Impediments to Enterprise System Implementation across the System Lifecycle: Insights from Polish Practitioners

Completed Research Paper

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ABSTRACT

This study's goal is to investigate impediments to successful enterprise system (ES) implementation across the system lifecycle. Drawing from the opinions of 82 ES practitioners and building on the authors' previous work on source problems in ES adoption, this study performs the further data analysis incorporating the ES lifecycle. The analysis employs the Cooper and Zmud's six-stage model of IT diffusion and investigates how the difficulties change along the ES lifecycle. Our findings suggest that Adaptation phase, which is the main implementation stage, is the most challenging period of the ES adoption project. The results also indicate that problems with employees are the most significant impediments to ES adoption success. The findings imply that difficulties during later stages of the ES adoption can be minimized by an appropriate system choice, a good training schedule, and the preparation of an appropriate IT infrastructure and database needed by the new system.

Keywords

Enterprise system, ERP, adoption, implementation, lifecycle, problem, Poland.

INTRODUCTION

Enterprise systems (ES) are complex application software packages that contain mechanisms supporting the management of the whole enterprise and integrate all areas of its functioning (Davenport 1998, p.121). ES adoption is a multistage and usually lengthy process during which the company may experience many problems and impediments to project success (e.g. Kim et al. 2005, Kremers and van Dissel 2000, Markus et al. 2000, Themistocleous and Irani 2001, Themistocleous et al. 2001, Wright and Wright 2002).

The multistage nature of the ES adoption results in the situation where considerations experienced by implementation projects depend on the actual phase of the project (Markus et al. 2000, Soja 2007). Further, prior literature reports various problems which represent diverse levels of generality and some of them, such as lack of benefits (O'Leary 2000), generally seem to be the consequence of other difficulties that appear during the implementation process. Other reported problems, in turn, appear to cause further problems, such as system drawbacks or lack of business problem reengineering (Kim et al. 2005, Kremers and van Dissel 2000, Wright and Wright 2002).

This paper seeks to address these two main issues and tries to investigate real (source) problems in ES adoption across the ES adoption phases. The particular research question involved in this study can be formulated as follows:

- What are the real problems in ES adoption depending on the project phase?

RESEARCH BACKGROUND

Prior literature includes several studies that are dealing with difficulties in ES implementation and are based on empirical research conducted among ES practitioners. The enquired respondents include adopters (e.g. Kim et al. 2005, Kremers and van Dissel 2000, Themistocleous et al. 2001), experts representing system suppliers or consulting companies (e.g. Soja 2008, Wright and Wright 2002), and representatives of both system providers and adopters (Markus et al. 2000).

The problems most often reported by previous studies as significant difficulties during ES adoption include time over-run, lack of business process redesign, system drawbacks, and lack of users' involvement (Kim et al. 2005, Kremers and van Dissel 2000, Themistocleous et al. 2001, Wright and Wright 2002). Nonetheless, prior studies report issues having various meaning and use varied categorizations which makes comparing their findings difficult. Also, as pointed out by Soja and

Paliwoda-Pękosz (2009) previous research works do not analyze interrelations between discovered difficulties and do not attempt to find the source problems.

The study by Markus et al. (2000) interestingly divides the discovered difficulties into groups on the basis of ES adoption project phase. This illustrates the need for incorporating the enterprise system lifecycle into the analysis of impediments to ES success. However, other studies dealing with ES adoption difficulties do not follow this approach and do not analyze changing considerations of ES adoption across the project phases.

The ES lifecycle has various definitions in prior research works (Soja 2011b, Themistocleous et al. 2011). In particular, Parr and Shanks (2000) divide implementation process into 3 general phases: Planning, Project, and Enhancement. Within the Project phase, they distinguish 5 sub-phases: Set up, Reengineering, Design, Configuration and testing, and Installation. Markus and Tanis (2000) discern 4 main enterprise system adoption phases named: Project chartering, The project, Shakedown, and Onward and upward. Ross and Vitale (2000) suggest 5 adoption stages: design, implementation, stabilization, continuous improvement, and transformation.

