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Determinants of Enterprise System Adoption across the System Lifecycle: Insights from a Transition Economy

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ABSTRACT

This study's goal is to investigate the determinants of enterprise system (ES) adoption projects across the system lifecycle in transition economies. On the basis of research conducted among ES practitioners in Poland, an example of a transition economy, the analysis revealed 29 determinants of ES adoptions and examined their changing criticality across the system lifecycle. In doing so, this study adopted a holistic approach where determinants are understood as both critical success factors and barriers. While investigating determinants across the system lifecycle, the analysis employed the Cooper and Zmud's six-stage model of IT diffusion. The main results suggest that over time determinants shift from issues connected with management personnel towards system-related issues. The findings also suggest that infrastructure, people's knowledge and attitudes have a greater significance in transition economies than in developed countries. At the same time, ES practitioners from transition economies pay much less attention to BPR.

Keywords

Enterprise system, ERP, adoption, lifecycle, determinants, barriers, critical success factors, transition economy, Poland.

INTRODUCTION

Transition economies denote countries that are in transition from a communist style central planning system to a free market system (Roztocki and Weistroffer, 2008b). Most transition economies can be classified as emerging economies that are a subgroup of developing economies and consist of countries with low absolute but fast growing per capita income, and with administrations that are dedicated to economic liberalization (Roztocki and Weistroffer, 2008a). Information technology (IT) adoption projects in developing countries experience different considerations than projects conducted in industrialized countries (Bingi, Leff, Shipchandler and Rao, 2000; Roztocki and Weistroffer, 2008a). The most significant issues present in developing and transition economies include lack of IT experience, inadequate IT infrastructure and maturity, and lack of long term strategic thinking (Huang and Palvia, 2001; Roztocki and Weistroffer, 2008b).

Enterprise system (ES) adoptions are one of the most advanced IT-related large-scale investments. ES evolved from MRP, MRP II, and ERP systems and are now very complex systems supporting the management and integration of the whole company and offering inter-organizational integration with company's clients and suppliers (Volkoff, Strong and Elmes, 2005). ES implementations are complex projects that require substantial resources from the adopting company. They are usually multi-staged and long-lasting projects and, in consequence, in order to understand the whole endeavor it is needed to incorporate the system lifecycle into the research approach (Themistocleous, Soja and Cunha, 2011).

The determinants of ES adoptions may be expressed as factors which contribute to the project success and are often called critical success factors (CSFs) (Finney and Corbett, 2007). However, on the other hand, they might be also barriers which have a negative influence and impede the positive run of the project (Themistocleous and Irani, 2001). Nonetheless, the existing literature predominantly investigates these two perspectives, i.e. CSFs and barriers, separately, which may lead to overlooking important considerations of ES adoption projects (Soja, 2011).

This study aims to address the shortcomings of prior research and seeks to investigate the determinants of enterprise system adoption across the system lifecycle. Also, in doing so, the research approach captures determinants as both CSFs and barriers. The general research questions involved in this study can be formulate as follows:

- What are the main determinants of ES adoptions in transition economies?
- How does the criticality of determinants vary across the system lifecycle?

RESEARCH METHODOLOGY

In order to answer the research questions, this study draws from the opinions of ES practitioners from Poland, an example of a transition economy from Central and Eastern Europe. The structured interviews have been employed as a data gathering method and the respondents have been asked to share their opinions about the main determinants of ES adoption taking into consideration the division into CSFs and barriers. The respondents also reported the phases of the lifecycle during which the declared determinants were the most critical. To this end, the research approach employed the six-stage ES lifecycle defined by Somers and Nelson (2004).

The adopted ES lifecycle model is based on the six-stage model of IT diffusion defined by Cooper and Zmud (1990). It covers both implementation and post-implementation stages of the project. The defined stages of the ES lifecycle are as follows:

- Initiation – during this stage a company justifies the need for adopting an enterprise system, defines business needs and goals, and chooses the actual enterprise system,
- Adoption – during this stage the definition of the project is worked out, the solution design is established and project participants are selected,
- Adaptation – this stage is the main implementation phase during which the project team translates the solution design into reality,
- Acceptance – the main purpose of this stage is to deliver the system and start its regular operation,
- Routinization – this phase is part of the post-implementation stage during which ES usage is encouraged as a normal activity,
- Infusion – during this post-implementation phase the company experiences the full potential of the ES operation.

