Enterprise Modeling in Complex ERP Adoptions: Learning from the Experience of an IT Company

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Abstract. This study reports on the experience of enterprise modeling within the ERP (Enterprise Resource Planning) system implementation project in an IT company in Poland. The project was complex due to project-intensive company organization and resulting information requirements, comprehensive logistic and service processes, and the necessity of ERP integration with specialized service applications. The study seeks to analyze the role of enterprise process modeling during the initial phases of large-scale implementation projects. It discusses modeling process from the perspective of human resources, tools employed, and process organization. Conclusions highlight both mistakes and best practices observed in the modeling process. Main findings indicate that the strategic significance and risk of modeling process increase along the scale of company's activities and complexity of processes and environment.

Keywords: ERP, implementation, modeling, pre-implementation analysis.

1 Introduction

ERP system adoptions run the risk of failure which grows with the complexity of a company's business processes and scale of operations. Among critical success factors for this kind of projects, the significant roles are played by an adequate definition of requirements, project team experience, and involvement of the adopting company resources [4]. Considering model approaches to the ERP lifecycle, it appears that the pre-implementation analysis is the main stage which ends in the agreement and definition of the requirements for the target system [10, 14]. In consequence, we may conclude that a good pre-implementation analysis is a critical precondition for a successful ERP adoption project.

During pre-implementation analysis, the modeling of enterprise and its business processes is performed [1, 3]. The importance of these activities grows along the level of changeability of a company's economic setting. This particularly refers to transition economies, i.e. economies in transition from communist style central planning system to free market system [11]. The fast changing business environment in transition economies results in the necessity to treat enterprise modeling as a separate project with a separate contract and agreements [15].

The goal of this study is to report on the experiences in enterprise modeling and pre-implementation analysis performed within the ERP adoption project conducted in a company from IT industry in Poland, a transition economy. The focal company is characterized by a project-oriented management approach, complex internal processes, and extensive range of internal IT systems. This study provides details on the modeling process and discusses observed best practices and mistakes. This report concludes with the discussion of the effectiveness of the whole adoption project and possibilities of its improvement through good practices applied during the modeling and analysis stage.

2 The Case Company and ERP Implementation Background

A company from IT industry, named "IT Firm" in this report, is the focal organization in this study. A company providing implementation services in the considered ERP adoption project in named "ERP Supplier". IT Firm specializes in computer system integration and company activities include the following:

- **System integration** – IT Firm is a nationwide integrator of computer systems and its activities and services include analysis of customer needs and resources, systems design, pilot project implementations, final project implementations, acceptance tests, and post-implementation maintenance.
- **Building automation systems** – IT Firm offers a majority of currently available systems used in modern buildings and provides technical consultancy, integrated design, and project implementation and maintenance.
- **IT services and outsourcing** – implementation and maintenance of the ICT infrastructure of the company's clients, on a both standard and outsourced basis. The company has 18 branches scattered over the whole country and offers its services to companies and institutions operating in public administration, banking and financial sector, telecommunication, manufacturing, trade, and service. The company employs 400 people.

IT Firm is a project-driven organization and its activities are divided into projects conducted for the company's clients and governed by the signed contracts. The key information required by the company's management refers to the projects profitability, which requires the granular and multidimensional cost and profit accounting. For the purpose of this study we will call various dimensions of cost and profit accounting (i.e. projects, organizational units, product and service types etc.) controlling cross-sections. The data gathered within an organization (payroll, purchase and sale invoices, etc.) have to be classified (recorded) simultaneously into all controlling cross-sections that are important from the perspective of managerial analysis. The company needed the reporting mechanism able to present the aggregated data in multidimensional controlling cross-sections. IT Firm, before making a decision on the implementation of a new software solution, was using an ERP system which did not have any dedicated module for project management or analytical tool satisfying the requirements of a project-driven approach. As a result, improvement in project reporting became the first goal of the new system implementation.

The second goal included the optimization and integration of business processes within the whole organization. The most difficult area involved services, with a special focus on so called service logistics. The company employed a dedicated portal to manage service requests, accessible by both customers and company's employees from various departments such as service, logistics, and call center. Using service portal, a client registers its service requests and then is able to track their status. The service portal was not integrated with the ERP system which resulted in process discontinuity and excessive workload required in order to meet service deadlines. In consequence, optimization and integration of IT processes and systems became the second goal of the new system implementation.

