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Exploring the gap between the practical and theoretical world of ERP implementations: results of a global survey

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ABSTRACT. This paper describes the differences between the theoretical world of ERP researchers and the practical world of ERP consultants. A survey was held among 129 ERP consultants to explore their opinion and experience with regard to a number of subjects that have been researched in many papers, such as the use of ERP implementation methods, ERP phase models, critical success factors (CSF's), and critical failure factors (CFF's). A central question was to investigate the consultants' use of scientific research in relation to their preferred source of information on ERP implementations.

The results of the survey shows that ERP consultants mainly use implementation methods that are developed by ERP vendors. Other implementation methods used are proprietary methods which in most cases are a combination of vendor methods and project management frameworks. Also ERP phase models developed by vendors are used most often by consultants. Respondents appear to hardly know ERP phase models that are scientifically based. The most preferred scientific phase model by respondents is a model that focuses on the implementation phase of the ERP lifecycle.

This study shows that the majority of the respondents does not use scientific publications on ERP. This mainly due to lack of time and knowledge which articles are interesting. Quite practically, the cost of accessing scientific material was also mentioned as a hindering factor. The conclusion is that there is indeed a gap between the scientific and the practical world of ERP implementations. The science community should reconsider other ways to let the business community take advantage of their knowledge. Reversely, the consultant community should dedicate more time in both reading and contributing to the scientific knowledge on ERP implementations.

I. RESEARCH TRIGGER

ERP implementations are notorious and well known for their failure. Although recent statistics about implementation failures are not available, a report from Gartner (Ganly 2006) says that 25 percent of the ERP implementations fail and that 80 percent are over time or over budget. In the scientific literature different numbers concerning implementation failure can be found. Barker and Frolick (2003) suggest that 50 percent of ERP implementations are

failures. Hong and Kim (2002) and Rettig (2007) estimate that 75 percent of ERP implementations are "unsuccessful". Scott and Vessey (2000) and Martin (1998) estimate failure rates to be as high as 90 percent. One explanation for this variation in failure rates lies in the definition of failure. Where one author only defines failure when the whole project is terminated, the other author defines failure when the objectives of the project are not reached within time and/or budget. Whichever definition is used, we can safely state that many ERP implementation projects do not reach the intended objectives within the given constraints.

According to Gartner (Biscotti 2009) the ERP software market is still growing: “Overall, the enterprise software market in Europe, the Middle East and Africa is

expected to reach 70 billion euros by 2013, with a five-year Compound Annual Growth Rate (CAGR) of 5.0%. During the same period, the worldwide market will reach 214 billion euros, with a CAGR of 7.1%.The need to integrate all the business processes in one computer system and align this system with the business goals in the high competitive world of today has only become more important. This means that ERP implementations will stay important for the next couple of years. Research in this field to make these steps as effortlessly as possible is hence important. The implementation process is still something that should be considered carefully because of the numerous studies that show that the projects still fail: (Holland, Light et al. 1999; Jarrar, Al-Mudimigh et al. 2000; Markus and Tanis 2000; Esteves and Pastor 2001; Somers and Nelson 2001; Akkermans and Helden 2002; Hong and Kim 2002; Al-Mashari, Al-Mudimigh et al. 2003; Nah, Zuckweiler et al. 2003; Umble, Haft et al. 2003; Somers and Nelson 2004; Motwani, Akbulut et al. 2005; Al-Mashari, Ghani et al. 2006; Finney and Corbett 2007; Bradley 2008; Ngai, Law et al. 2008).

Much scientific research has been done in the field of ERP software implementations. Apparently however, ERP failure rates are not decreasing. If ERP implementations were done according to the recommendations derived from scientific research, one might expect a reduction in implementation failures. Although figures about implementation failure rates cannot be scientifically validated, the numbers still appear to be high (Newman and Zhao 2008; Pan, Hackney et al. 2008; Wu, Ong et al. 2008). After some discussions with ERP project leaders about the use of scientific literature, a possible problem emerged. With the vast amount of literature about ERP, which is published in a broad range of scientific journals, it might be very problematic to keep up to date about this subject. The normal learning cycle of exploration, concept development and concept application of scientific knowledge may not hold true in the case of ERP implementation. Due to the vast amount of literature, it could well be true that the ERP consultants never reach the phase of concept application.

In order to investigate if the consulting world has problems digesting the information produced by the scientific world, the following main research question was derived.

"To what extent are the theoretical world and the practical world of ERP implementation disconnected?"

In order to investigate the main research question the following sub questions were derived:

- Which implementation methods and phase models are used by ERP consultants?
- How do ERP consultants keep their knowledge up to date about ERP implementations?
- Which critical success factors and critical failure factors are considered by ERP consultants as most important?

Because of the broad range of journals that publish articles about ERP, also the following question was asked:

- Which journals are considered valuable by ERP consultants?

This last question is valuable for the research community to make them aware of which journals one should publish in order to reach the intended reading public.

The final main goal of this study is to give insight into the possible gap of knowledge about ERP implementation between ERP consultants and the current scientific state-of-the-art. If

indeed the main research question holds, meaning that there is a gap between the scientific and the practical world, the scientific world has to think about a method to bridge this gap and to find a way to effectively transfer knowledge to the ERP community.