As a result of performed research, the opinions of 11 respondents have been gathered. The respondents represent different participants of enterprise system adoptions. The respondents have experience with various enterprise system solutions and worked for various companies. The roles played by the respondents in ES adoptions are varied and include such positions as end user, IT specialist, analyst, consultant, trainer, member of the Project Team, Project manager, and Project supervisor.

| Roles Played in ES Adoptions | Number of Conducted ES Projects | Work Experience on ES in Years |
|---|---------------------------------|--------------------------------|
| IT specialist, network/system administrator | 3 | 6 |
| Analyst | 4 | 4 |
| Analyst | 7 | 8 |
| Member of the Project Team | 1 | 1 |
| Supervisor | 2 | n/a |
| IT specialist, network/system administrator | 3 | 5 |
| End user | 1 | 1 |
| Project manager | 1 | 2 |
| Trainer, analyst | 7 | 1 |
| Member of the Project Team | 1 | 6 |
| Consultant | 3 | 4 |

Table 1. Respondents Background

The respondent opinions have been analyzed in a bottom-up manner derived from grounded theory approach (Charmaz, 2006; Corbin and Strauss, 1990). In particular, the respondent statements were compared and analyzed in the search of similarities and differences during the coding procedure. The statements were given conceptual labels and initial categories of concepts were created. Next, the emerged categories and relationships between the categories were tested against data and verified. This resulted in the redefinition and changed scope of some categories and, in consequence, yielded a robust categorization of determinants.

DATA ANALYSIS AND RESULTS

Determinants of ES Adoption in Respondent Answers

As a result of conducted research and data analysis, 29 issues describing determinants of ES adoption have been elicited. The following subsection contains the short description of the discovered determinants. Since the determinants were reported by the respondents as CSFs or barriers to ES adoption success, this notion has been taken into consideration in the description of the elicited issues. The determinants have been listed in descending order of importance calculated on the basis of respondent declarations. In particular, the employed rule for the calculation of importance levels was connected with the number of indications of individual determinants, as declared by the respondents.

- *Top management support* – company’s top management should support the ES adoption project and should be actively involved in the implementation duties. Representatives of the company’s management should be members of the steering committee and should supervise the project. Lack of top management support is a significant barrier to ES adoption success.
- *Project manager* – an ES adopting company should appoint a project manager who is a person from within the adopting organization and is involved in the project duties and devotes most of his/her working time to the ES adoption. S/he should be able to act as a contact point for the system provider and is responsible for numerous tasks during the project, such as responsibilities allocation, overseeing task completion, problem solving etc.
- *Communication* – good communication between the company’s departments and between the adopting company and the system provider should be ensured. The company’s employees, who are prospective system users, should be informed of the adoption project, its consequences and benefits. Problems with communication between the company’s employees and members of the project team may jeopardize the whole project.
- *Reluctance* – people’s reluctance to changes and the new system is a significant barrier to ES adoption success. Reluctance is connected with lack of involvement in the project duties and lack of willingness to cooperate. It may apply both to employees holding operational positions and managers.
- *Experience* – it is beneficial for the project when the participants are experienced in implementing enterprise systems or other large scale projects. Prior experience is valuable in problem solving and going through the most difficult stages of the adoption project.
- *Infrastructure* – a proper hardware, software, and network infrastructure should be prepared for the project. Problems with infrastructure are significant barriers to ES adoption success, they may refer to network capacity, security issues, inadequate computers or printers etc.
- *System* – special attention should be paid to the new enterprise system being installed in the company. The system should be reliable and its functionality and interface should fit the company’s needs. System-related problems, such as unreliability, errors, and too complicated interface are important barriers and may lead to the project delay and additional costs.
- *Provider* – good cooperation with the system and implementation services provider should be established. The agreement between the companies should allow for the definition of the service quality, warranty terms, and reaction time. The adopting company should receive from the provider immediate help and support in problem solving.
- *Trainings* – a company’s employees should receive proper training in how to use the new system and how to operate new business processes. Special attention should be paid to the trainings’ quality, timing, and fit to the company’s needs. Problems with trainings would result in the users’ inability to exploit the new system’s potential.
- *Knowledge* – project participants and company’s employees should have adequate knowledge of IT and enterprise system implementation process. The company’s personnel should be aware of the necessity and complexity of the adoption project. Lack of participant’s knowledge is an important barrier to ES adoption success and may require extensive trainings.
- *Schedule* – a detailed and realistic schedule should be defined at the beginning of the project and should be further updated. The project schedule should be publicly available within the company and should contain concrete milestones and responsibilities. Nevertheless, companies may experience problems in long term planning and this might be a serious barrier to ES adoption success.