The most comprehensive understanding of the ES lifecycle is defined by Somers and Nelson (2004) who distinguish 6 implementation phases grounding their approach in the six-stage model of IT diffusion (Cooper and Zmud 1990). The proposed stages of ES implementation are as follows:

- Initiation – a company justifies the need for adopting an ES system, chooses the actual enterprise system, and defines business needs and goals,
- Adoption – during which the definition of the project takes place, the solution design is created and project participants are selected,
- Adaptation – the main implementation stage where the project team translates the solution design into reality,
- Acceptance – with the main purpose to deliver and run the system,
- Routinization – part of the post-implementation stage during which usage of ES in encouraged as a normal activity,
- Infusion – part of the post-implementation period where the company experiences the full potential of the ES operation.

The Somers and Nelson model's strength consists in two last stages representing post-adoption behavior. The presence of clearly articulated post-implementation stages helps in capturing the whole complexity of ES adoption and prevents overlooking important considerations of events happening after the system roll-out. Due to these advantages the Somers and Nelson's lifecycle model has been employed by this study.

METHODOLOGY

In general, the authors' intention was to work out the comprehensive list of impediments to ES adoption success on the basis of information gathered from people located at the source of issues investigated. To this end, the authors turned to practitioners who participated in ES adoptions and hence experienced various difficulties during their adoption projects. In order to meet the research goals and assumptions, a qualitative research approach based on grounded theory proposed by Glaser and Strauss (1967) was adopted with interviews employed as a data-gathering method.

The researchers decided to use open-ended questions, rather than employing a predefined list of possible benefits developed from the prior literature. This was done in order not to suggest the answers and to allow the respondents to express their opinions in an unconstrained way. The respondents were asked to specify the most important problems that occur during their ES adoption projects and express their opinions regarding the causes of each problem enumerated. For each discussed issue, the respondents were asked to point the phase of the ES lifecycle during which the problem occurred.

Data have been gathered from 82 ES practitioners from Poland who represented companies of various sizes, operating in a variety of industries, and implementing a wide range of ES systems. The data was interpreted and classified by the authors who performed their own open and axial coding (Corbin and Strauss 1990). The researchers adopted a 'bottom-up' approach to coding data and developed coding schemes inductively, grounding the examination of emerging issues in the data. In particular, in the process of open coding, statements given by the respondents were compared and analyzed in the search of similarities and differences, and were assigned labels. During this process the basic categorization of impediments emerged and tentative categories and subcategories were created. Next, in the process of axial coding, categories and subcategories were inspected and verified, categories were related to their subcategories, and the relationships were tested against data.

In order to discover the source problems, in the first step, a causal map of interrelations among problem categories has been worked out on the basis of the respondents' declarations as regards problems and their possible causes. In the next step, potential source problems have been selected following the rule that a potential problem (represented by a problem subcategory) was not reported as the consequence of other problems outside the category. In the last step, building on the two abovementioned rules, the list of source problems has been proposed. For more details regarding the applied analytical procedure see (Soja and Paliwoda-Pękosz 2009).

DATA ANALYSIS AND DISCUSSION

Problem Categories

As a result of data analysis, 45 problems have been identified. These problems are represented by subcategories and have been categorized into 9 problem categories. The discovered problem categories are as follows:

- Employees – problems mainly connected with employees' skills and negative attitudes such as fear and reluctance,
- Enterprise – difficulties mainly related with the adopting company, its financial condition, organizational structure, experience, and preparation for the project,
- System – problems mainly connected with the enterprise system solution, its errors, efficiency, and level of complexity,
- IT infrastructure – difficulties mainly related with network and hardware infrastructure needed by the enterprise system,
- System misfit – problems mainly connected with lack of fit between the company and the enterprise system, its customization and functional deficiency,
- System replacement – difficulties mainly related with existing legacy systems and data import,
- Training – problems mainly connected with trainings' scope and schedule and cooperation with the vendor,
- Implementation process – difficulties mainly related with the project definition, duration time, and involved participants,
- System vendor – problems mainly connected with the vendor's lack of sufficient resource and problems with implementation consultants.