In the next sections a closer look at the theoretical background is taken, how the data was gathered and analyzed and finally conclusions are drawn.

2. THEORETICAL BACKGROUND

In this chapter, a closer look will be taken on the research about ERP methods, phases and models. When searching the scientific literature on ERP methods or models, one is confronted with ambiguity. Three type of ERP methods and three types of models have been found in the scientific literature. Each is discussed in the next sections.

2.l ERP methods

In scientific ERP literature three types of methods can be found: implementation approaches, structured steps towards a successful implementation, and the market segment method. The third type applies to situations in which ERP is either implemented alone or in combination with partners in the same market segment. By teaming up with other organizations in the same market (or when you are big enough) an ERP vendor can be enticed to make a special version for a specific market. Within the scientific literature this type is only mentioned and the researcher was unable to find further studies about this method.

2.l.l Implementation approaches

The first type of methods are sometimes called implementation approaches or ERP strategies (Brown and Vessey 1999; Holland, Light et al. 1999; Parr and Shanks 2000; Esteves and Pastor 2001; Stender 2002; Mabert, Soni et al. 2003; Esteves and Bohórquez 2007; Vathanophas 2007). Four types of implementation approaches are mentioned most frequently: Big Bang implementation (all the modules across all of the organization), site implementation (all the modules one site at the time), modular implementation (one module at the time) and the process implementation method (where a process of the organization is modeled into ERP). Parr and Shanks (2000) have a different view on implementation approaches. They classify the approaches depending on how much customization is needed: plain vanilla (no customizations), middle road (minor customizations), and comprehensive implementation (extensive customizations). Depending on the characteristics in Physical Scope, the BPR Scope, Technical Scope, Module Implementation Strategy, and Resource Allocation, they allocate the implementation to one of the three categories. The Module Implementation Strategy are then the four implementation approaches mentioned earlier thus combining the different approaches.

2.l.2 Structured steps

The second method is a systematically structured approach to successfully integrate software based service or component into the workflow of an organizational structure. These methods are divided into categories: project management frameworks, embedded frameworks and generic frameworks. First, the project management frameworks are discussed.

There are several project management methods or frameworks that can serve as a basis for an implementation method. The most famous ones are: PRINCE2, DSDM and PMI. PRINCE2 and DSDM both have a focus on software and information system implementations as both frameworks have defined an implementation phase. The DSDM framework consists of three sequential phases where the project lifecycle is the most elaborate one (see table 1).

Together they form an iterative step-by-step approach in developing an information system.

PRINCE (Projects in Controlled Environments) was first developed by the UK government in 1989 as the standard approach to IT project management for central government. Since then, the method has been enhanced to become a generic, best practice approach suitable for the management of all types of projects. PRINCE2 is

based on seven principles: Business justification, Learning lessons, Roles and responsibilities, Managing by stages, Managing by exception, Product focused and Tailored. These principles flow through to the underpinning processes (see table 1).

Embedded frameworks are the frameworks from ERP vendors. Typically, these frameworks are only used to implement the ERP package from this particular vendor. SAP for instance has its Accelerated SAP (ASAP) method and Oracle has its Application Implementation Method (AIM). (see table 1).

[TABLE 1]

Generic frameworks are produced by consulting companies or the scientific community. Consulting companies rarely publish their methods and therefore these methods are no further elaborated in this study. In scientific literature there are a number of authors who describe implementation steps (Agarwal, Raha et al. 2000; Chang and Gable 2000; Markus, Axline et al. 2000; Ross and Vitale 2000; Al-Mudimigh, Zairi et al. 2001; Dibbern, Brehm et al. 2002; Stender 2002; Umble, Haft et al. 2003; Ioannou and Papadoyiannis 2004; Vathanophas 2007).

There is a thin line between implementation steps and phase models (also called process models or lifecycle models). Because implementation steps often need to be taken in a certain order to be effective, it is logical to relate these steps to a phase model.

The main difference between the scientific models is whether steps for a pre- or post-implementation phase are taken into account or not. The methods of Agarwal, Raha et al.(2000) and Al-Mudimigh, Zari et al. (2001) end when the implementation is finished, while Chang and Gable (2000), Markus, Axline et al. (2000), Ross and Vitale (2000), Dibbern, Brehm et al. (2002) and Umble , Haft et al. (2003) specifically mention the post implementation phase where the ERP system is continuously monitored and improved. The methods of Stender (2002) and Ioannou and Papadoyiannis (2004) are iterative processes that can go on indefinitely.

In the pre-implementation phase, the models typically focus on the requirements, ERP selection process, the business case and the planning of the ERP implementation. In the post-implementation phase the models typically focus on the upgrade path of the ERP system, ongoing improvements of the system and the achievement of the expected business results.

2.2 ERP models

With regard to ERP models the literature is comparable to the domain of ERP methods. Three different models can be found: data models, Critical Success Factor (CSF) models and phase models. The data models are ERP vendor specific and of no interest to this study.

CSF models are from the scientific world. ERP vendors do address CSF's but this study has not found models or frameworks from ERP vendors where these CSF's are grouped.

Phase models can be found in the scientific world and by the ERP vendors. In the next two subparagraphs both types of models will be discussed.