- *Project team* – an adopting company should pay special attention to the project team composition and the appointed people should be actively involved in the implementation duties. It is beneficial to minimize the rotation of the project team members since this usually causes additional problems.
- *Acceptance* – the adopting company's employees should accept the project and new system, they should identify themselves with the project goals and should have positive attitude towards the new enterprise system. Lack of system acceptance may result in the system operation avoidance and is an important barrier to ES adoption success.
- *Decision making* – the adopting company should establish an effective decision-making process during the project run. Barriers connected with decision making refer to lack of empowered people in the project team and postponement in making decisions which may result in the whole project delay.
- *Finance* – the company should be prepared for an enormous financial burden connected with the cost of the system and implementation services. The company should be also aware of the costs of its reorganization, which are usually difficult to estimate. Overall, problems connected with the company's finances are significant barriers to ES adoption success.
- *Work time schedule* – during the adoption project a company may experience an excessive overload of some employees which may lead to decreased performance of the ES adoption project. This should be avoided and/or properly handled by the adopting company.
- *Responsibility allocation* – there should be a good definition of organizational procedures and clear allocation of responsibilities in the adopting company, concrete people should be responsible for all company areas affected by the implementation project. Failure to allocate responsibility could lead to communication barriers.
- *Goals* – the company should define the adoption project goals that should be aligned with its business strategy. Nevertheless, lack of clearly defined goals is a frequent problem in ES adoption and could lead to the project delay.
- *Integration* – the adopting company should integrate the new enterprise system with its legacy systems. This is connected with time consuming tasks such as data migration and software interface development that burden company resources.
- *Supervision* – the adoption project should be carefully supervised and all important documents created during the project should be recorded and stored.
- *Habits* – employees of the adopting company may be accustomed to the old style of work and to the use of legacy systems. People's habits may pose a serious barrier to the efficient work in the new system and may result in the lack of the new system acceptance and could be connected with additional costs.
- *Testing* – the system being implemented and the worked out solutions should be carefully tested and verified at each implementation stage, starting from the beginning of the project. Lack of tests at the early stages of the adoption could result in further project delay and additional costs.
- *Involvement* – the adopting company and its employees should reveal active involvement in the adoption project, they should be willing to cooperate with partners from within the company and from external organizations. The adoption project should be given top priority in the company.
- *Motivation* – project participants should be motivated by the company's management to greater efforts required by the implementation duties. This could be accomplished by organizational and financial measures.
- *Fear* – people may be afraid of changes and the new system. People's fear may be caused by the expected consequences of ES adoption such as personnel layoffs, more duties, necessity to obtain new skills. People's fear is a significant barrier to ES adoption and, left unhandled, may lead to the project failure.
- *Requirements* – the adopting company should have realistic expectations towards the new system and should be able to define their requirements for the adoption project. Excessive expectations could pose a serious barrier and may lead to disappointment and lack of the new system acceptance.
- *Effects* – project participants should perceive fast partial positive results of the ES adoption. Lack of such effects may result in employees' decreased motivation and the avoidance of the new system operation.
- *Continuous improvement* – the solutions worked out during the ES adoption should be subject to continuous verification and improvement. End user performance should be continuously inspected.
- *BPR* – the company's organizational structure and its business processes should be modified taking into account the new system's requirements. Failure to perform BPR may pose a serious barrier to ES adoption success.