Problems across the ES Lifecycle

The distribution of problems across the enterprise system lifecycle is presented in Table 1. The numbers in the table denote problem occurrences in appropriate phases as declared by the respondents.

Group/Phase	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion	not assigned*	All
Employees	20	11	30	12	15	15	3	106
Enterprise	13	6	9	10	12	3	5	58
System	5	1	14	9	6	14		49
IT Infrastructure	15	5	15	16	5	7	1	64
System Misfit	6	4	14	5	8	13		50
System Replacement	7		14	4	2		1	28
Training	5	3	13	5	6	7		39
Implementation Process	8	5	9	1	3			26
System Vendor	2	1	5		3	2		13
All	81	36	123	62	60	61	10	433

Note: *The number of problems from each group that has not been assigned to any phase of the ES lifecycle.

Table 1. Problem categories across the enterprise system lifecycle

The largest number of problems was reported during Adaptation phase (123 out of 433 reported) and during Initiation (81). Overall, in all phases, the most recognizable problems seem to be connected with employees, either directly or indirectly, such as through the category Training. Problems connected with the general enterprise condition were especially visible during Initiation and Routinization. Issues connected with the system were the most recognizable during Adoption and Routinization. Problems connected with IT infrastructure were visible in all phases with the stronger visibility during phases: Acceptance, Initiation, and Adaptation. System misfit revealed itself mostly during Adaptation and Infusion. Finally, issues connected with the system replacement, trainings, and implementation process were mostly visible during Adaptation phase. The distribution of problems and problem categories across the ES lifecycle is presented in Table 2.

Group/Phase	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion	not assigned*	All
Employees	20	11	30	12	15	15	3	106
fear	6	2	7		3	1	1	20
reluctance	4	3	6	2	2	3		20
computer skills	1	2	5	4	2	4	1	19
habits	1	1	3	1	3	3		12
knowledge	3	1	1	1	1	1		8
skills		1	1	3	1	2		8
lack of system acceptance		1	2		2		1	6
other**	5		5	1	1	1		13
Enterprise	13	6	9	10	12	3	5	58
changes	1	2	3	3		2	1	12

project	6	1	2		1		1	11
finance	2	1	1	2	2		1	9
preparation	3	1	2		1			7
structure		1			2		1	4
cooperation with vendor				1	2			3
other**	1		1	4	4	1	1	12
System	5	1	14	9	6	14		49
errors	3		9	4	5	12		33
communications across modules		1	2	4	1			8
other**	2		3	1	0	2		8
IT infrastructure	15	5	15	16	5	7	1	64
network infrastructure	5	3	5	9	4	4	1	31
inadequate hardware	5	1	4	2	0	1		13
incompatibility	3	1	4	2				10
other**	2		2	3	1	2		10
System Misfit	6	4	14	5	8	13		50
[general]	3	1	9	3	3	5		24
functional deficiency		1	3		2	6		12
customization	3	1	1	1	2	1		9
other**	0	1	1	1	1	1		5
System Replacement	7		14	4	2		1	28
data import	4		8	3	1			16
smooth replacement	2		2	1	1		1	7
legacy systems	1		3					4
other**			1					1
Training	5	3	13	5	6	7		39
schedule	3	1	8	1	2	1		16
[general]	1	1	3	1	1	2		9
cooperation with vendor					2	2		4
scope			2					2
other**	1	1		3	1	2		8
Implementation Process	8	5	9	1	3			26
duration time		2	5	1				8
employees	3	2	2					7

project definition	1		1			2
project manager	2					2
other**	2	1	1	3		7
System Vendor	2	1	5	3	2	13
lack of time	1	1		2	2	6
consultants			3			3
other**	1		2	1		4

Notes: *The number of problems from each group that has not been assigned to any group.**A group of problems with single occurrences

Table 2. Problems and problem categories across the enterprise system lifecycle

In the problem category connected with employees, the most frequently listed are those connected with fear and reluctance towards a new system and towards changes caused by the new system. These problems were visible mostly in Initiation and Adaptation phases. Problems with skills manifested themselves mainly in Adaptation, Acceptance and Infusion phases.