2.2.l CSF Models for ERP

CSF models for ERP implementations are probably the most published subject in the filed of IS/IT research. CSF's with regard to ERP is a classic theme as can be demonstrated by the extensive number of publications (cf. Bingi, Sharma et al. 1999; Brown and Vessey 1999; Cantu 1999; Holland, Light et al. 1999; Laughlin 1999; Jarrar, Al-Mudimigh et al. 2000; Parr and Shanks 2000; Somers, Nelson et al. 2000; Al-Mudimigh, Zairi et al. 2001; Esteves and Pastor 2001; Nah, Lau et al. 2001; Rosemann, Sedera et al. 2001; Somers and Nelson 2001; Akkermans and Helden 2002; Muscatello 2002; Mabert, Soni et al. 2003; Colmenares

2004; Rasmy, Tharwat et al. 2005; Sun, Yazdani et al. 2005; Al-Mashari, Ghani et al. 2006; King and Burgess 2006; Plant and Willcocks 2006; Finney and Corbett 2007; Bradley 2008; Bueno and Salmeron 2008; El Sawah, El Fattah Tharwat et al. 2008; Ngai, Law et al. 2008).

One of the first to develop a CSF model for ERP implementations was Rodrigo Cantu (1999). His classification is presented in Table 2.

[TABLE 2]

If we compare this framework with the most cited CSF model of Somers and Nelson (2001) (see table 4, later on) one can see much overlap between the two. Also, Cantu coupled the CSF's to the phase model of Cooper and Zmud (1990).

Holland, Light et al. (1999) are known for their classification of CSF's in strategic and tactical factors. Parr and Shanks (2000) in their research coupled the CSF's with their own process model i.e. in which phase are which CSF's important. Al-Mashari, Al-Mudimigh et al.(2003) made a taxonomy of CSF's where CSF's are coupled with ERP benefits and dimensions of success. King and Burgess (2006) created a dynamic model where the CSF's are linked in a causal chain. Using simulation they hope that managers can explore the consequences of their actions. Ngai, Law et al. (2008) take a better look at culture and at the differences in ten different countries/regions. 'Top management support' and 'Training and education' are the most frequently cited CSF's within these regions.

2.2.2 ERP process and phase models

Of a literature review is done on the subject of ERP process and phase models, thirteen different phase models can be found: (Cooper and Zmud 1990; Bancroft, Seip et al. 1996; Esteves and Pastor 1999; Chang and Gable 2000; Markus, Axline et al. 2000; Markus and Tanis 2000; Parr and Shanks 2000; Ross and Vitale 2000; Dibbern, Brehm et al. 2002; Bernroider and Leseure 2005; Esteves and Bohórquez 2007; McGinnis and Huang 2007; Vathanophas 2007).

The oldest model is by Cooper and Zmud (1990) (see table 3)

[TABLE 3]

There are two main differences between the phase models. The first is whether the whole lifecycle of the ERP system is taken into account. Some models only focus on the actual implementation while others have phases from the initial idea to the retirement of the system. The second difference is whether the focus is only on the organization that is implementing the ERP system and on the data that flows through the organizations. Organizations are no longer the sole owner of data. They receive data, modify it and pass it to other organizations. Vathanophas (2007) is the first to differ the phases between Inter-organizational and Intra-organizational. Now that the data of ERP applications flow between organizations this addition is relevant.

In the scientific literature three different process models are cited frequently, used or referred to the most: Bancroft (Bancroft, Seip et al. 1996), Ross (Ross and Vitale 2000) and Markus and Tanis (Markus and Tanis 2000).

3. SURVEY DATA COLLECTION

This section presents the results of a global survey that was held among ERP consultants. One of the biggest problems in the collection phase was reaching the target population. The first strategy was to use LinkedIn because ERP consultants can easily be found there. A second strategy was to use Google to find ERP consultancy firms throughout the world. This search resulted in 266 companies receiving an individual e-mail with an invitation to participate. After four weeks, a reminder of the survey was sent.

The strategy of e-mailing ERP consultancy firms proved to be the best strategy to reach the target audience. Because most of the respondents left an e-mail address, one could count the e-mail addresses that corresponded to one of the companies. From the results, 51 e-mail addresses where identified as belonging to a company on the list. This resulted in a response rate of about 19%. Of course is it possible that people used their private e-mail account for the survey and the true response rate was probably higher. To get a representative sample, consultancy firms in specific countries where searched. Unfortunately, not all countries were represented equally. In Eastern Europe and Latin-America consultancy companies could not be persuaded to participate in the survey for example.

In total, 189 people clicked on the link to open the survey. From those, 141 started the survey and 106 fully completed the survey from 35 countries. The data for the people who did not finish the questionnaire was not totally removed. The answers they gave before leaving the survey were considered valid and therefore used in the analysis phase. Twelve respondents were removed because they only answered the first couple of questions (N=129).

[FIGURE 1]

4. DATA ANALYSES

4.l The use of ERP methods and phases

With regard to the use of ERP methods we can concluded that consultants mainly use the method of an ERP vendor. This group of 47.7% (‘designed by ERP vendor’ and ‘dependent on ERP vendor' group added together) is more than half of the total group that is using an implementation method (86.9% of the total group used an implementation method). An implementation method is a model or framework with the steps to be taken towards a successful implementation. The reason for use of a method is to make sure that no step is forgotten and that the process can be repeated to obtain a reliable result. A surprisingly high number of respondents (13.1%) do not use an implementation method or framework. A further investigation into the reasoning behind this strategy is needed, because the advantage of not using an implementation method is not clear.

