

Interrelation between ERP Modification and Modification Scheduling: Four SME Case Studies in Croatia

Stipe Čelar* - Eugen Mudnić - Sven Gotovac

University of Split, Faculty of Electrical Engineering,
Mechanical Engineering and Naval Architecture, Croatia

ERP customization and implementation requires significant resources and is a timely and complex project. ERP implementation became extremely demanding for SMEs because such projects generally include modifications with all the inherent risks of software development process. In this paper the relations between the impact of the amount of ERP changes and the scheduling of these changes on key project parameters is presented. The study was conducted in four medium-size companies in Croatia, which are similar in organization and operations, and all have successfully completed the implementation of one and the same ERP system. Data for analysis were collected during the project implementations. The results showed the expected large impact of ERP modifications on the project duration. However, it was found that the wise dividing of modifications into two phases and their good planning can significantly affect the duration and cost of the project.

© 2011 Journal of Mechanical Engineering. All rights reserved.

Keywords: enterprise resource planning (ERP), critical success factors (CSFs), ERP implementation, small and medium-sized enterprise (SME), case study, ERP modification factor, function point

0 INTRODUCTION

A typical ERP (Enterprise Resource Planning) implementation in large enterprises (LE) can be generally expensive to implement [1] and [2] and take too long to realize business value – from one to five years [3] and [4]. Such implementation could cost several million dollars for a moderate size firm (license, installation, modification and maintenance costs) [3] to [6]. For small and medium-sized enterprises (SME) the major obstacles to wider application of classic ERP systems is project long-term duration and high cost of implementation and modification.

This paper focuses on the correlation between two critical success factors (CSF) in ERP implementation in SMEs (*amount of ERP changes* and their *schedule*). Both CSFs are defined in the four successful ERP projects in Croatian medium-sized SMEs made with the integrated ERP system called SUSTAV. The aim of this paper is to present a two-step modification approach of ERP system for SMEs as a way to reduce a project risk.

The paper is structured as follows. Introduction is followed by a brief business profile of the case studies and projects descriptions while Section 2 presents the case studies results.

Section 3 deals with the modification factor and scheduling. Conclusions are given in Section 4.

1 FOUR SME CASE STUDIES

Parameterization of commercial ERP systems cannot resolve all the specific requirements of SMEs, which consequently require modifications that lead to project extension. In this paper, the outcomes of ERP projects in four Croatian SMEs are analyzed. Furthermore, it is shown how the *modification schedule* is related to the *implementation length*.

The described case studies (denoted A-D retrospectively), shown in Table 1, were conducted in Croatian enterprises that successfully implemented SUSTAV [7] one of domestic ERP systems surveyed by [8]. SUSTAV achieved very good marks for the components it contains [8]. The main motive for seeking a new ERP suppliers and launch a complex project in all four companies was the desire to better support the expansion of business system.

Although well-structured ERP system with a lot of useful functionality can largely be parameterized, it is impossible to completely avoid its adaptation or extension. These additional

*Corr. Author's Address: University of Split, Faculty of Electrical Engineering,
Mechanical Engineering and Naval Architecture, R. Boškovića bb, Split, Croatia, stipe.celar@fesb.hr

Table 1. *Case studies – business data*

CASE	A	B	C	D
industry	retail	wholesale, retail	wholesale, retail	hotel, manufacturing, SCM, retail
vision & mission	integration of 4 small companies into a middle one and expansion of new retail stores	expansion of new retail stores; build regional wholesale/retail network	expansion of new retail stores; build large regional retail network	construction of new factory; building of the large regional retail network
employees, Jan. 2010	266	171	304	374
income 2009	20 mio €	20 mio €	29 mio €	13 mio €
end users, Jan. 2010	75	67	140	70

efforts directly affect the duration, cost and overall success of the ERP project. Therefore, this paper attempts to find an answer to two questions asked in the ERP projects in SMEs: (i) how ERP modification before go-live affects the ERP *project duration* and (ii) what is an adequate *modification approach* when the ERP changes are necessary?

