

Analysis of factors influencing the success of implementation of ERP systems based on self-assessment

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Abstract. *Implementation of an ERP systems is a demanding process that often ends with partial success and customer dissatisfaction. The research presented in this paper defines and compares the critical factors of success of implementation in 22 Croatian companies which have installed MAX EXACT solution and the satisfaction with its performance. The assessment was performed by using an ABCD checklist of the CMMI methodology.*

Keywords. ERP, Implementation, Critical Success Factors (CSFs), ABCD checklist, CMMI methodology.

1 Introduction

The business environment is changing dramatically, so organizations must improve their business practices and procedures in order to stay competitive in the market. The business sector is aims to achieve this by implementing and using of Enterprise Resource Planning (ERP) systems that integrate internal and external management information across manufacturing, sales, finance/accounting, human resource management, customer relationship management and other functions. The organizations which have successfully implemented the ERP systems are reaping the benefits of having integrating working environment, standardized process and operational benefits to the organization [1].

Despite benefits that yield from the ERP, implementation of these systems can be very risky because of their complex nature. It is reported that three quarters of ERP projects were estimated to be unsuccessful by the ERP implementations firms, about 90 percent of ERP

implementations are late or over budget and recently the ERP failure rate is estimated 40% to 60% [2].

In accordance with Standish Group International, 90% SAP R/3 ERP projects are late [3]. The study of 7400 projects shows that 34% ERP projects are late or over budget, 31% are abandoned, trimmed or modified, and only 24% have ended within time and budget frame [4].

Many researchers are trying to determine the cause of these disturbing results, by indentifying critical success factors of successful implementation. Al-Fawaz K. et al. points out the eight key factors of successful implementation: support from the highest leadership, vision and the business plan, reengineering of business processes, project team, team work and synchronisation, the choice of ERP solutions, involvement of users, education and practice. In the paper, 6 key reasons of failure are rated, and first of all is the support of the highest leadership. The problem of cultural differences is defined as the third cause of implementation problems in this paper.

Many authors from the Far East put the problem of cultural differences on the top of implementation problems, which is very important from the point of view of the role of the Chinese and other Asian economies.

Planning of implementation and management issues stand out as key to implementation success [7].

Regardless of the pitfalls and obstacles of the ERP systems implementation, it is expected that the global market of ERP software will until the year 2015 reach the value of US\$ 67,8 billion,

with the continued yearly growth of 7% [8]. It is expected that the Croatian market of ERP solutions will grow by 9,5% per year and reach the 59 million US\$ in 2015 [9].

Based on mentioned above a planning of the implementation processes and a structuring of the implementation team are very important for the success of the implementation.

The research presented in this paper is divided into two sections. The first one tries to rank the significance of the suggested 12 criteria of implementation success in Croatian companies, based on the experinace of implementation of the same ERP solution. This is extended in the second section by the ABCD check list, [11] and according to the CMMI model [12].

2 The success of implementation of Max Exact ERP solution

The research described in this paper took into account the above mentioned methodology. Key people in 22 companies were asked to answer the same 12 questions about the success of implementation in their companies. All of these 22 companies have been implemented the same ERP solution, i.e. EXACT ERP (ex MAX for Windows). Implementation has been completed in the last 8 years.

This research is limited in two ways:

- research is made only in companies that have the same solution (even though the implementation was made by three implementation houses) and
- research is made solely in manufacturing companies.

The completed implementation means as follows:

- that all business functions from the ERP core module were covered,
- that MRP calculation was successfully conducted for longer than six months on weekly basis and that it was the foundation generating work and purchase forms and
- that the business decisions were made on the basis of the ERP software data.

Except in the case of one company, it was the first implementation of an ERP solution in the company. Eleven of the mentioned companies

had some kind of an information system which comprised software modules of different vendors, that had some form of interoperability (same database, conversion exchange of SDF data, etc.). The rest of these companies had partial software solutions, and in some parts they used Microsoft tools for the process support.

Key people who answered the questions were:

- A. chief Executives Offices,
- B. implementation project managers and
- C. company's information technology managers.

The intent was to cover a diversity of responses of people who have significantly different functions in regard to the implementation of ERP solutions. In fact, studies that were discussed in the introductory part and other literature, present the research based on the data obtained from companies. The problem is that they never declare the organisational units and persons that were sources of data inside the company.

We believe that particular groups of managers may have different insights and perspectives on the implementation process of an ERP solutions.

The fundamental question posted to the participants was: Please rank the areas to which you would give the most attention in the case that you have an opportunity to participate again in the implementation of an ERP system.