3 Enterprise Modeling Process in IT Firm

3.1 Implementation Methodology

The implementation methodology, adopted in the project conducted in IT Firm with the support of ERP Supplier, is based on three pillars:

- international project management standard PRINCE 2 [2, 8],
- agile project management methodologies such as SCRUM [12, 13],
- flexible architecture of the system being implemented and the provider's extensive experience gained during a few hundred implementation projects in various industries.

The implementation methodology hinges upon three basic rules:

- phased approach to project planning and control,
- project tasks progress monitoring on the basis of project products,
- prototyping during the phase of user requirements implementation.

The whole implementation project cycle is depicted in Fig. 1. Next sections shortly describe two aspects of the methodology: main stages of the project run (Pre-implementation analysis and Requirements implementation) and project task verification rules.

- **Pre-implementation analysis** – involves specification of processes, with a map of top-level processes as a starting point for creating a hierarchical list of processes. Next, the processes are being decomposed into the elementary processes.
- **Requirements implementation** – is the longest stage of the project and is conducted together with trainings, which is imposed by the prototype approach. This approach involves creating prototypes of elementary processes defined at the analysis stage. The prototype is delivered to the Key Users for testing. Then, after introducing corrections to the prototype, repeated testing takes place and such an iteration repeats until the final acceptance of the prototype, which becomes part of the new final solution.

The project stages and methods of progress verification illustrate the key role of pre-implementation analysis, which should include appropriate definitions of processes being implemented in the new solution. Processes become project products

that, in the next stages, form a framework for the project schedule and control mechanism.

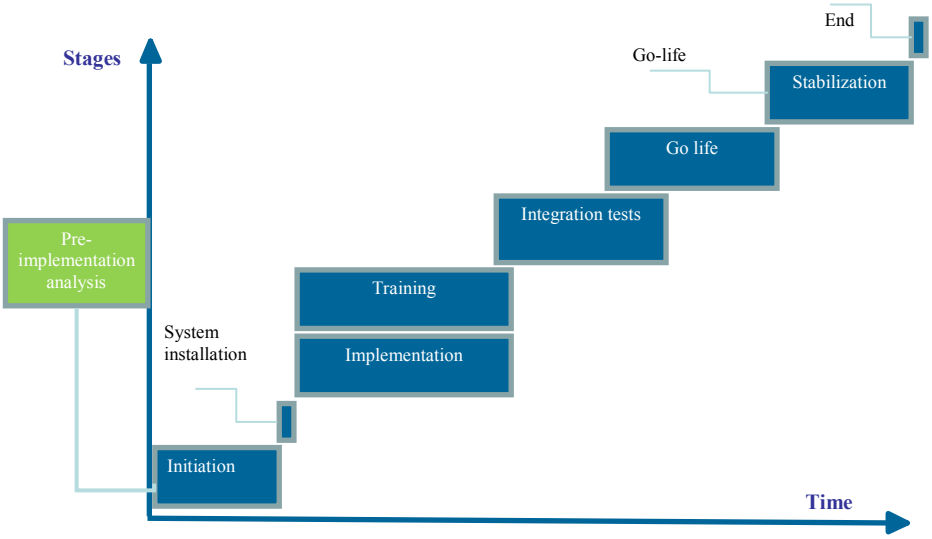

Fig. 1. Implementation project stages in IT Firm

3.2 Implementation Project Run

ERP system selection process in IT Firm started in 2006. In May 2007, a decision on enterprise system implementation had been made. The chosen system has been produced and implemented by the ERP Supplier. Two elements determined the system choice: (1) an extended project management module integrated with the other modules and (2) the overall system flexibility caused by its multi-layer architecture and a range of software tools enabling system customization. The general project schedule covered a one year time period with a productive start scheduled for January 1, 2008.

The general project schedule was divided into the following stages:

- Project preparation (PP)
- Analysis of business requirements (ABR)
- Implementation, divided into functional areas
  - ✓ Logistics and sales
    - System adaptation
    - System testing
    - Productive start
    - Stabilization
  - ✓ CRM (with similar sub phases as in the case of logistics and sales)
  - ✓ Finance and accounting, fixed assets, HRM

The analytical works started in June 2007. In practice, phases PP and ABR have been merged. During the first meeting, project managers from both sides agreed the

rules of project team composition, methods of communication and control, and the schedule for the first month of analytical works. A project initiation document (PID) has been prepared, which was presented during the first meeting of the analytical team (kick-off meeting).