Importance of Determinants across the ES Lifecycle

Table 2 contains the determinants’ criticality depending on the lifecycle phase, as revealed on the basis of the analysis of respondent opinions. For each lifecycle phase, the importance of determinants understood as CSFs is described by upward arrows, while the criticality of determinants perceived as barriers is depicted by downwards arrows. The thickness of an arrow represents a low, medium, or high level of criticality of the given determinant.

| Determinant | Lifecycle Phase | | | | | |
|---------------------------|-----------------|----------|------------|------------|---------------|----------|
| | Initiation | Adoption | Adaptation | Acceptance | Routinization | Infusion |
| Top management support | ↑ ↓ | ↑ ↓ | ↑ | ↑ | ↑ | ↑ |
| Project manager | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| Communication | ↑ | ↑ ↓ | ↑ ↓ | ↑ ↓ | ↑ ↓ | ↑ ↓ |
| Reluctance | | ↓ | ↓ | ↓ | ↓ | ↓ |
| Experience | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| Infrastructure | | ↓ | ↓ | ↑ ↓ | ↓ | ↓ |
| System | | | ↑ | ↑ ↓ | ↑ | ↑ ↓ |
| Provider | ↑ | ↑ | ↑ | ↑ ↓ | ↑ | ↑ ↓ |
| Trainings | ↑ | ↑ ↓ | ↑ ↓ | ↑ ↓ | | ↑ |
| Knowledge | | ↓ | ↓ | ↑ ↓ | ↑ ↓ | ↑ ↓ |
| Schedule | ↑ ↓ | ↑ | ↑ | ↑ | ↑ | |
| Project team | ↑ | ↑ | ↑ | ↑ | ↑ | |
| Acceptance | ↑ | ↑ | ↑ | ↑ | ↑ ↓ | ↑ |
| Decision making | ↑ ↓ | ↑ ↓ | ↑ ↓ | ↑ | ↑ | ↑ |
| Finance | ↑ ↓ | ↑ ↓ | ↑ ↓ | ↑ | ↑ | |
| Work time schedule | | ↓ | ↓ | ↓ | ↓ | |
| Responsibility allocation | | ↓ | ↑ ↓ | ↑ ↓ | ↓ | ↓ |
| Goals | ↑ ↓ | ↑ | | | | |
| Integration | | ↓ | ↓ | ↓ | | |
| Supervision | ↑ | | ↑ | ↑ | ↑ | |
| Habits | | | | ↓ | ↓ | ↓ |
| Testing | | | ↑ | ↑ | ↓ | |
| Involvement | ↑ | | ↑ | | | |
| Motivation | ↑ | ↑ | | ↓ | | |
| Fear | | ↓ | ↓ | ↓ | | |
| Requirements | ↑ | | | | | ↓ |
| Effects | | | ↓ | ↑ | | ↓ |
| Continuous improvement | | | | | ↑ | ↑ ↓ |
| BPR | | ↓ | | ↓ | | |

Note: Importance of determinants represented by arrows: ↑ ↑ ↑ for CSFs, ↓ ↓ ↓ for barriers; arrows’ thickness represents low, medium, or high level of criticality.

Table 2. Importance of Determinants across the Enterprise System Lifecycle

DISCUSSION OF FINDINGS

Discovering the Most Critical Determinants across the ES Lifecycle

The determinants discovered as a result of data analysis represent numerous areas of ES adoption that are important for the project success. Data represented in Table 2 give us insight into the changing criticality of determinants across the ES lifecycle and allow us to discern issues that are the most critical for the project prosperity. The rule differentiating the most important determinants is connected with the simultaneous perception of given determinants as both CSFs and barriers by the

respondents. Following this rule we may conclude that the most critical issues for the project prosperity are connected first and foremost with the system characteristics, top management support, infrastructure, trainings, detailed schedule, and goal definition. Another significant issues perceived by the respondents to a lesser extent embrace issues connected with good communication and adequate knowledge revealed by project participants and company's employees.