1. Top management support,
2. Chose project champion,
3. Chose project team,
4. Chose representatives of business functions,
5. ERP software package selection,
6. Better defining customization,
7. Necessary time of implementation,
8. Business process reengineering before implementation,
9. User training and education,
10. Clear goals and objectives,
11. ERP vendor selection, and
12. Interdepartmental cooperation.

2.1 Research results

It is important that all companies covered by the survey gave a complete answer, which testifies their perception of the importance of the problem and research.

The respondents were pleased to make the ranking for all 12 questions. Research results are shown in Table 1. and Figure 1., taking into account the following:

$$F=(A+B+C)/3 \quad (1)$$

$$G=(A+B)/2 \quad (2)$$

Table 1: Key Success Factor of Implementation towards respondents

Critical Success Factor	A	B	C	F	G
1.	12	3	2	6	2
2.	11	12	6	12	9
3.	10	1	1	1	1
4.	8	2	3	2	3
5.	7	5	7	7	5
6.	2	4	8	3	6
7.	1	8	5	4	7
8.	3	9	10	8	10
9.	4	7	4	5	4
10.	6	10	12	11	11
11.	5	11	11	10	12
12.	9	6	9	9	8

These mean values were made for all three groups of subjects, as shown in column F (1), or only for project managers and IT managers, as shown in column G (2). It is interesting that in both cases the most important place for the successful implementation has the defining of a project team. Second place, in the first case, has a better selection of representatives of certain business functions and greater participation of the highest leadership.

Support of the top leadership is reflected in the support given to the project. It is difficult to expect that the implementation of the ERP project will become and a longer stay the No. 1 priority of the company, regardless of its significance and the price.

Support of the top leadership must be continuous and especially fast in the inflection points.

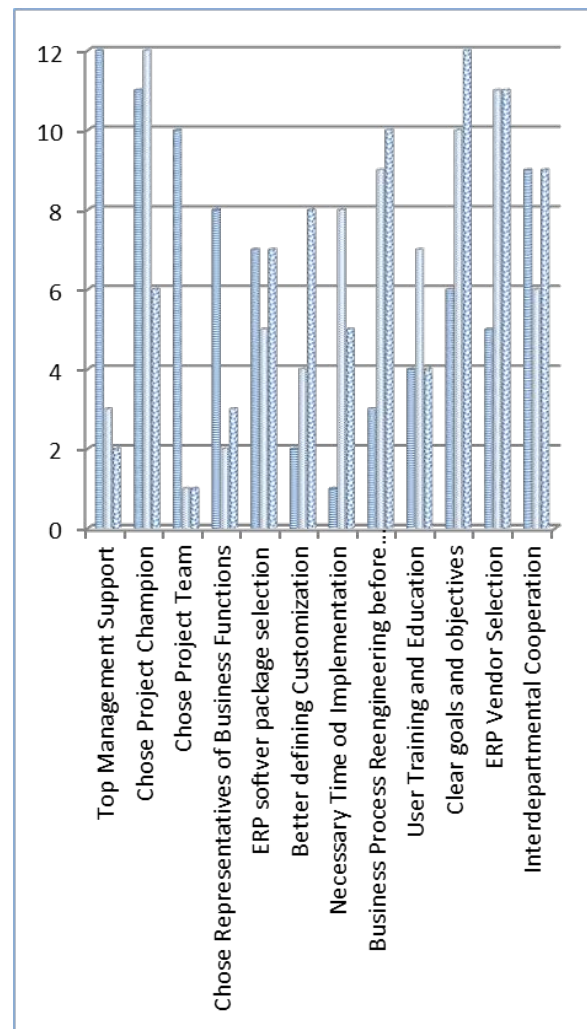


Figure 1: Success Factors of Implementation from the aspect of questioned person

So, waiting for an important decision of the top leadership during some phase of the project leads to the so-called "project creep", which usually slows down the activities. As a logical consequence it is a slowdown in the dynamics of the implementation team, primarily in their minds. The project team is absolutely an important factor.

It is difficult to expect the engagement of the best people in a project team for the long time. It is also hard to find the members of the implementation team who have some previous experience in the ERP area.

The participation of representatives of all business functions should be provided. These people are expected to have a good knowledge of the business functions whose representatives they are, the possibility of participation in the team and to perform their tasks without delays, as well as 100% commitment to the success of the project. Occasional and messy participation

is not acceptable. Therefore, at forming the project team, one must decide whether the team members will be permanent or flexible. Flexibility often implies that we will be able to hire better people, but from time to time, and a permanent membership may imply a worse man but continuous activity. Some studies show more productive results and greater satisfaction of flexible (ad hoc) teams [10].