3.3 Analytical Team

The project team involved the following stakeholders:

- **Steering committee** – a body of top management representatives from both companies delegated to the project supervision. In the analyzed project, the committee has been lead by a vice-president of IT Firm, who also served as a project sponsor. The supplier's side was also represented by a person from top management – a director of operations in ERP Supplier.
- **Project manager** – was responsible for supervision and coordination of activities conducted by units involved in the project from the IT Firm's side. Project manager was responsible for communication in the project team and with the steering committee. Project manager, together with project coordinator, made operational decisions in the project. In the analyzed project, project manager role was played by a director of IT department in IT Firm.
- **Project coordinator** – was responsible for supervision and coordination of activities conducted by units involved in the project from the ERP Supplier's side. In the analyzed project, project coordinator role was played by a director of implementation department in ERP Supplier.
- **Key users** – a team of specialists from various areas of IT Firm involved in all stages of the project and responsible for verification of all solutions being implemented (project products). In the analyzed project, key users were recruited among managers of departments and teams working in the areas affected by the implementation project.
- **Key developers** – employees of ERP Supplier with broad implementation experience in individual functional areas. Responsible for creating and delivering project products. A team for analytical support was involved among ERP Supplier's representatives. Its members were responsible for implementation methodology, analytical tools, and documentation.

3.3 Analytical Tools

A document named Pre-implementation Analysis (PA) was the main product of the analysis stage. It was a model of information system in the organization managed with the help of the new IT system. In the analyzed case, PA also included organization- and project-related elements (e.g. schedule). The adopted approach to enterprise's information system was based on the structural analysis and design [16] where models of data and processes were the most important elements of the system. PA document was divided into the following parts: Analysis organization, Organizational characteristics, Map of processes with proposed solutions, Project organization, and Schedule.

Process model. Process model included Data Flow Diagrams (DFD) and process specification.

- Data Flow Diagrams (DFD) – depicts the system as a grid of information processes connected by data flows and data repositories. In the analyzed project, the modeling process started at the topmost level (level 0) which illustrates all main information processes of the organization (see Fig. 2). Next, each main process is decomposed and detailed until the elementary process.

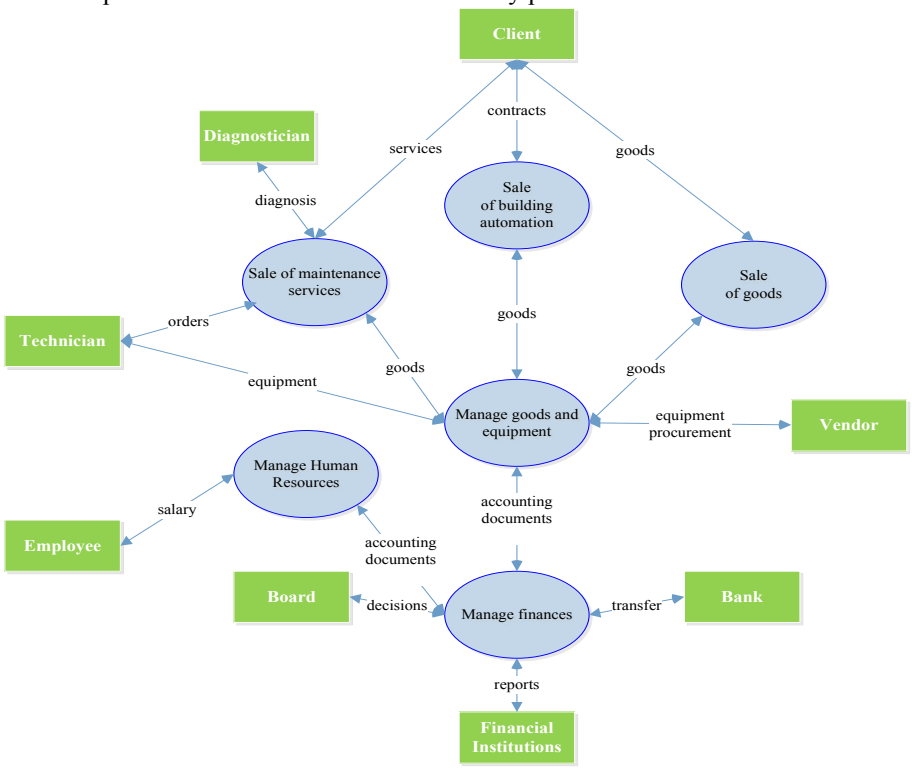

Fig. 2. IT Firm's DFD 0

- Process specification – each elementary process was defined with the help of a so called process card. Specifications were created in natural language; however, thanks to a formalized layout of the process card, they were unambiguous and precise. On the whole, IT Firm's model included 82 processes specified in this way.