In all the projects, a detailed gap analysis was made – customer current situation, their desire and business plans were compared with the ERP functionality. As a measure for overlapping of business processes and ERP functionality a gap analysis was performed. In all these projects the big-bang implementation strategy with minor modifications before the go-live activities and major modification after go-live and stabilization phase was suggested to the companies. However, in companies A and B it was decided to make the whole adaptation (Retail back office automation and front office automation, retrospectively) and then to implement the adapted ERP. In companies C and D a minor ERP modifications were started immediately after the gap analysis and finished before go-live activities, while larger modifications were made after go-live (see Fig. 1). Most of the modifications in companies C and D referred to reporting (C) and Production Management (D). Interoperability with legacy systems in company D is provided by ERP changes after go-live while others changed ERP completely.

2 CASE STUDIES' RESULTS

PMBOK [9] was applied in implementation projects as a management guideline. All companies involved in the study are privately owned and

managements were very willing to organizational changes, although the management of companies A and C had no previous experience in the ERP implementation. In addition, the management used the ERP implementation projects as a means to achieve the re-engineering of business processes (BPR).

Although the change management readiness among top management was at a high level, end user acceptance was accessed as a high risk element. In order to eliminate this risk, a well-planned, prepared and executed education with a follow up was needed. The exception was the case D because of the initial small number of end users and because the key users used the same ERP two to three years (two years earlier, in another company).

In analyzing Figs. 1 and 2, several phenomena relevant to SME market can be seen. Projects lasted from 4 (company C) to 13 months (company A) – see Fig. 2. A large difference in the implementation effort in the company D (only 11.9 man-months) is notable. The reasons are a small number of end users, an extensive experience of the key users, a small number of retail stores and small stores integration effort. Company C had much fewer changes (only 2.8 man-months) than the others and completed implementation in the shortest time and with the smallest total effort.

On the other hand, company D, in which the changes amounted to a total of 11.3 man-months completed the project for 6 months while company B with only 5.2 man-months of changes needed even 9 months. Furthermore, project D completed more than twice faster than project A (6 to 13 months), although the total project effort ratio is relatively high (23.2 to 34.1 man-month).

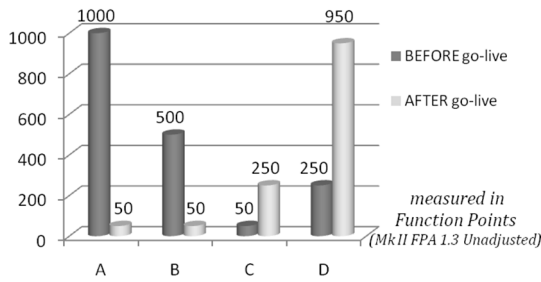


Fig. 1. Amount of delivered modifications

The amount of changed functionality is not the only variable that significantly affected the project duration and success. According to the risk analysis and project outcomes (Figs. 1 and 2) the key element was the schedule of modification. Companies C and D finished their projects two to three times faster than companies A and B.

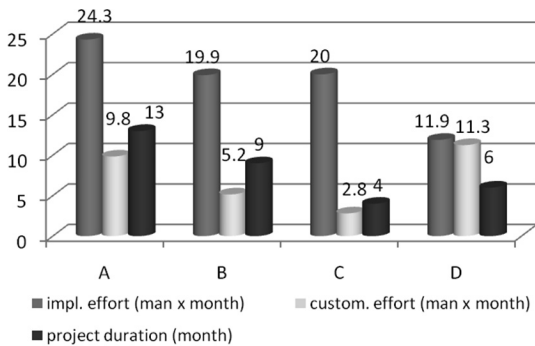


Fig. 2. Efforts and project duration

Generally speaking, these two modification approaches have some advantages and disadvantages, which are summarized in the Table 2. This comparison could be useful for project managers who have to make a decision about an appropriate scheduling approach and risk management.

3 MODIFICATION FACTOR AND MODIFICATION'S SCHEDULING

Since the amount of modification and its scheduling proved in the observed case studies as the key success elements, in this paper the *modification factor (m)* is defined as follows:

$$m = m_i / m_{max}, \quad 0 < m \leq 1, \quad (1)$$

where m_i is the functional gap to modify in case i (in Function Points), m_{max} is maximal functional gap among the benchmarked cases (in Function Points).

The modification factors of the four analyzed case studies are shown in Table 3. The modification factor for case C shows that company C has the highest degree of overlapping of business processes and ERP functionality (all companies use the same ERP).