Several the most important determinants are significant throughout the whole system lifecycle, however, there are numerous issues that have changing criticality depending on the lifecycle phase. In this respect, the determinants revealing significant criticality during initial phases of the lifecycle deserve our special attention since they may decide on the further course of the project. In particular, determinants that are the most critical at the beginning of the project include issues connected with people supervising or managing the implementation project, i.e. top management, project manager, and members of the project team. Another group of such determinants include issues connected with project definition, i.e. project schedule and goals. Additionally, the analysis interestingly revealed the critical role of requirements definition at the very beginning of the adoption project, while, at the same time, this determinant is not perceived as important in other phases of the ES lifecycle.

Another group of important determinants consist of those issues whose significance appear critical at the final stages of the adoption project. Such determinants might be dangerous for the project prosperity since, planning the adoption, the adopters might not be aware of its presence and may not expect them to appear. In consequence, the occurrence of such determinants might be surprising for the adopters and may result in unforeseen consequences. This group of determinants include first and foremost system characteristics, people's habits, and continuous improvement. The last issue deserves our special attention since this determinant appears only in the last two phases of the lifecycle and is not important in general ranking. In consequence, it might have been overlooked if we did not adopt the lifecycle approach. The group of determinants with increasing importance along the system lifecycle is complemented by adequate knowledge revealed by the project participants and company's employees.

Upon analyzing the phases of the enterprise system lifecycle it is difficult to state which stages are the least important in the whole lifecycle. In fact, there is a slightly smaller emphasis on the last two stages of the lifecycle; however, we should not treat them as clearly less important. This is due to the fact that there are determinants, such as continuous improvement and system characteristics, whose criticality is particularly high during these stages. In general, there is emphasis on the first four stages of the system lifecycle and the first phase, Initiation, seems to be the most critical since it accumulates the largest number of determinants. Nonetheless, on the other hand, during the phases Adaptation and Acceptance the barriers seem to outnumber CSFs which suggests the high criticality of these stages.

Transition versus Developed Economies

In order to contrast this study's findings with determinants experienced by developed economies, we may set the results of this study against the most significant critical success factors and barriers represented in prior literature. To this end, the analysis employs the categorization of the most significant determinants worked out by Soja (2011) which takes into consideration the CSFs and barriers. The issues discovered by this study have been mapped onto the aforementioned determinant categorization and the results are presented in Table 3. The presented determinants are ordered in decreasing order of importance among developed economies. Arrows in the column Change indicate the direction of changes which take place among Polish adoptions when compared with projects conducted in developed economies.

The comparison presented in the table suggests that the topmost determinants recognized by developed economies are less important among Polish practitioners. This first and foremost refers to lack of emphasis on BPR among Polish companies, while, at the same time, this issue is very significant among developed economies and occurs both as a CSF and barrier. The same rule, to a lesser extent, applies to other topmost determinants: Provider support and Trainings. However, these issues are perceived by the Polish respondents to a greater extent as CSFs, as compared to BPR. Issues less frequently perceived by the Polish respondents are supplemented by system characteristics. Interestingly, Polish practitioners perceive system characteristics more as a CSF than a barrier.

Determinants characteristic of Polish adoptions include first and foremost issues connected with infrastructure needed for the adoption and people's attitudes. The former is not present among the important determinants revealed in developed economies, while the latter appears to a moderate extent as a barrier. Meanwhile, in Polish adoptions people's attitudes are perceived as a very significant barrier and an important CSF. The group of determinants revealing greater significance among Polish adoptions is supplemented by the project participants knowledge and the need for testing the adopted solutions. The latter is uniquely perceived by the Polish respondents, however, to a limited extent. Participants knowledge, on the other hand, is a very important CSF and an important barrier among Polish adoptions, while among developed economies it appears only as a barrier.