3 Comparison of MAX Exact information systems in ABCD checklists and CMMI methodology

Previously described study is qualitative in nature because it is based on descriptive data and expert assessments. In order to verify and improve the reliability of qualitative research and expert opinions, it is necessary to apply some alternative, preferably independent methods. Therefore, the further research was conducted where the ABCD checklist proposed by Oliver Wight and the CMMI are applied on the same sample of companies. The results are presented later in this chapter

3.1 ABCD checklist

The ABCD checklist was set up by Oliver Wight in 1977, primarily for the MRP II system [11]. The list has been upgraded for years and accordingly has produced 6 official versions with many editions within each version. The whole approach can be divided into the two parts. The first part has been finished with the fifth edition and had a unique process for MRP II and ERP systems.

The sixth edition represents a different approach. The method is intended for self-assessment as well as for assessment performed by external assessors.

Assigning of scores is changed. Grading system [11] is based on a scale of 0 to 5 with an increase of 0.5. A finer increase assumes an accuracy that in reality sometimes does not exist. However, this does not preclude the internal assessment to use a finer division if there is a need for it.

The scores are defined as:

Score 0 (Not doing): Practices are required for this business, but they do not exist at present.

Score 1 (Poor): Practices exist, but they have not been developed to contribute to the business and its improvements.

Score 2 (Fair): Practices have been developed in isolation from the rest of the business. They have delivered benefit but are not integrated or formalized into the business processes.

Score 3 (Good): Practices are formalized and their checklist definitions are being satisfied; however, they have not yet been subjected to a systematic application of continuous improvement techniques.

Score 4 (Very good): Practices are fully integrated into the company's business processes, and all checklist definitions and description characteristics are routinely achieved and continuous improvement is demonstrated.

Score 5 (Excellent): Practices are excellent and fully effective in the company. Successfully enable reaching all of the business goals.

An average score of 4,5 is required for all definitions in the agreed scope for Business Excellence Class A recognition. To achieve excellence set forth (in terms of external assessment) it is required to achieve such a result at least 3 consecutive months, with only one failure within 6 months.

The sixth edition of "Class A Checklist for Business Excellence" in nine chapters asks 825 questions. The authors realized that the approach which is limited to the elements related to the ERP is not enough. It should be extended to the entirety of the business, as it do COBIT, CMMI, etc. Management of the strategic planning processes, which is the first of 9 chapters, was selected in full, so the adequate questions with explanations were asked to 22 companies on three levels: company executives, project managers and heads of the IT departments.

3.2 CMMI maturity model

Capability Maturity Model Integration (CMMI) is a maturity model intended for the process of developing products and services improvement [12]. The goal of CMMI project is to improve usability of maturity model for software engineering and other disciplines by integrating many models into a framework of action. It is also possible for companies to have an access to the essential elements of effective processes.

Today, this model is internationally considered and accepted for the software

maturity evaluation, but also for identifying the key steps necessary to improve the quality of business processes in companies.

CMMI model provides two different approaches for the processes improving and evaluation by using two views: the continuous and the phase one.

Reaching each level of maturity can increase the efficiency of the company process. These levels are:

Level 1 (Initial-Chaotic): Processes are (typically) undocumented and in a state of dynamic change, tending to be driven in ad hoc, uncontrolled and reactive manner by users or events. This provides a chaotic or unstable environment for the processes.

Level 2 (Repeatable): A characteristic of processes at this level is that some processes are repeatable, possibly with consistent results. Process discipline is unlikely to be rigorous, but where it exists it may help to ensure that existing processes are maintained during times of stress.

Level 3 (Defined): Sets of defined and documented standard processes are established. They are subject to some degree of improvement over the time. These standard processes are in place and used to assure consistency of process performance across the organization.

Level 4 (Managed): At this level management can effectively control IS process by using process metrics. In particular, management can identify ways to adjust and adapt the process to particular projects without measurable losses of quality or deviations from specifications. Process Capability is established from this level.

Level 5 (Optimized): At this level the focus is on continually improving process performance through both incremental and innovative technological changes/improvements.

3.3 The research result

The research was performed in the same companies where the first was done. An extension referred to the ABCD checklist and CMMI methodology was in terms of alignment of all elements of the business functions with the ERP solution.