The problem with a vendor implementation method is that it can only be used for the products of that vendor. Almost half of the respondents who use vendor implementation methods use the method dependent on the vendor they work with (10.3%). The problem for this group is that they constantly have to switch between implementation methods and the problem of mixing things up. For consultants who work with multiple ERP vendors, a more generic implementation method could be useful. This is probably the reason why a large group of 30.8% have developed a proprietary implementation method. Further investigation is needed into why this group prefers to develop a proprietary model instead of using a scientific method or

an available generic methodology like the Object Process Methodology (OPM)1. A possible explanation could be the fact that those methods are relatively unknown to the respondents and are not easily found on the Internet.

With regard to phase models comparable results are found. Here 43.9% of the respondents use phase models from vendors (‘designed by ERP vendor’ and ‘dependent on ERP vendor’ group added together). Almost half of this group (18.7%) switches between different phase models.

29% of the respondents develops proprietary models The scientific models are hardly known.

It can be concluded from the proprietary methods and phases that a mix of implementation frameworks like DSDM, PRINCE2 or PMI in combination with vendor methods is used the most

The overall conclusion that can be made is that vendors dominate in the methods and phase models used by the ERP consultants. Of course, the vendor methods are proven and specifically constructed to implement the software of the vendor. However, a generic method can often be adapted more easily to situational factors. For consultants who work with many ERP vendors, it is probably convenient to learn one generic method than to learn the methods of each vendor.

4.2 How do ERP consultants keep their knowledge up to date?

In general, three different learning styles can distinguished on how people learn, i.e. by seeing, hearing and experiencing2. If we apply this to the ways that consultants keep their knowledge about ERP implementations up-to-date are placed in preferred order, the following table emerges:

[TABLE 4]

The most popular way of keeping knowledge up to date is by doing implementations (91%, N=114), i.e. learning by doing. But with the length of ERP implementations the learning cycle will be long this way and people have the tendency to stick to their habits of working. By using scientific journals, the learning cycle could become less long and could inspire people to try new ways of working.

The second most preferred way of learning is the use of websites (86%, N=117). The reason for the popularity is the accessibility of this medium. Information is readily available when needed. The only problem is the quantity and the quality of the information. There are many websites and some are not easy to locate. Due to the popularity of ERP there is, unfortunately, a large group of websites with questionable content and targeted at generating income through advertising3.

Colleagues are in third place (79%, N=115) for keeping knowledge up to date. Almost half of this group (48%) still does not use project deliverables as a source of knowledge. Although this source is freely available, (they have to be made anyway) and project management frameworks do stress this point, the group that does not make time for it is quite large.

The last position of scientific articles (38%, N=120) is of concern. Of the respondents, 64% indicated a lack of time available for reading. The reason why people do not have time for reading is billable hours. The average rate that a consultant needs to be billable is about 85%. This leaves six hours in a 40 hour workweek to do the rest of the work and to educate oneself. Furthermore, respondents do not know the interesting articles, do not know the top authors in the field, do not know how to find them and, if they do find them, are hindered because of the cost of accessing this material.

4.3 Critical Success Factors

One of the sub questions of this study was which critical success factors are considered important by ERP consultants. For this question the respondents were asked to rank the CSF's in a similar manner as Somers and Nelson (2001). Somers and Nelson did their research around 2000, and hence it is interesting to find out if the position of CSF's is different according to this audience and might also has changed over time. The number of respondents who participated in the research of Somers and Nelson was: 86. The number of respondents for this question was: 107. To see if the change in position is significant Welch's t-test was used (see Appendix A Welch's t-test). The normal Student t-test could not be used due to the unequal variance of both samples. The values marked with a * indicate the CSF's where P two tailed is smaller than α=.05 and the change in position is significant (see table 5).

A number of observations can be made. Overall, the standard deviations of the answers were lower than in the research of Somers and Nelson. This means that the respondents agreed more with each other on this research.

When we look at the positions of the CSF there are some differences between the rankings. The most prominent difference concerns Change Management as a CSF. It is ranked 15 places higher by the consultants compared to the research by Somers and Nelson. Change management has received more attention the last couple of years(Kemp 2008; Motwani et al. 2008; Allen 2008; Kerimoglu and Basoglu 2006) and this new research underlines this view on change management. The next high riser was Use of consultants which raised five places. The largest drop was by CSF Vendor support that dropped nine places followed by Project Champion that dropped eight places.

[TABLE 5]

4.4 Critical Failure Factors

For this question the CFFs were rated the same way as the CSFs. Although CFFs are sometimes just the opposite of a CSF there are still some subtle differences. The top two indeed overlap with the CSFs. One CFF that stood out is number five: 'Poor internal communication'. Looking at the CSFs it is lower on the list, where the opposite is on rank nine. Because of the length of this survey, the respondents were not asked to place the CFFs in the different phases. From the results of the CSFs this would be something of interest because the same conclusions could probably be drawn that in certain phases, certain CFFs are more important.

[TABLE 6]

4.5 What journals are considered by ERP consultants as most valuable?

The fact that the best known journal (see table 7) is known by only 15 respondents indicates that the common goal of science to gain knowledge about 'the world around us' and not to be kept secret, is an ambition that is far away.