| Determinant | Developed Economies | | This Study's Respondents | | |
|-------------------------------|---------------------|---------|--------------------------|---------|---------|
| | CSF | Barrier | CSF | Barrier | Change* |
| Provider support/relationship | ●●● | ●●● | ●● | ● | ↓ |
| BPR | ●●● | ●● | | ● | ↓ |
| Trainings | ●●● | ●● | ●● | ● | ↓ |
| Project schedule/planning | ●●● | ●● | ●●● | ●●● | |
| Project team | ●●● | ●● | ●●● | ● | |
| Change management | ●●● | ●● | ●●● | ●●● | |
| System characteristics | ●● | ●●● | ●● | ● | ↓ |
| Top management support | ●●● | ● | ●●● | ● | |
| Project cost | ● | ●●● | ●● | ●● | |
| Participants knowledge | | ●●● | ●●● | ●● | ↑ |
| Company's organization | | ●●● | ● | ●● | |
| People's attitudes | | ●● | ●● | ●●● | ↑ |
| Infrastructure | | | ● | ●●● | ↑ |
| Testing | | | ● | ● | ↑ |

Notes: the level of determinant criticality is represented by bullets, *arrows indicate change among Polish respondents as compared to developed economies

Table 3. Determinants of ES Adoption in Developed Economies versus Polish Respondents

While comparing transition economies with developed countries, the results indicate that it is interesting to discuss the role of the system-related determinants. Among transition economies, from one hand, the system characteristics play a less significant role. However, on the other hand, the infrastructure needed by the system is significantly more important. These two issues are connected with testing, which is a determinant uniquely perceived by the respondents from a transition economy. In consequence, considering the system-related determinants in an integrated way, we may conclude that determinants connected with technical issues are still very important for transition economies.

Implications and Further Research

This study's results should be helpful for ES practitioners from both transition and developed economies in organizing their adoption projects. The findings suggest areas which are crucial for ES adoption depending on the lifecycle stage and, also, with reference to the level of the national economy development. The practitioners may use the results in better resource allocation during the project and in an improved diagnosis of impediments to ES adoption success and problem solving. Drawing from this study's findings the practitioners may better anticipate problem areas and have more possibilities to take remedial measures.

First, the results give the practitioners opportunities to focus on the most critical determinants during a given lifecycle stage and as such may contribute to better management of restricted company resources. Second, the ES adopters may have greater awareness as regards the determinant dynamics over time and, as a result, may better predict what would happen in the future. In consequence, the practitioners may learn that there are determinants that are not important in general ranking but they get significant during the later phases of the lifecycle. This refers first and foremost to the characteristics of the system and, to a lesser extent, infrastructure and people's habits.

The determinants connected with the new enterprise system characteristics are a good illustration of the importance of analyzing the determinants over the lifecycle. Overall, the results imply that ES managers should be aware that the right system choice is crucial for the whole implementation process. Although the system-related determinants reveal themselves most frequently only starting from Acceptance phase, the system should be thoroughly tested in earlier phases, preferably before the final decision about the particular system choice is made. By following this rule the managers would have possibility to deal with shortcomings of the considered enterprise system, or even to opt for another system solution.

This study has an exploratory nature and as such is subject to some limitations and requires further research. The main limitation is connected with the scope of research results due to the research respondents including ES practitioners from Poland. Hence, we should generalize the results for other countries with caution. It appears that the scope of this study's

findings may cover countries from Central and Eastern Europe which joined recently the European Union and are now undergoing economic transition.

The findings indicate some avenues for further research which may focus on investigating the causal structure and mutual relationships among the discovered determinants. To this end, future studies may involve a multi-method research combining qualitative and quantitative approaches. Another strand of future research may be connected with examination of the influence of proposed determinants on ES adoption success. This would require the definition of the success measure and would result in discovering the most critical areas for the ES adoption prosperity.

CONCLUSION

This study examined determinants of enterprise system (ES) adoptions over the system lifecycle and built on the experience of ES practitioners from Poland, which is an example of a transition economy. The analysis adopted a bottom-up approach and the understanding of determinants as critical success factors and barriers. The employed research approach allowed us to discover the most significant determinants of ES adoption and to investigate how their significance changes across the system lifecycle. Further, the conducted analysis revealed how determinants of ES adoptions in transition economies differ from those experienced by developed countries. The main findings illustrate that in transition economies the initial stages of the lifecycle require greater involvement of management personnel and, in time, this emphasis shifts towards system- and infrastructure-related determinants. The achieved findings should be beneficial for practitioners dealing with ES adoptions in transition economies as they may learn from this study's results about the dynamics of ES adoption determinants over time and in consequence better plan and manage the whole project.

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