, and the user organization – and it can be stated that all three of these are involved in the implementation of ERPs. However, enterprise resource planning systems (ERPs) is software that aims at integrating “all” departments in an organization (Bernroider et al. 2005) and thereby improve co-operation and interaction in the organization by integrating the entire value chain in an organization (Lengnick-Hall et al. 2004; Rolland et al. 2000). A key issue in ERP implementation is how to secure alignment between the selected ERP system and the organization’s business processes (Luo et al. 2004). The attention ERPs have received and that still receive exists have, according to Atoji (2007), made ERPs moving out from the old factory building and now attracts other types of organizations than strictly manufacturers. It can also be said that it is not only a specific type of organizations that find ERPs as attractive, it is also in focus of small and medium sized enterprises (SMEs) at the moment. Implementation of ERPs in SMEs has specific problems since most often the SMEs do not have the same possibility to dedicate resources specific for the implementation (Atoji 2007). Another difficulties for SMEs is the huge variations of functionality in ERPs and it can be assumed that SMEs do not use a lot of functionality, but they need the right functionality (Atoji 2007).

In the paper, we report results from a questionnaire study conducted between May – July 2007. The questionnaire was submitted to executives in randomly selected companies in Denmark, Slovakia and Slovenia. This study uses the results from collected answers to the questionnaire to discuss if and if so in what way different factors influence selection of a specific approach when organizations implements an ERP system. The specific questions discussed in the paper are: What makes an organization select a specific approach when implementing ERPs? And in what way do specific factors influence selection of a specific approach when implementing ERPs? In the investigation we have categorized implementation of ERPs as being possible to do in three different approaches: slow phased, pilot project and big bang implementation. These approaches were to some extent tested in a survey made by Bernroider and Leseure (2005). In their study they found a difference between small and medium sized enterprises (SMEs) and large enterprises (Les) when it comes to which implementation approach the organization use when implementing ERPs. This study aims at developing that finding further by investigating if we find size as a factor influencing selection of implementation approach, but also if four other factors are influential and if so, how they influence the selection of implementation approach. We also compare our findings to Palanisamy (2007), who conducted research in North American companies in 2006, and who investigated implementation approaches as well.

The rest of the paper is structured as follows. The next section describes the study conducted and defines the basic concepts used. This is followed by section three that describes and discusses the results from the survey in relation to the questions asked. This is then followed by the final section which gives some

conclusions possible to draw from the results and gives some direction for future research about selection of implementation approach related to implementation of ERPs.

## **Implementation of ERPs**

In the paper, implementation is defined as the way how organizations systematically integrate ERPs into the specific organization. This can be done in different ways and that is what we mean with implementation approach. Implementation approach is defined as a systematically structured approach that aims at integrate selected ERP system into the workflow of an organizational structure ([http://en.wikipedia.org/wiki/Product\\_software\\_implementation\\_method](http://en.wikipedia.org/wiki/Product_software_implementation_method)) One way to distinguish between different implementation approaches is to look into changes in the organization and when these changes take place. This can be described as piecemeal versus concerted implementation (Robey et al. 2002). The difference between these is that in the piecemeal implementation the ERPs is implemented first and then changes in the organizations business processes are implemented. The concerted implementation approach means that ERPs are implemented and at the same time as changes in the business processes are implemented. These different approaches could be related to IT/IS strategy and it could be suggested that if the organization has a formalized IS/IT strategy that probably influences what ERP implementation approach that the organization select. It can also be related to business process reengineering (BPR) (Davenport 1993; Hammer et al. 1993) which has a clear focus on restructuring both the organizational structure as well as the used information system (IS) structure, and it can be stated that this makes the change from the earlier structure of legacy system complex. It is, therefore, interesting to see what influences organizations when they select a specific approach for implementation.