There are however some bright spots on the horizon. More and more journals have become open access journals. Research has been done on the impact on citations5. Free online availability substantially increases the impact of an article. This makes it more interesting for authors to publish in an open access journal. Unfortunately, there are very few open access journals that publish about ERP. It would be advisable to check the Directory of Open Access journals regularly6.

[TABLE 7]

5. CONCLUSIONS

A number of conclusion can be drawn from this study. From a 'positive' perspective, we can stress that 38% of the respondents does know and uses scientific literature on ERP. However, there is a clear gap between the scientific world and the business community. The scientific community must seriously rethink the way in which research can become more open. Research must not only be published, but used, applied and built upon by others. The conclusion from this study is that scientific research is infrequently used and applied by the business community.

This however, does not originate in unwillingness to learn. From the remarks of this survey, almost all of the respondents are very enthusiastic about this kind of research and feel that more of this research should be done. However, it appears that the scientific community is unable to accommodate to the needs of the business community. The way the scientific community chooses to make research public is the least favorite form of the business community.

There are some suggestions to be made for further research. For the phases, the approach in this study was to use the most often cited scientific phase models to

discover which one was the most popular. In hindsight this may have been the wrong approach. The most popular phase model is useful for the actual implementation, but an ERP project is more than that. The phases before and after the actual implementation are also important. Especially now when a lot of companies are upgrading their ERP systems. Two of the models do encompass the whole lifecycle of an ERP implementation but are not specific enough. One model has the right granularity but ends when the implementation is finished. I would encourage someone to make a phase model with the right granularity that does encompass the whole lifespan of an ERP implementation.

A last suggestion is to investigate implementation failure rates. To my knowledge, only three scientific studies have been done about failure rates and the latest was from the previous century. From the Internet it was suggested that failure rates are still high. Scientifically I cannot validate that feeling. Information on these figures is crucial. If science is applied and the numbers are not diminishing, something is wrong or something is being overlooked. The results from this study show that the business community only partly uses the lessons from science. The feeling on the Internet about implementation failure rates could thus very well be true.

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[APENDIX A]

[APENDIX B]

TABLES, FIGURES AND APPENDIX

Table 1

Table 1 Framework stages

PRINCE2	DSDM	SAP	AIM
Starting up a project	pre-project	Project preparation	Business Process Architecture
Directing a project	project lifecycle	Business blueprint	Business Requirement Definition
Initiating a project	• Feasibility Study	Realization	Business Requirement Mapping
Controlling a stage	• Business Study	Final preparation	Application and Technical Architecture
Managing stage boundaries	• Functional Model Iteration	Go live, support and continuous change	Build and Module Design
Managing product delivery	• Design and Build Iteration		Data Conversion
Closing a project	• Implementation		Documentation
	post-project		Business System Testing
			Performance Testing
			Adoption and Learning

Table 2

Table 2. CSF model of Cantu (1999)

Critical success factor	CSF attributes
1. Management/organization	1. Commitment
	2. Education
	3. Involvement
	4. Project team selection
	5. Training
	6. Roles and responsibility
2. Process	7. Alignment
	8. Documentation
	9. Integration
	10. Process redesign
3. Technology	11. Hardware
	12. Software
	13. Systems management
	14. Interface
4. Data	15. Master files
	16. Transactional files
	17. Data structure
	18. Maintenance and integrity
5. People	19. Education
	20. Training
	21. Skills development
	22. Knowledge management

Table 3

Table 3. Phase models

Cooper and Zmud (1990)	Bancroft, Seip et al. (1996)	Esteves and Pastor (1999)
Initiation	Focus	Adoption
Adoption	As-is	Decision phase
Adaptation	To-be	Acquisition phase
Acceptance	Constructing and testing	Implementation phase
Routinization and Infusion	Actual implementation	Use and maintenance phase
		Evolution phase
		Retirement phase

Ross and Vitale (2000)	Markus and Tanis (2000)
Design	Project chartering
Implementation	Project configuring & rollout
Stabilization	Shakedown
Continous improvement	Onward and Upward
Transformation stage	