In the problem category related to the system, difficulties connected with conducting necessary changes in the enterprise were the most visible with a special emphasis on Adaptation and Acceptance phases. During Initiation phase, the implementation design played the most significant role. Financial problems appeared in all phases. The problems connected with the adjustment of the company structure to the new system requirements revealed themselves during Acceptance and Routinization phases.

Problems connected directly with the new system errors were visible at all stages except for Initiation phase. Further, problems with communication between system modules revealed themselves during Acceptance and Adaptation.

Network infrastructure seemed to be the most identifiable problem in the IT infrastructure problem group. Interestingly, network-related problems were assigned to all phases, whereas hardware incompatibility was mostly noticeable during Initiation and Adaptation phases.

Among problems with the system misfit, the most evident were general problems connected with the lack of system fit to the enterprise needs and these difficulties were mostly recognizable during Adaptation phase. Lack of system functionality was visible mostly during Infusion, while problems with customization ran though all phases; nonetheless, they seemed to be noticeable to a lesser extent.

The comparison of distribution of problems in an enterprise system life cycle between Polish practitioners and practitioners from developed economies revealed that Polish enterprises suffered mostly from system-related problems whereas companies from developed economies had to focus more on business-related issues. Further, in Polish companies, problems tended to spread over time and seemed to have greater influence on companies than in developed economies. However, some similarities also can be noted, especially during the project phase where system migration problems were mainly reported. Nevertheless, these problems were of a different nature: in Poland they concerned migration from legacy systems while in developed economies they were connected with upgrading current enterprise system or changing its brand (Soja and Paliwoda-Pękosz 2013b, Markus and Tanis 2000).

Source Problems across the ES Lifecycle

As a result of data analysis, from among 45 problems discovered, 20 difficulties have been elicited as candidates for source problems, i.e. those being the causes of other impediments. Table 3 presents the distribution of these source problems across the enterprise system lifecycle phases.

Group/Phase	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion	not assigned*	All
System	4		10	4	5	12		32
errors	3		9	4	5	12		30
too complicated	1		1					2
Employees	10	4	11	2	7	5	1	31
fear	6	2	7	0	3	1	1	16
habits	1	1	3	1	3	3		8
knowledge	3	1	1	1	1	1		7
IT infrastructure	10	4	9	11	4	5	1	30
network infrastructure	5	3	5	9	4	4	1	20
inadequate hardware	5	1	4	2	0	1		10
Enterprise	4	4	5	7	7	2	3	29
changes	1	2	3	3		2	1	11
finance	2	1	1	2	2		1	7
structure		1			2		1	4
cooperation with vendor				1	2			3
lack of experience	1		1					2
needs				1	1			2
System Replacement	5		11	3	1			20
data import	4		8	3	1			16
legacy systems	1		3					4
Training	4	2	8	1	2	1		10
schedule	3	1	8	1	2	1		10
System Misfit	3	1	1	1	2	1		4
customization	3	1	1	1	2	1		4
System Vendor			1		1			2
lack of sufficient resources			1		1			2
Implementation Process	1		1					2
project definition	1		1					2

Table 3. Source problems across the enterprise system lifecycle

Among the source problems, the most numerous category of difficulties is connected with the system and denotes system errors and too high level of system complexity. These impediments revealed themselves during all phases of the system lifecycle except for Adoption phase and are the most strongly noticeable during Routinization. The problems connected with

the system are followed by the difficulties connected with employees (fear, habits, knowledge) that appeared in all phases with the special emphasis on Initiation and Adaptation. Network infrastructure and inadequate hardware manifested themselves in all phases and were the most visible during Acceptance. Difficulties with data import, other problems connected with legacy systems, inadequate training schedule, and limited finance revealed themselves mainly during Adaptation phase.