Table 2. Analysis of modification approaches

Approach A-B	advantage	Client starts go-live with an customized ERP systems Functional uncertainty in the project is smaller than in the approach C-D
	disadvantage	Modification is a risky task and may delay the go-live and the whole implementation Greater involvement of the client and the contractor (in parallel is to adapt and to prepare implementation) Project takes more time to achieve final results
Approach C-D	advantage	Project is less risky Client sees the project benefits earlier, after 1 st modification step When a client sees the benefits, it is easier to introduce new changes Delays in modification have less impact on ERP go-live
	disadvantage	Higher degree of compliance between business processes and ERP functionality is needed Change management culture in customer organization should be mature Business process (re)engineering readiness should be positive Relative "small 20%" of changes in the 2 nd step could take 80% of project duration

When the modification factor is big, it is recommended to make modification in two steps and thus reduce the riskiness of the project. In cases C and D modification was smaller and/or it was applied in two steps, so that the implementation was shorter. In addition, these two projects were also less risky. Therefore, a two step

approach is the recommended approach for the projects with a higher modification factor.

Table 3. *Modification factors*

CASE	A	B	C	D
<i>m</i>	0.88	0.46	0.25	1.00

Experience of other companies that made similar projects could be helpful for new projects planning and scheduling.

4 CONCLUSION

In general, ERP system implementations are complex projects and many of them are unsuccessful. Almost all SMEs need some functional modifications of ERP in implementations and well-managed project implementation in SME takes at least 4 to 5 months. It is, therefore, important to manage the critical success factors wisely. Case analyses show that the ERP modifications significantly affect the success of ERP implementation projects. In addition to experience in the management of ERP projects and knowledge about ERP system itself, the key factor is also the schedule of these modifications.

In four ERP projects in SME companies the impact of sharing the ERP modification into two phases (before and after ERP's go-live) was analyzed. The analysis shows that even projects with a higher modification factor and total project effort could be shorter than projects with a smaller modification factor if the modifications are scheduled wisely. The schedule approach with a minimal amount of necessary modifications in the first phase and larger modifications in the second, resulted in less risky and shorter projects. The key step in both approaches was the detailed gap analysis with an aim to determine the difference between SME business processes and functionality of the ERP system.

It is, therefore, advisable for SMEs to implement modified ERP systems in two phases (regarding necessary ERP modifications) and thus reduce the riskiness of the project and its duration. In this way, it could be easier to manage the whole

ERP project and thus control the implementation costs. In addition, the modification factor could also help in benchmarking the projects.

5 REFERENCES

- [1] Botta-Genoulaz, V., Millet, P.-A. (2005). A classification for better use of ERP systems. *Computers in Industry*, vol. 56, no. 6, p. 573-587.
- [2] Su, Y., Yang, C. (2010). Why are enterprise resource planning systems indispensable to supply chain management? *European Journal of Operational Research*, vol. 203, p. 81-94.
- [3] Nicolaou, A.I. (2004). Quality of postimplementation review for enterprise resource planning systems. *International Journal of Accounting Information Systems*, no. 5, p. 25-49.
- [4] Mabert, V., Soni, A., Venkataramanan, M.A. (2003). Enterprise resource planning: Managing the implementation process. *European Journal of Operational Research*, vol. 146, no. 2, p. 302-314.
- [5] Al-Mashari, M., Al-Mudimigh, A., Zairi, M. (2003). Enterprise resource planning: A taxonomy of critical factors. *European Journal of Operational Research*, vol. 146, no. 2, p. 352-364.
- [6] Matičević, G., Majdandžić, N., Lovrić, T. (2008). Production scheduling model in aluminium foundry. *Strojniški vestnik – Journal of Mechanical Engineering*, vol. 54, no. 1, p. 37-48.
- [7] Celar, S., Gotovac, S., Vickovic, L. (2008). The role of PMO concept in project outcome increasing, Ch. 17, Katalinic, B. (Ed.), *DAAAM International Scientific Book 2008*, DAAAM International, Vienna, p. 197-204.
- [8] Fertalj, K., Kalpić, D. (2004). ERP software evaluation and comparative analysis. *Journal of Computing and Information Technology*, vol. 3, p. 195-209.
- [9] ANSI/PMI (2008). *A Guide to the Project Management Body of Knowledge*. PMI Inc., Newtown Square, Pennsylvania.