Figure 1

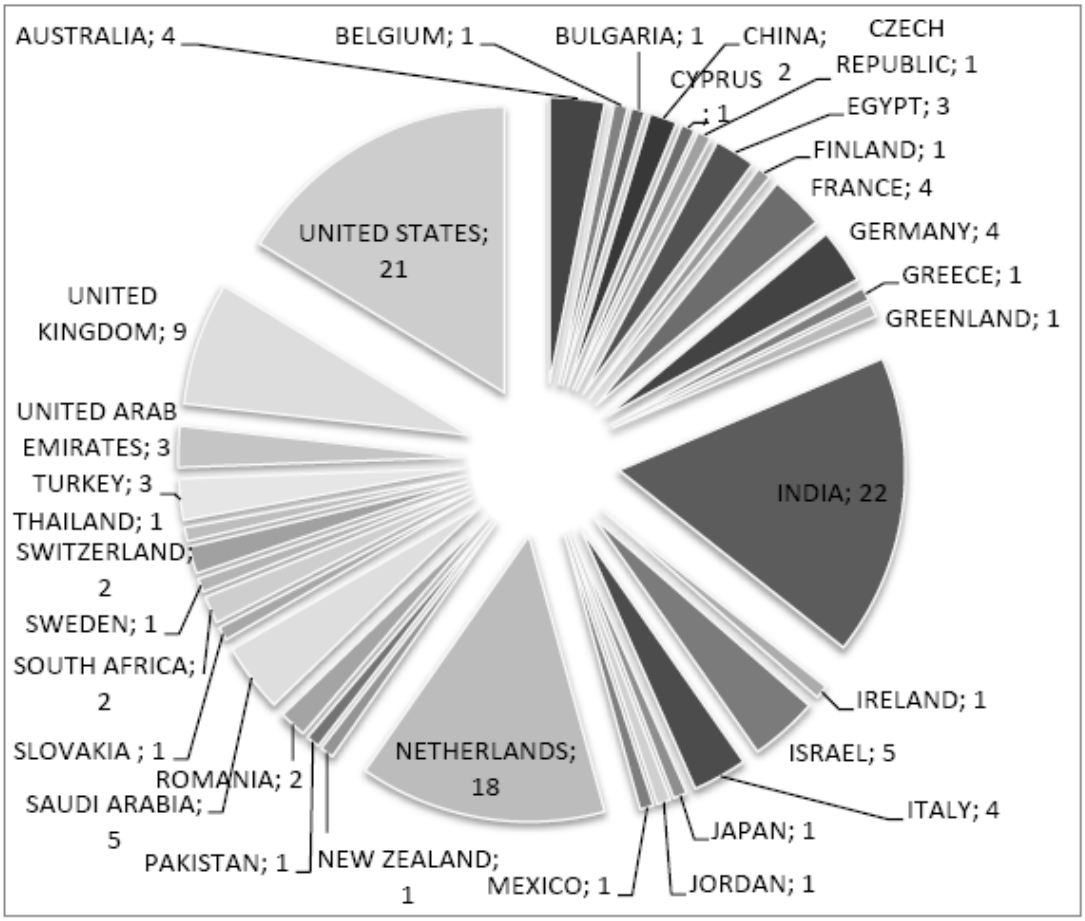

Figure 1. Respondents by country

Table 4

Table 4. Preferred learning styles of ERP consultants

Rank		Seeing	Hearing	Experiencing
1	doing implementations,	x		x
2	websites,	x		
3	colleagues,	x	x	
4	seminars,		x	
5	magazines	x		
6	scientific articles.	x		

Table 5

Table 5. Ranking of CSF

Rank according to Somers and Nelson	Critical success factor	Mean	Std. Dev	Rank according to this study	Mean	Std. Dev	Change in pos.
1	Top management support	4.29	1.16	1	4.61	.697	0*
2	Project team competence	4.2	1.07	5	4.16	.689	-3
3	Interdepartmental cooperation	4.19	1.2	8	3.95	.840	-5
4	Clear goals and objectives	4.15	1.14	2	4.51	.678	2*
5	Project management	4.13	0.96	3	4.23	.681	2
6	Interdepartmental communication	4.09	1.33	9	3.89	.805	-3
7	Management of expectations	4.06	1.37	6	4.10	.846	1
8	Project champion	4.03	1.58	16	3.61	1.105	-8*
9	Vendor support	4.03	1.6	18	3.42	1.028	-9*
10	Careful package selection	3.89	1.06	15	3.64	.954	-5
11	Data analysis & conversion	3.83	1.27	13	3.74	.904	-2
12	Dedicated resources	3.81	1.25	10	3.87	.836	2
13	Use of steering committee	3.79	1.95	14	3.72	.909	-1
14	User training on software	3.79	1.16	7	4.00	.858	7
15	Education on new business processes	3.76	1.18	12	3.78	.793	3
16	Business Process Reengineering	3.68	1.26	11	3.86	.966	5
17	Minimal customization	3.68	1.45	21	3.20	1.085	-4*
18	Architecture choices	3.44	1.19	19	3.32	1.121	-1
19	Change management	3.43	1.34	4	4.22	.793	15*
20	Partnership with vendor	3.39	1.21	20	3.26	1.127	0
21	Use of vendors' tools	3.15	1.57	22	2.88	.997	-1
22	Use of consultants	2.9	1.2	17	3.52	.965	5*

Table 6

Table 6. Critical failure factors[4]

Rank	Critical Failure Factor	Mean	Std. Deviation
1	Lack of top management involvement and support	4.51	.746
2	Ambiguous business needs and unclear vision	4.41	.778
3	Lack of user involvement and inputs from the onset	4.16	.818
4	Weak definitions of requirements and scope	4.12	.752
5	Poor internal communication	4.04	.767
6	Poor project planning	4.03	.810
7	Insufficient authority from the project manager	4.00	.862
8	Absence of an influential champion and change agent	3.97	1.009
9	Changes in design specifications late in the project	3.89	.854
10	Reactive and not pro-active in dealing with problems	3.88	.777
11	Consultant/vendor underestimated the project scope and complexity	3.87	.817
12	Unrealistic expectation of the information system	3.84	.896
13	Lack of support from middle-level managers	3.82	.741
14	Organizational rigidity and bureaucracy	3.73	.921
15	Poor or lack of business process reengineering	3.68	.952
16	Incomplete specifications when project started	3.64	1.007
17	Inappropriate choice of software	3.63	1.132
18	Inadequate project risk analysis	3.62	.941
19	Underestimate the gap between technology and ability	3.55	.947
20	Underestimate of timeline	3.54	.771
21	Incorrect assumptions regarding risk analysis	3.49	.928
22	Involve high degree of customization in application	3.46	1.123
23	Weak business case	3.44	.977
24	Top down management style	3.20	1.099