The assessment was carried out by self-assessment of above-mentioned examinees, i.e., CEOs, project managers and IT managers. Right at the beginning several problems appeared:

- the concept of self-assessment by any methodology was unfamiliar to all

examinees, except for some IT managers, and

- almost none of the examinees has ever heard of the ABCD checklist or CMMI.

Therefore the research did not cover completely the ABCD checklist and the CMMI as a whole, but in less demanding parts.

At the same time, respondents have provided more detailed explanations of those specified by manuals. Each of the respondents gave their assessment. The mean value of all three responses is calculated. A period of one week between the application of the ABCD and CMMI is left, in order to avoid the influence of one method to another.

We opted for the first chapter of the ABCD Checklist, "Managing the Strategic Planning Process" Group of 11 questions (total of 73 questions in form of explanations).

The methodology of Interpreting CMMI Capability Maturity Model Integration (CMMI) for Business Development Organisations in The Governed Business and Industrial Sectors has 4 chapters. We chose the chapter Project Management with 6 areas and a total of 13 groups of questions (46 questions in total).

CMMI defines 'The Project' as 'managing the establishment of inter-related resources that deliver one or more products to the customer or end user' [10].

The results of the CMMI approach would be entirely comparable with the questionnaire, and the ABCD checklist if all the questions listed in the original manuals had been answered but there was not enough users' commitment for such study. As noted above, research was conducted among: CEOs, ERP implementation Project Managers and IT managers. Each of them gave answers. Calculated mean values were rounded in accordance with the rules of ABCD Checklist (0.5) or to an integer in CMMI models.

The results of the ABCD checklist are presented in the Table 2 and Figure 2.

Table 2: ABCD Check List for Managing the Strategic Planning Process

Name of Process	Level
Managing the Strategic Planning Process	
Understanding and Analyzing the External Environment	3,0
Business Mission, Vision and Values	3,0
Strategic Planning	3,0
Supporting Process and Function Strategies	2,0
Strategy Development	2,5
Business Planning and Annualized Plans	4
Evaluation and Control	1,5
Business Strategy Management Process	2,5
Risk Management	2
Performance Measures	2,5
Behavioural Characteristics	3
Average of : Managing the Strategic Planning Process	2,63

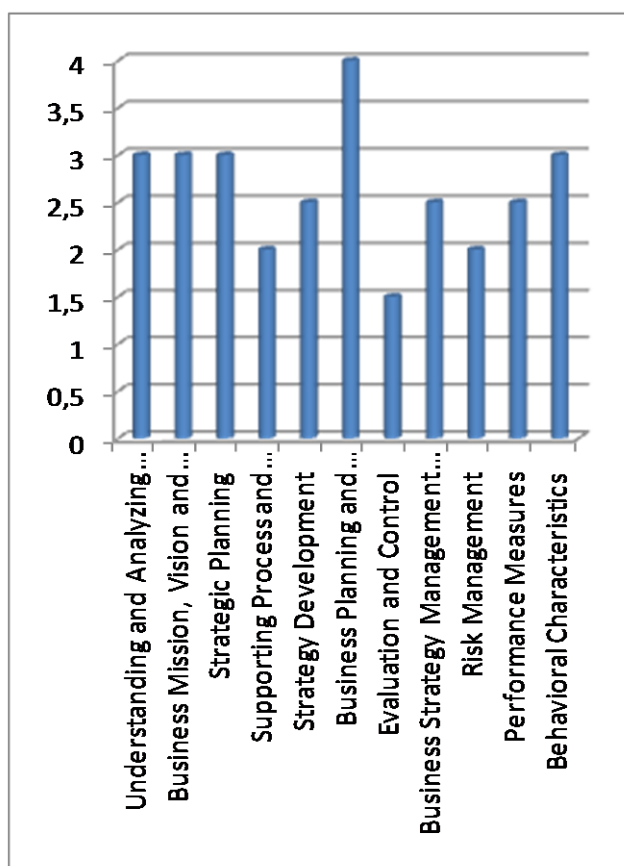


Figure 2: Managing the Strategic Planning Process

The average rating of the Managing the Strategic Planning Process in these companies was 2.63. This means that according to the proposed evaluating method these companies belong to:

Points 3 (good): The procedures are formalized, the checklist is satisfactory. However, they are

still not included in the systematically way of application.

If we try to compare the result with the fifth edition of ABCD checklist it could be concluded by simplification that the companies were in the process of transition from the class C into class B.