McGillicuddy (2007) states that there is a difference between size of the organization when it comes to the time it takes between the organization starts to implement an ERP to its implemented ERPs go live. The claim is that small businesses have a shorter time than mid-sized and large organizations. This statement builds on data presented in a report from the Aberdeen Group. In that report it is said that 86 % of small enterprises achieved their first go live milestone within the first year, in mid-sized enterprises the same happened in 64 % of the implementing enterprises and when it comes to large enterprises just 47 % of them reported that they experienced the first go live milestone within a year. The question is if this means that small organizations more often implement ERPs as a big bang approach and that the bigger the organization is, the more likely is a slow phased implementation approach.

In this study, we distinguish between three types of implementation approaches: slow phased, pilot project and big bang implementation. In the literature it exist two general approaches for how ERPs are implemented which were popularized in the mid-1990s (Mabert et al. 2003; Markus et al. 2000): (1) the “big bang” approach and (2) the phased implementation approach. The “big bang” is an implementation approach that means that the entire organization starts to use the new ERP at the same time. The big bang probably has been planned for a long time and the specific ERP have been adjusted and to some extent tested before the actual big bang, but, what happens is that the organization decides on a specific date for when the ERP should be taken into usage. When that specific day then comes data are transferred from the old legacy system and all users start to use the new system. This can then be compared to the phased implementation approach. The differences between these are that the phased means that some parts of the organization start to use the new ERP and after a while the next part starts to use it and so on. The phased implementation can be phased in different ways, it could be that, if the organization is situated at different locations, a specific location starts, or it could be that a specific user group starts and so on. The major difference between these two approaches is probably the time it takes. The big bang approach means definitely a shorter time for the roll-out in the entire organization. The phased implementation approach takes longer time, but it is not sure that it takes so much longer time from the first decision on adoption of a new ERP to the time it is in full use. It could be that the big bang implementation approach demands a longer time period for preparing before the big bang. However, it can be stated that although phased implementation is time consuming, it involves less risk compared to the “big bang” approach (Scott et al.

2000). Recent research has also revealed that the phased implementation tends to involve less reengineering efforts

Parr and Shanks (2000) state that there is a need to further describe implementation approaches into a taxonomy if being able to investigate ERP implementation. They suggest a taxonomy describing three different implementation approaches which they label: Comprehensive, Middle Road and Vanilla implementation. However, in our view this categorization is more related to earlier decisions such as deciding on what ERP package to adopt and/or deciding on if going for “best practices”. But the taxonomy suggested by Parr and Shanks have an interesting further categorization when they talk about characteristics related to each approach in the framework. The characteristics are: 1) physical scope, which means if implementation is made at several places, 2) BPR scope, which consider to what extent reengineering is considered, 3) technical scope, which is about to what extent the adopted ERP is modified, 4) module implementation strategy, considering two different strategies for implementation of ERPs modules, 5) resource scope, which is about the time and budget scope for the implementation. In this paper the most interesting characteristics from Parr and Shanks to investigate further is the module implementation strategy. What they state about this is that there exist broadly two different decision points in the module implementation strategy. The first decision is about whether the ERP should be implemented as a skeleton or with full functionality and the second decision is then if the implementation should be done module by module integration to legacy systems or all ERP modules implemented and then integrated to legacy systems (Parr et al. 2000). The latest described approach – all ERP modules implemented – can be compared to big bang implementation while the other one could be compared with phased implementation. Parr and Shanks state that phased implementation, is less risky, but more resource intensive, while the big bang implementation is precarious but a less time consuming option. According to Basoglu et al. (2007), big bang implementation creates adoption problems in the long run, and the reason they state for this is that organizations, when implementing big bang, spend less effort in adjusting the software and the organization to each other.