IMPLICATIONS

The results of this study have several implications for practitioners dealing with ES implementations. The particular beneficiaries of this study's outcome are managers running the ES adoption projects or planning to implement an enterprise system. The implications for practitioners are formulated in the following.

- Practitioners should pay special attention to Adaptation as this phase appears to be the most difficult stage of the project. Nonetheless, the results suggest that practitioners should be watchful during the whole system lifecycle, even during the very last phases of the project when they might have expected less difficulties as the new system exploitation should reach its full potential at this stage.
- Managers should be aware that the right system choice is crucial for the whole implementation process. Although the system errors reveal themselves most frequently only in Infusion phase, the system should be thoroughly tested before the final decision about the particular system choice is made. By following this rule the managers would have possibility to opt for another system solution in case of serious system-related problems.
- Special attention should be paid to employees' training, starting from the very beginning of the implementation project in order to minimize the employees' fear of the new system and to change systematically their habits. The trainings should involve appropriate participants and training schedule should be prepared carefully.
- The necessity of adjusting IT infrastructure to the new system needs may cause problems not only during Initiation but also during other phases, with a special emphasis on Acceptance phase. This illustrates the necessity to carefully consider the technical details of ES implementation during Initiation phase.
- Managers should be prepared for problems connected with data import from legacy systems in Adaptation phase. In order to minimize these problems, the process of transferring data from legacy system should be carefully prepared in advance, presumably in Initiation phase.

LIMITATIONS AND FUTURE RESEARCH

The main limitation of this study's findings refers to their transferability, which is connected with the fact that the research data concerned only Polish enterprises. Therefore, the generalization of findings should be done with caution. Poland is a transition economy, i.e. an economy which is experiencing fast changes from centrally planned economic system to a market driven system (Roztocki and Weistroffer 2008, 2011). In consequence, this study's findings might possibly be applied to the countries that are undergoing economic transformation and belong to the same geographical region, i.e. Central and Eastern Europe. This limitation indicates a promising avenue for future research which might be connected with expanding the research sample and performing a cross-country analysis.

In the recent years a change in approach to enterprise system modeling and enterprise system design has been noticed and is particularly connected with Service Oriented Architecture (SOA), Software as a Service (SaaS) model, and cloud computing (Demirkan et al. 2010, Linthicum 2009). Researchers have started to explore potential benefits of these new paradigms (e.g., Spillner et al. 2013, Wang and Xu 2013) and companies have begun to apply them (Miranda, 2013). Nonetheless, these innovative models bring new challenges to enterprise system adoption and it would be interesting to explore which considerations of enterprise system adoption will remain important and which will lose significance. However, enterprise system solutions that follow SaaS and SOA are still in the early stages of development, especially in Poland where new information technologies are usually adopted later than in developed countries (Soja 2011a, Soja and Paliwoda-Pękosz 2013a). For this reason, investigating SaaS- and SOA-based enterprise system adoptions in transition economies seems an interesting path for future research.

CONCLUSIONS

Building on the classification of problems occurring during enterprise system implementation developed previously by the authors, this study analyzed the impediments across the system lifecycle. To this end, the Cooper and Zmud's six-stage model of IT diffusion has been employed. The main findings suggest that Adaptation phase seems to be the most difficult

with the highest number of impediments perceived by the respondents. Among these difficulties, problems connected with employees appeared the most significant. The analysis of source problems occurrence over the lifecycle yielded valuable implications for managers who, firstly, should be aware of the crucial role of choosing the right, error-free system solution which should have been thoroughly tested during the initial phase of the project. Second, managers should be aware of the need for preparing appropriate training schedule in order to minimize future problems connected with employees. The third important issue resulting from this study relates to the necessity to carefully prepare the IT infrastructure adjustment and data import from legacy systems during Initiation phase in order to minimize potential problems in subsequent stages.

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