Response dissipation is relatively large, from 1 to 5, which indicates a gap between the Business planning and Annualized plans for each business function and the Evaluation and Control. It threatens the fulfilment of these and asks for the additional efforts in the Risk Management.

The cause of this discrepancy is the insufficient awareness of the importance of certain functions inside the company itself. The company's business plans are sometimes being prepared to meet the requirements of investors, banks and owners, and not to run the business. Risk management and process evaluation are usually a desire of ambitious managers.

Basically, there is no problem to prepare plans, even in their execution, but the problems occur in the systematic monitoring of the execution of plans. Sometimes is the external pressure necessary to bring a significant change in this area.

Results of the CMMI maturity model questionnaire, put to the same group of people, are shown in Table 3 and Figure 3. Testing the CMMI maturity model has shown similar results as the ABCD checklist. Of course, it happened in these parts where the questions were structured in the same or similar way. Perhaps because of a slight adaptation to the questions, they were answered faster.

The best results were achieved for two processes: Project planning and Management of contracts with suppliers. In both cases, the planning is directly linked to funding. The weakest result was achieved, as in the case of ABCD Checklist, in the process of Project Monitoring and control.

Table 3: CMMI model for Project Management

Process Area	Scores
Project Management	
Project Planning	4
Estimates of project planning parameters are established and maintained	3
A project plan is established and maintained as the basis for managing the project	4
Commitments to the project plan are established and maintained	3
A sales plan for major market opportunities is defined	4
Project Monitoring and Control	2
Actual performance and progress of the project are monitored against the project plan	2
Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan	2
Supplier Agreement Management	4
Agreements with the suppliers are established and	4
Agreements with the suppliers are satisfied by both the project and the supplier	4
Integrated Project Management	3
The project is conducted using a defined process that is tailored from the organization's set of standard practices	3
Coordination and collaboration of the project with relevant stakeholders is conducted	3
Risk Management	2
Preparation for risk management is conducted	3
Risks are identified and analyzed to document their relative importance	2
Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives	2
Average of: Project Management	3

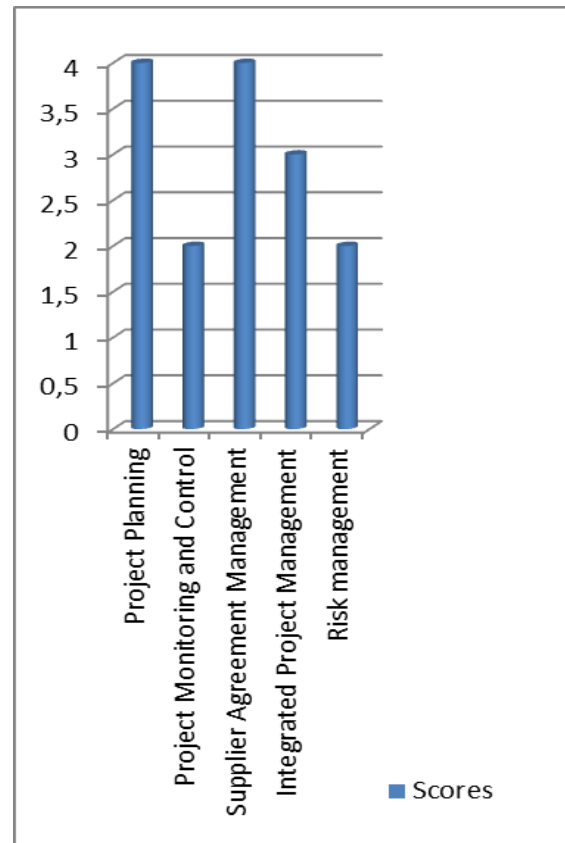


Figure 3: CMMI model for Project Management

4 Conclusions

Based on the results of research presented in this paper, implementation planning and structure of the implementation team have a strong influence on the ERP implementation process and its success.

Both the ABCD checklist and CMMI maturity model indicate that companies in which the research was done are equally good when it comes to the integration of business functions and ERP software from the point of view of average results, it can be concluded that companies are aware of the need for alignment of all business functions with ERP solution and its functionality.

As a result, future research will focus more on certain aspects of the implementation team and the way how they execute the plan. An ERP implementation is not exclusively the managerial project, but it comprises and engages a wide range of end user and people who are at lower levels of the project hierarchy. Therefore, it should include a variety of socio-technical aspects, personal motivation and value factors.

Of course, questions should be structured to reflect the level of knowledge about the processes in which they participate.

It is also necessary to investigate the factors affecting the in-house implementation, as compared with the implementation when it is carried out by the specialized consultants.

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