Because of the advantages of a phased implementation, it was of our interest also to figure out how exactly companies approach this issue and what it is that makes an organization select a specific implementation approach. This and the inspiration from (Bernroider et al. 2005) was the reason for splitting the phased implementation into slow phased-in implementation approach (one module at a time) and a pilot project implementing (one module followed by all other modules in one step). In a study conducted by Palanisamy (2007), in which four types of implementation approach were used, it was found that 28,6 % used big bang implementation, 61,5 % phased implementation, 5,5 % pilot implementation, 1,7 % parallel implementation, 1,1 % of organizations stated that they used other approach and 1,7 % did not respond to this question. Although one could try to divide big bang implementation into two, as e.g. (Madapusi et al. 2005) did, it could also confuse respondents. However, the basic question we ask is if selection of implementation approach is influenced by any specific factors. The factors that we investigated were: Growth, organizational size, IS/IT strategy, IS/IT division represented at the board level (i.e. presence of a CIO), and country. The rationality for choosing these factors are described in the next section, were we also describe research method and the study as such.

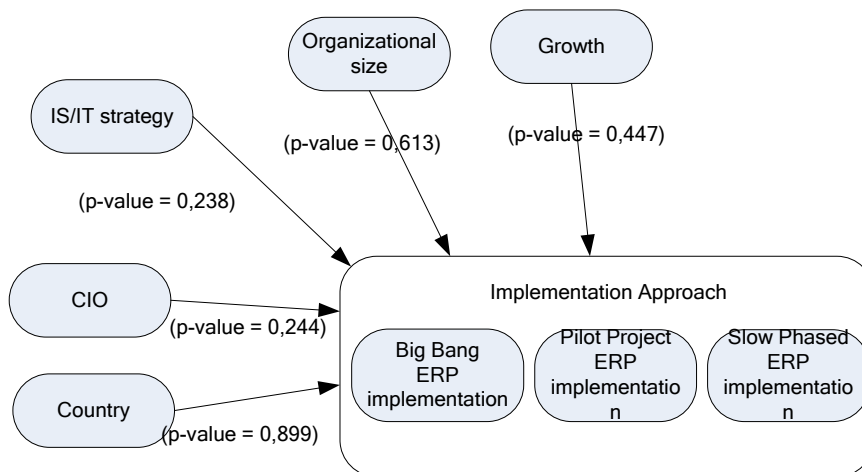
## **The study**

To investigate factors involved in selection of approach when implementing ERPs, we developed a questionnaire. The questionnaire was to a high extent influenced by Bernroider and Leseure’s (2005) study, and one reason for that was that we wanted to compare our results with their results. 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 Statistical Bureaus in Slovakia and Slovenia, and from a CD-DIRECT database in Denmark. In each country, 600 questionnaires were sent to small companies, 300 to midsized companies and 300 to large companies. The

number of questionnaires mailed to small companies was double the size of other organizational sizes 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). Unfortunately, only 144 respondents replied to all the questions, and that means that the results presented builds on the sample size of 144 companies (16 Danish, 64 Slovak and 64 Slovenian). Regarding the factor of growth only 130 companies answered that. It is not possible to estimate the return rate exactly, since companies were chosen randomly without any consideration to whether they have an ERP system installed or not.

In the paper, the most important question was the question related to implementation. This question was strictly formulated as: “Chosen implementation strategy?”. And the respondents were then supposed to choose one of the following options regarding how they have implemented their ERP: slow phased-in implementation approach – one module at a time; a pilot project implementing one module followed by all other modules in one step; big bang implementation of all ERP software modules. The options that the respondents had to choose from were defined as described above and that means that they are defined in the following way: 1) Slow phased-in implementation approach – one module at a time is implemented, 2) A pilot project implementing one module followed by all other modules in one step, and 3) Big Bang implementation of all ERP software modules at the same time.

The analysis of the data was then made from the factors described in Figure 1, which means that the following factors were used: growth, organizational size, IS/IT strategy, CIO, and country. The model suggests that the factors are influential on the selection of either of the implementation approach: slow phased, pilot project and big bang implementation.