Table 7

Table 7. Top ten known journals

Rank	Journal name	Number of respondents
1	Business Process Management Journal	15
2	Information Systems Management	13
3	Manufacturing Engineer	12
4	Communications of the ACM	11
5	Computers in Industry	11
6	Decision Support Systems	10
7	European Journal of Information Systems	10
8	Information & Management	10
9	Journal of Information Technology	10
10	Information Resources Management Journal	9

Appendix A

Appendix A

Welch's t-test

Critical success factor	Welch's t	df	P two tailed
Top management support	-2.23	132.5535	0.0271*
Project team competence	0.31	138.719	0.758
Interdepartmental cooperation	1.55	146.85	0.1234
Clear goals and objectives	-2.61	131.6683	0.01*
Project management	-0.84	148.219	0.3996
Interdepartmental communication	1.24	133.1439	0.2175
Management of expectations	-0.25	134.9262	0.8003
Project champion	2.10	146.8103	0.0374*
Vendor support	3.06	138.5554	0.0027*
Careful package selection	1.67	172.9443	0.0969
Data analysis & conversion	0.56	148.5971	0.5734
Dedicated resources	-0.38	142.4048	0.7072
Use of steering committee	0.31	114.4843	0.758
User training on software	-1.40	152.5142	0.1638
Education on new business processes	-0.11	142.7883	0.916
Business Process Reengineering	-1.09	156.2987	0.2771
Minimal customization	2.57	153.7888	0.0112*
Architecture choices	0.73	177.2015	0.4677
Change management	-4.86	131.222	0.0001*
Partnership with vendor	0.75	176.1889	0.4514
Use of vendors' tools	1.39	137.4752	0.1657
Use of consultants	-3.91	161.3561	0.0001*

Appendix B

Appendix B

❍ Indicates single answer possible
❑ Indicates multiple answers possible

What is your sex?
❍ Male
❍ Female

What is (was) your role in the current (last) ERP implementation?_____

What is your highest education?
❍ Secondary education (such as a high school, secondary school or gymnasium)
❍ Undergraduate level (Bachelor degree)
❍ Graduate level (Master degree)
❍ Post graduate

What is your sex?
❍ Male
❍ Female

What is (was) your role in the current (last) ERP implementation?_____

What is your highest education?
❍ Secondary education (such as a high school, secondary school or gymnasium)
❍ Undergraduate level (Bachelor degree)
❍ Graduate level (Master degree)
❍ Post graduate level (MBA etc.)
❍ Advanced academic degree (PhD etc.)

How many years of experience do you have with ERP implementations?
❍ 0 to 2 years
❍ 2-5 years
❍ 6- 10 years
❍ More than 10 years

In which sector(s) have you conducted ERP implementations and how many did you do? (multiple answers possible)
❑ Education (number of implementations conducted ___)
❑ Insurance (number of implementations conducted ___)
❑ Retail (number of implementations conducted ___)
❑ High technology (number of implementations conducted ___)
❑ Financial services (number of implementations conducted ___)
❑ Manufacturing (number of implementations conducted ___)
❑ Utilities (number of implementations conducted ___)
❑ Health care (number of implementations conducted ___)
❑ Government (number of implementations conducted ___)
❑ Professional services (number of implementations conducted ___)
❑ Telecommunication (number of implementations conducted ___)
❑ Other _____ (number of implementations conducted __)

Which industry type is the main focus for your implementation?

- ❍ Education
- ❍ Insurance
- ❍ Retail
- ❍ High technology
- ❍ Financial services
- ❍ Manufacturing
- ❍ Utilities
- ❍ Health care
- ❍ Government
- ❍ Professional services
- ❍ Telecommunication
- ❍ Other_____

With which of the following ERP vendors have you been working during implementation, or do you know from using yourself? (multiple answers possibl

Vendor name	Implementation experience	User experience
Activant	❑	❑
CDC Software	❑	❑
Deltek Systems	❑	❑
Epicor	❑	❑
Exact Software	❑	❑
Glovia	❑	❑
IFS	❑	❑
Infor	❑	❑
Lawson	❑	❑
Microsoft	❑	❑
Netsuite	❑	❑
Oracle	❑	❑
QAD	❑	❑
Sage Group	❑	❑
SAP	❑	❑
Unit4Agrersso	❑	❑
Visma	❑	❑
Other	❑	❑

Have you experience with international implementations? (i.e. in cross-border settings)

- ❍ Yes, (number of implementations) ___
- ❍ No

What is the mean of the financial scale of the implementations you do?