Data model. The most important tools in data model included data dictionaries.

- Data dictionaries – included: element name, description, type, necessity, and default value. The field "description" was especially important as it defined and clarified the understanding of attributes in the analyzed organization.

3.4 Analysis Run

During the preparatory stage of the project, the project team was divided into domain teams created for the following areas: service, logistics, sales/CRM, finance, and IT. The adopted division turned out to be not adequate as, from the very beginning, people from service and logistics areas worked together. The schedule assumed meetings of teams at the same time and place so that mutual experience could be exchanged. However, in time, such a discipline disappeared and in consequence area teams worked according to their individual schedules and often in distant regions of the country.

Activities in the area of service and logistics. The team met on a regular basis and adopted the most detailed analytical perspective. The IT Firm's logistic team had a previous experience in business process modeling gained in past projects, when they used MS Visio and created process diagrams similar to BPMN notation [9]. This experience was very useful during the analysis and definition of company processes using DFD and process cards. The logistic team was very involved and motivated which resulted from the large scale of the team activity, as they had to handle a few thousand of service requests per month. In fact, a very difficult aspect of service-logistic activities was connected with the necessity of using two separate software tools. Customers, servicemen, call-center workers used the service portal for registering and handling requests. Logisticians, in turn, were handling materials and service equipment in the ERP system. In consequence of the analysis, the required interface was defined.

Activities in the area of finance. The financial team adopted an assumption that only processes relevant for the activities of financial department have to be modeled, such as cash register, bank transfers, and chart of accounts. The logistic team adopted an opposite assumption and presumed that the financial team is responsible for the definition of accounting schema and business rules binding logistic and accounting operations. In consequence, these connections were defined just during the project run, which was sometimes connected with changes in processes. Overall, the requirements overlooked origin of data and impact of other areas' requirements on controlling processes. It was assumed that members of other teams would handle controlling-related issues in their processes. Overall, processes were defined at a very general level and did not reach elementary level.

Activities in the area of sales/CRM. The sales/CRM team worked separately from other groups due to its distinct location. Before the project start, this area employed the largest number of nonintegrated software solutions, mainly desktop applications. In consequence, the vision of a uniform, integrated solution was very difficult to develop. The team did not put any effort into a detailed modeling of the client acquisition process and preparation of offers or contracts depending on a client's business background. The process definition was restricted to a text-based description linked to the abovementioned sales procedure and other official regulations. The data structure analysis nor process decomposition was not performed.

4 Discussion and Lessons Learned

The discussion of findings has been conducted using an approach similar to the perspectives employed in the previous section, i.e. human resources, tools, and analytical process run. We arrived at this decision considering the three main components of information systems: organization, management, and technology [5] and also drawing from product development and operations management area [6].

4.1 Human Resources

Project management staff empowerment. In the analyzed project, the empowerment of the chief of the steering committee, who was also the project sponsor, played a very significant role. The appointed person was a member of the company board, which assured access to company's resources. The project manager, who was an IT director, assured an effective project organization and good communication with the ERP Supplier's team. Nonetheless, the key users' empowerment raises doubts because, despite having adequate knowledge, they did not have a crucial influence on organizational changes or team members' availability.

Knowledge exchange between the analytical and implementation teams. The key determinant of the overall ERP implementation success is connected with transferring knowledge about the organization from the analysis stage to further stages. This transfer may refer to explicit knowledge (e.g. analytical documents) and tacit knowledge (e.g. gathered in the analysts' minds) [7]. The applied implementation methodology, proposed by ERP Supplier, assumed that the key developers were also leaders of the area teams. Such a solution turned out very beneficial during the later phases as the key developers started to get to know people, organization and their problems right from the beginning of the project.

Coordinating the effects of analytical works. The role of the project manager was to manage the organizational aspects of the project. She was not responsible for the quality of the final product, which was the PA document in the investigated case. Building on the experience of the analyzed project, the suggested recommendation is to empower the project manager with authority to control the final effect of conducted works.

4.2 Tools

Modeling organizational and system structure. The formal organizational structure was missing in the PA document. Such a structure is a basis for developing roles and user rights in the system. Skipping roles in process modeling prevents the analysts from discovering possible organizational responsibilities and interdependencies which may result from differences between allocated and actually performed organizational duties.

Process modeling. In the applied process modeling, the context level was missing, where the organization should be modeled as a black box with emphasis put on objects from the environment handled by the information system. The most

convenient tool for illustrating and negotiating system behavior, used by many system analysis and design frameworks, are context diagrams [16]. In practice, lack of this perspective leads to overlooking major system stakeholders. In the analyzed case, missing context level resulted in lack of answer to a fundamental question: for whom the system is being built?