**Figure 1 Research model, five factors and there relation to selection of implementation approach**

The first two factors were measured as intervals, since asking for a precise number might had decreased the number of responses. Growth, which was measured in the economic development of companies over the years 2004-2006, was divided into reduction in turnover, stable (i.e. zero growth), growth of 0-5%, growth of 5-10%, and higher growth than 10%. Organizational size measured (in number of employees) was divided into small (less than 50 employees), midsize (with 50-249 employees) and large companies (with 250+ employees). The other three factors were categorical. Respondents could only state whether their company has a formal IS/IT strategy or not, that IS/IT division is represented at the board level (i.e. there is a CIO). The country was Denmark, Slovakia or Slovenia. Data on organizational size and country were not a part of the questionnaire, since there was another reliable source for obtaining the same data.

From the model above, we are interested in relationships between the independent factors and the dependent variable – selection of implementation approach. Chi-square test was used to test relationship between selected implementation approach and independent variables, and to test whether our percentages are compatible with Palanisamy (2007), according to whom it is 28,6 % big bang, 61,5 % phased, 5,5 % pilot. Palanisamy (2007) allowed for three additional categories of answers (parallel approach (3 respondents), other (2 respondents), and missing (3 respondents)), we did not include these categories in our questionnaire. All tests are commented on confidence level  $\alpha = 0,05$  and the result of this is shown in Figure 1.

## **Motivating the factors and presenting results from the study**

In the study, the overall results of the question about selection of implementation approach are the following: 28,5 per cent said they used a slow phased implementation, 20,8 per cent used a pilot project for implementation, while 50,7 per cent used the big bang implementation. The result in our study shows a significant ( $p\text{-value} < 0,001$ ) difference between the percentages and results presented by Palanisamy (2007). The result of our study is as such interesting to compare with statements about the IT productivity paradox (Brynjolfsson 1993; Brynjolfsson 2003; Carr 2004; Hitt et al. 1996) and statements about the risk of big bang implementation (Parr et al. 2000; Scott et al. 2000). It is also interesting to think about software vendors and distributing partners when analyzing this. It can, definitely, be stated that the way ERPs are implemented, depends on the vendor's suggestion and since they suggest and provide tools for big bang implementation, it is not that strange that 50 per cent of implementation is done in that way. However, there could also be other factors involved and the rest of this section discusses some of these, starting with turnover growth.

### ***Growth***

The first factor to discuss is whether growth influences selection of ERP implementation approach, and if it does how. It can be said that growth not directly is connected to selection of a specific ERP implementation approach. Growth could be said is more a result of a specific approach especially since it, at least in this study, was asked about growth as economic development between 2004 – 2006, and not specifically before or after the actual ERP implementation. However, it could be interesting to analyze the data from the growth perspective since it could be assumed that an organization with high growth also had the high growth before the implementation. From this it could be stated that an organization with high growth is more responsive to changes in the market and therefore also more responsive to change existing information systems more rapidly which means that if implementing an ERP they do that more often as a big bang approach.

It can also be suggested that an organization that shows high growth is more risk devoted and therefore it could be assumed that high growth and big bang implementation goes hand in hand since big bang implementation is described as being more risky. The data about selected implementation approach and growth in organizations is presented in Table 1. In the questionnaire growth was described as economic development between the years 2004-2006

**Table 1 Relation between growth and selected implementation approach**

Influencing factor	Implementation approach		
	Slow phased	Pilot project	Big bang
Growth			
Reduction in turnover	40,00%	30,00%	30,00%
Stable turnover	24,00%	16,00%	60,00%
Growth of 0-5%	30,43%	21,74%	47,83%
Growth of 5-10%	41,67%	8,33%	50,00%
Growth of 10%+	22,92%	29,17%	47,92%

One interpretation of the data presented in the table, which could be described as the most interesting finding is that the most common implementation approach when organizations have experienced a reduction in turnover is the slow phased implementation approach. The opposite is then shown when it comes to growth of 10 per cent, here the most common used ERP implementation approach is the big bang. This is then in line with the statements above about an organization that is more risk devoted often shows a higher growth. It could also be related to adoption of new technology especially since it can be stated that new business opportunity comes from new technology. It is definitely of interest to do a follow up research on the subject of growth after ERP implementation and then relate the findings to what ERP implementation that were used.