- ❍ Annual revenue (turnover) of the companies is 0 - $50 million
- ❍ Annual revenue (turnover) of the companies is $50 - $200 million
- ❍ Annual revenue (turnover) of the companies is $200 million - $1 billion
- ❍ Annual revenue (turnover) of the companies is $1 billion and up

How did you learn the ERP implementation business? (multiple answers possible)

- ❑ Generic ICT education
- ❑ Specific ERP education
- ❑ On the job
- ❑ Other way _____

How do you keep up with the new developments in the ERP implementation process? (multiple answers possible)

- ❑ Read ICT newsmagazines. How many per month? ___
  What is in your opinion the best ERP related magazine?
  _____
- ❑ Read scientific journals
- ❑ Go to seminars.
  What is the name of the most interesting seminar?
  _____
- ❑ From websites.
  Which website is the most informative?
  _____
- ❑ From colleagues
  - ❑From internal presentations
  - ❑From knowledge bases (wiki etc.)
  - ❑From the distribution of articles
  - ❑From marketing services like Gartner or Forrester
  - ❑From project deliverables
  - ❑Other: _____
- ❑ By doing implementations
- ❑ Partnership with university.
  Name of the university?
  _____
- ❑ Other _____
- ❑ I do not keep up to date with new developments

What are the competences that a ERP consultant should have?

ERP competences	un-important	a bit important	important	most important	crucial
Organizational competence (working with the organization, its culture, power distribution and history)	❍	❍	❍	❍	❍
Strategic competence (connecting use of the ERP system with business strategy and needs)	❍	❍	❍	❍	❍
Business process competence (connecting use of the ERP system with business processes, helping to reshape business processes)	❍	❍	❍	❍	❍
Project management competence (project planning, defining goals and identifying qualified people)	❍	❍	❍	❍	❍
Technology competence (shaping appropriate IT policies for the organization)	❍	❍	❍	❍	❍
ERP system competence (knowing about the modules and the configuration tables and formulating demands)	❍	❍	❍	❍	❍
Human resource competence (developing employees' ERP knowledge and work, assessing training needs and delivering training)	❍	❍	❍	❍	❍
Leadership competence (energizing people, steering organizational arrangement and making them work)	❍	❍	❍	❍	❍
Communication competence (the ability to communicate relevant information in appropriate ways to different stakeholders)	❍	❍	❍	❍	❍

Which scientific journals do you know and use? Mark only the journals you know.

Journal name	Read regular	Read sometimes	Read never but know the journal
Communications of the ACM	❍	❍	❍
Business Process Management Journal	❍	❍	❍
Computers in Industry	❍	❍	❍
Decision Support Systems	❍	❍	❍
European Journal of Information Systems	❍	❍	❍
European Journal of Operational Research	❍	❍	❍
Expert Systems with Applications	❍	❍	❍
Industrial Management & Data Systems	❍	❍	❍
Information & Management	❍	❍	❍
Information Resources Management Journal	❍	❍	❍
Information Systems Frontiers	❍	❍	❍
Information Systems Management	❍	❍	❍
International Journal of Accounting Information Systems	❍	❍	❍
International Journal of Business Information Systems	❍	❍	❍
International Journal of Information Management	❍	❍	❍
International Journal of Management and Enterprise Development	❍	❍	❍
International Journal of Production Economics	❍	❍	❍
International Journal of Production Research	❍	❍	❍
Journal of Enterprise Information Management	❍	❍	❍
Journal of Information Systems Education	❍	❍	❍
Journal of Information Technology	❍	❍	❍
Journal of Management Information Systems	❍	❍	❍
Journal of Strategic Information Systems	❍	❍	❍
Manufacturing Engineer	❍	❍	❍
Strategic Finance	❍	❍	❍
The DATA BASE for Advances in Information Systems	❍	❍	❍
Other _____	❍	❍	

If you DO NOT read scientific literature much, what is the reason for that? (multiple answers possible)

- ❑ No time for
- ❑ Too difficult to read
- ❑ Cost too much to get the articles
- ❑ I do not know which articles are interesting
- ❑ Other _____

Which authors of scientific literature about ERP do you know and how valuable is their work? (multiple answers possible)

Name	Known	Known and Valuable
Al-Mashari, M.	❍	❍
Ash, C.G.	❍	❍
Bendoly, E.	❍	❍
Bradford, M.	❍	❍
Burn, J.M.	❍	❍
Corbitt, G.	❍	❍
Daneva, M.	❍	❍
Gable, G.G.	❍	❍
Gulledge, T.R.	❍	❍
Gunasekaran, A.	❍	❍
Halingten, A.	❍	❍
Hawking, P.	❍	❍
Holland, C.P.	❍	❍
Huang, J.C.	❍	❍
Hunton, J.E.	❍	❍
Irani, Z.	❍	❍
Jones, M.C.	❍	❍
Koh, S.C.L.	❍	❍
Kræmmergaard, P.	❍	❍
Light, B.	❍	❍
Markus, M.L.	❍	❍
Møller, C.	❍	❍
Nah, F.F.H.	❍	❍
Nelson, K.G.	❍	❍
Newell, S.	❍	❍
Pan, S.L.	❍	❍
Rosemann, M.	❍	❍
Sia, S.K.	❍	❍
Soh, C.	❍	❍
Somers, T.M.	❍	❍
Sommer, R.A.	❍	❍
Stewart, G.	❍	❍
Strong, D.M.	❍	❍
Themistocleous, M.	❍	❍
Verville, J.C.	❍	❍
Volkoff, O.	❍	❍
Wang, E.T.G.	❍	❍
Zairi, M.	❍	❍