Modeling inter-system interfaces. Interfaces between information systems are usually difficult and risky elements; therefore, they should be carefully modeled during the analysis stage. In the investigated case, the modeling was restricted to the textual description what the resulting changes were in the service system when a particular process activity occurred in the ERP system. A data exchange mechanism useful for software developers was not modeled, although the system was supposed to work in an on-line mode. Building on the experiences of the analyzed study, the authors suggest to develop a prototype of a partial interface in order to verify if the project assumption were satisfied.

4.3 Analysis Run

Phased approach and budget. In the investigated project the pre-implementation analysis was a separated stage; however, its results could not have had impact on the project budget and time. The authors' suggestion therefore is to keep an implementation contract not signed until the analysis stage is finished, even with the possibility of canceling the whole project.

Domain-based analytical works. The division of the analytical team on the basis of business areas might not match the developed process model. It is difficult to prevent such a situation; however, it is beneficial to be aware that the initial division might be subject to change. Learning from the investigated project, it is suggested to delegate "inspectors" of the analysis integrity. In the discussed case, such inspectors might have been recruited from the controlling or project management departments.

5 Conclusion

This study investigated experiences of enterprise modeling gained during the complex implementation of an ERP system in a company operating in IT industry in Poland. Such projects bear significant risk of failure which increases with growing complexity of a company's business processes and scale of operations. The performed analysis indicates that the risk of failure is inversely proportional to the quality of a developed enterprise model and this relationship is influenced not only by technical factors, but also by human-related and organizational elements. The investigated case illustrates that the following factors had the most significant influence on the modeling quality:

- too general level of process definition,
- unclear definition of interfaces between the ERP system and legacy systems,
- lack of consistency in the application of the adopted methodology,
- lack of supervision over the whole modeling process.

In general, this study's findings suggest that the properly conducted pre-implementation analysis is a very significant instrument in minimizing risk of implementation project failure. Therefore, increased resources invested in a high quality analysis are strategically justified and should pay off.

References

1. Berio, G., Vernadat, F.: Enterprise modelling with CIMOSA: functional and organizational aspects. Production Planning & Control, 12(2), 128--136 (2001)
2. Bradley, K.: Understanding Prince 2. Spoce Project Management Limited, Dorset (1997)
3. Dalal, N.P., Kamath, M., Kolarik, W.J., Sivaraman, E.: Toward an Integrated Framework for Modeling Enterprise Processes. Communications of the ACM, 47(3), 83--87 (2004)
4. Finney, S., Corbett, M.: ERP implementation: A compilation and analysis of critical success factors. Business Process Management Journal, 13(3), 329--347 (2007)
5. Laudon, K., Laudon, J.: Essentials of Management Information Systems. 10th Edition, Prentice Hall, Upper Saddle River, New Jersey (2012)
6. Morgan, J.M., Liker, J.K.: The Toyota Product Development System: Integrating People, Process and Technology. Productivity Press, New York, USA (2006)
7. Nonaka, I., Takeuchi, H.: The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press, Inc., New York (1995)
8. OGC: Managing Successful Projects with PRINCE2® 2009 Edition. The Stationery Office, London (2009)
9. Panagacos, T.: The Ultimate Guide to Business Process Management: Everything you need to know and how to apply it to your organization. Theodore Panagacos (2012)
10. Ross, J.W., Vitale, M.R.: The ERP Revolution: Surviving vs. Thriving. Information Systems Frontiers, 2(2), 233--241 (2000)
11. Roztocki, N., Weistroffer, H.R.: From the special issue editors: Information technology in transition economies. Information Systems Management, 28(3), 188--191 (2011)
12. Schwaber, K.: Agile project management with Scrum. Microsoft Press, Washington, USA (2004)
13. Schwaber, K., Sutherland, J.: Scrum Guide, Scrum Org, http://www.scrum.org/Scrum-Guides (2011)
14. Somers, T., Nelson, K.: A taxonomy of players and activities across the ERP project life cycle. Information & Management, 41, 257--278 (2004)
15. Themistocleous, M., Soja, P., Cunha, P.R.: The Same, but Different: Enterprise Systems Adoption Lifecycles in Transition Economies. Information Systems Management, 28(3), 223--239 (2011)
16. Yourdon, E.: Modern Structured Analysis. Prentice Hall (1989)