### ***Organizational size***

In the questionnaire, there was no specific question about the size of the organization, this information was instead collected from other sources and linked to each response. The organizations were divided into the following size groups: large, midsized, and small using the measure of number of employees. This means that large is when the organization has 250+ employees, midsized 50-249 employees, and small when the organization has less than 50 employees. From the perspective of selection of ERP implementation approach the size of the organization is of interest. Our basic thoughts about this are that if it is a small organization then it would go for the big bang implementation, and the reverse would then account for large organization. The rationality for this statement would be that a small organization does not have so many users so it would therefore be easier to do a big bang implementation. In the large organization it would be more risky to do a big bang implementation and therefore would it be possible to suggest that slow phased ERP implementation is more often used. The result from the questionnaire related to organizational size is shown in Table 2.

**Table 2 Relation between organizational size and selected implementation approach**

Influencing factor	Implementation approach		
	Slow phased	Pilot project	Big bang
Organizational size			
Large	27,03%	17,57%	55,41%
Midsized	25,00%	27,78%	47,22%
Small	35,29%	20,59%	44,12%

There is no difference between large, mid-sized, and small organizations when it comes to which approach is most commonly used, and as shown in the table the most common used approach is big bang. However, percentage of big bang as used implementation approach decreases when the size of

organization increases. This means that percentage of slow phased implementation is higher in small organizations than it is in large organizations. In one way it could be said that this is strange since it should be easier to do a big bang implementation in a small organization and less riskier than in a large organization. One potential explanation to the result could be that implementation approach is connected to what ERP system that is implemented, and that would maybe mean that in for instance large organization SAP is more commonly implemented and it could be that the implementation approach is influenced by what ERP that is implemented. Another possible explanation could be that large organization have resources available to do some kind of test implementation which they after having done decides on roll-out in a big bang implementation. This would then mean that they do a big bang implementation after doing a sort of parallel test implementation. For small organizations it can be suggested that they do not have the resources to do that and since the potential impact of a failure of a big bang implementation is smaller they maybe more often directly goes for big bang ERP implementation.

According to Bernroider et al., (2005), who used the same three types of implementation strategy, in small and medium enterprises (which they merged together), the most often used implementation approach was big bang, the second most common implementation approach was slow phased, the least used was pilot study. And in large companies, the most often used implementation approach was big bang, the second most common implementation approach was pilot study, the least used was slow phased. Our results are in line with Bernroiders' results but it differs to some extent when it comes to percentage of pilot project and slow phased implementation when it comes to large organizations. Unfortunately, although there are several studies conducted in the U.S. such as Madapusi et al. (2005), although investigating only two general implementation strategies – big bang and phased-in, but they cannot be compared to these outcomes, since the definition of a company size differs significantly between the U.S. and European Union.

### ***IS/IT strategy***

In the questionnaire, there was question about whether the organization has a IS/IT strategy or not. The answer on this question is rather complex to interpret since having strategy or not could be seen from the perspective of whether the strategy is formalized or not. However, our intention with this question was to distinguish between if the organization has a written formal strategy or not. The idea of then relating the extent of having a formalized strategy or not is that it would be interesting to see if it influences selection of a specific ERP implementation approach. The result of this is shown in Table 3.

**Table 3 Relation between IS/IT strategy and selected implementation approach**

Influencing factor	Implementation approach		
	Slow phased	Pilot project	Big bang
Yes	23,08%	24,36%	52,56%
No	34,85%	16,67%	48,48%

The results from the analysis show that there are no big surprises in whether the organizations have a formal IS/IT strategy or not in relation to selected implementation approach. There is a higher extent of slow phased implementation in organizations without formal IS/IT strategy, which could indicate that these organizations does not have that clear perspective on whether they should fully implement the specific ERP. However, it could also be that they have a clearer perspective of what they aim at and therefore takes longer time for the actual ERP implementation and focus more on adjustment of the specific ERP as well as adjustment of specific business processes.



## **CIO**

We aimed at investigating if presence by IT professionals in the board of organizations influences the selection of ERP implementation approach. In order to do that we asked whether the IS/IT division were represented at board level in the organization. In the paper, we describe representation in the board as having a CIO. The reason for asking about representation at the board level was thoughts about that this maybe for instance influence selection of ERP implementation approach. It could be suggested that if there is representation of IT/IS at board level then the risk of implementing ERP as big bang would be considered in more depth and from that it would be possible to state that a higher level of pilot project and slow phased implementation should be the case. The result of this question can be seen in Table 4.

**Table 4 Relation between presence of CIO and selected implementation approach**

Influencing factor	Implementation approach		
	Slow phased	Pilot project	Big bang
CIO			
With CIO	23,08%	26,15%	50,77%
Without CIO	32,91%	16,46%	50,63%

The results on representation of the IT department at the board level do not show any significant results regarding relation to selection of implementation approach. There is a small difference between the slow phased and pilot project if the organization have a CIO or not, but if summing up slow phased and pilot project and comparing the sum with the big bang implementation approach no difference is seen. The result is to some extent a surprise since it does not show any difference whether the IT department is represented on board level or not on selected implementation approach.

## **Country**

The final factor investigated is whether country as such has any influence on selection on ERP implementation approach. The three country investigated are Denmark, Slovakia, and Slovenia. These three countries shows definitely some cultural differences and therefore we were interested in whether they differ in what ERP implementation approach that are selected. The result of how country influences selection of implementation approach in shown in Table 5.

**Table 5 Relation between country and selected implementation approach**

Influencing factor	Implementation approach		
	Slow phased	Pilot project	Big bang
Country			
Denmark	18,75%	25,00%	56,25%
Slovakia	29,69%	18,75%	51,56%
Slovenia	29,69%	21,88%	48,44%

The Table does not show any big difference between countries regarding selected implementation approach. There is a small difference when it comes to the percentage of big bang implementation between Denmark and Slovenia, where Denmark shows the highest number of big bang implementation. Otherwise the results are in line with the overall results on ERP implementation approach. It would be interesting to further investigate whether the difference in percentage of big bang implementation is a cultural difference between the three countries. An initial hypothesis on this could be that Slovakia and

Slovenia companies are more used to work with long time planning and therefore in higher degree goes for the slow phased and pilot project implementation in relation to Danish organizations.

## Conclusion and Further Research

It can be concluded that, at the moment, implementation of ERPs is of a great attention and that ERP implementation is of high complexity. It is, therefore, of interest to investigate factors related to selection of ERP implementation approach. This paper reports results from a questionnaire aiming at identifying if there is any relationship between factors and selection of a specific ERP implementation approach. The main conclusion from the analysis is that there is no clear significant relationship between the suggested factors and the selection of implementation approach. Even if the result does not show any significant relationship between investigated factors there are some indications that the factors influence selection.

It can be stated that the most common order among the factors and their relation to selection of implementation approach was big bang, slow phased and pilot project. Some exceptions from this was found and these exceptions were midsized companies, companies with information strategy, companies with representation of the IT department at the board level, companies with turnover growth of 10%+, these factors had the order of big bang, pilot project and slow phased; and companies with reduction in turnover, where slow phased and pilot study were used with the same frequency.

Further research in this area could be to investigate how different implementation approaches influence the success of the implemented ERP especially would this be of interest if it is combined with an investigation of the total cost of implementation. That would maybe show that despite the fact that concerted implementation as first could be seen as the best approach may not be that since it probably costs more to do such implementation.

It would also be of interest to further analyze the data from selected ERP system. In that case the question whether software vendors "best practice" regarding how to implement an ERP influence the approach which are used when implementing the specific ERP should be in focus. It could be that organizations select implementation approach when they select the specific ERP. Conducting such investigation could probably explain why the factors in this investigation not are found having significant relationships to selection of implementation approach.

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