

# IMPORTANT FACTORS IN ERP SYSTEMS IMPLEMENTATIONS

## *Result of the research in Polish enterprises*

Piotr Soja

*Department of Computer Science, Cracow University of Economics, Rakowicka 27, 31-510 Kraków, Poland*

**Keywords:** ERP systems, implementation, success factors

**Abstract:** In the article the problem of success factors in ERP systems implementations has been discussed. The review of the literature concerning success factors has been discussed and the collection of potential ERP implementation success factors was identified. Next, the result of research has been presented, where respondents have been asked about their opinion about the importance of subsequent factors for the implementation success. There were two groups of respondents: the first consisted of people from Polish enterprises implementing ERP systems and the second comprised experts working in ERP systems suppliers. On the basis of the research, the most important and necessary factors in the respondents' opinions have been identified, as well as the least important ones.

## 1 INTRODUCTION

Enterprises operate in a market where fast reaction, flexibility and fulfilling the individual needs of a customer are the common rules. In order to cope with increasing competition the enterprises have to act in a planned manner by carefully selecting and working out their corporate strategies. In order to achieve assumed strategic goals and follow the difficult route, enterprises have to enhance and reorganise their functioning rules. The enterprises' needs are met by information technology functionality, which offers integrated systems to support the enterprise management.

The most advanced group of integrated systems are the ERP class systems which became well known in Poland in the nineties. The ERP systems include mechanisms based on planning and forecasting which support the management of the entire enterprise and integrate all areas of its functioning. The effective implementation of such a system can bring about many benefits, starting from the most general such as enterprise management and information flow enhancement. Consequently, economic indicators' improvement can be accomplished which finally leads to enterprise profitability increase.

However, the achievement of these mentioned benefits depends upon the effective implementation

of the ERP system within its full functionality. An examination of the Polish ERP market shows that this is quite difficult. The implementation of an ERP system is a process lasting as long as 2 or 3 years and strongly involving enterprise resources. This in turn causes great expenses on the system and implementation services. The situation of ERP implementation market is not good because the vast majority of implementation projects do not bring about planned effects or even end up in project abandonment. The implementation projects' duration time and budget significantly extend estimated amounts and the planned scope of the implementation is limited, often reduced only to inventory management support.

Due to this situation, it seems to be very necessary to conduct research in order to reveal the mechanisms determining the success of implementation projects. There is a need to perform analysis towards the identification of potential ERP implementation success factors. The next step is the verification of findings with the help of real implementation project participants. In the next stage of research, the group of factors that are the most important for the implementation success should be formulated.

## 2 THE IDENTIFICATION OF ERP IMPLEMENTATION SUCCESS FACTORS

### 2.1 The overview of the research on ERP implementation success factors

The ERP system implementation is a process of great complexity, involving crucial resources of the enterprise. There are great many conditions and factors potentially influencing the ERP implementation. Their occurrence could have positive effect on the outcome of ERP project, while their absence could generate problems during implementation. The results of some researches on ERP implementation success factors have been described below.

Burns, Turnipseed and Riggs (1991) doing research on critical success factors in MRP implementation suggested the division of potential factors to environmental and methodological. The environmental factors include, apart from those describing enterprise activity (organisation size, organisation function and production process), the product technology level and the organisation's willingness to change. The methodological factors are connected with incorporated implementation approach and contain aspects related to implementation team, project manager and consultants involvement, implementation plan existence, integration level of introduced solution, the source of the software, extent of hardware modification, the previous systems' environment and the extent of organisational modification required. On the basis of 504 responses on a mail survey, most of the methodological factors were identified as being associated with MRP II success, while only two of environmental factors were found to be connected with implementation success. They were product technology and organisation willingness to change.

In other research, the purpose of which was the identification of necessary factors for successful implementation of ERP systems, Parr, Shanks and Darke (1999) turned to experts participating in many implementation projects. The research sample consisted of 10 experts who had participated in a total of 42 ERP implementation projects mainly as project managers. The experts were interviewed in order to understand ERP systems implementation in practice and to elicit experienced practitioners' beliefs about factors that lead to successful

implementation. Based on the interviews, 10 candidate necessary factors for successful implementation of ERP systems are identified. They were divided into the groups related with management, personnel, software and project. Of these 10 candidate factors, three are of paramount importance. They are management support of the project team and of the implementation process, a project team that has the appropriate balance of business and technical skills, and commitment to the change by all stakeholders.

Holland, Light and Gibson (1999) presented a number of potential success factors in ERP implementation and suggested their division into strategic and tactical factors. The model was only illustrated on the sample of 5 implementation projects. Furthermore, the authors did not formulate conclusions regarding factors' importance and their ranking.

Esteves and Pastor (2000) suggested a unified ERP implementation critical success factors model. This model is based on the analysis of considerable research regarding implementation success factors. The authors indicated that factors should be categorised in strategic and tactical factors from organisational and technological perspectives.

### 2.2 The general model of ERP implementation success factors

The results of above mentioned research on ERP implementation success factors illustrate the problem complexity and the variety of approaches. The potential success factors and the research's results differ substantially from each other. Except for general agreement regarding the necessity of management support for implementation works, it is rather difficult to compare achieved research's outcomes. This difficulty is deepened by the difference in research samples, which ranged from hundreds of manufacturing enterprises, through a group of experts up to a set of only 5 implementation cases.

Taking into account the results of mentioned research, literature studies (among others Fui-Hoon Nah et al. 2001; Ip and Yam 1998; Parr et al. 1999; Skok and Legge 2001; Stewart et al. 2000) and the experience in business environment, the general model of ERP implementation success factors has been proposed. During creation of the model attention was paid to the organisational aspect of the implementation. It was assumed that the ready-to-use ERP software package, purchased from an external supplier, is being implemented. Hence, the problems regarding ERP software creation process were not discussed.

Table 1: The general model of ERP implementation success factors

Factor	Factor description
Related to the implementation participants	
A project manager	The project manager is the person from the enterprise who sacrifices most of his working time to implementation duties
B team composition	The implementation team consists of various people having high qualifications and knowledge about the enterprise
C team involvement	The project manager and members of the implementation team are strongly involved in the implementation duties
D motivation system	There is a motivation system rewarding participation in implementation and on-time task delivery
E co-operation with supplier	Good co-operation with the system supplier who is competent and offers high level of services
Related to the top management involvement	
F top management support	The top management support for the project and the management members involvement in implementation duties
G top management awareness	Top management awareness regarding the project goals and complexity, demanded labour, existing limitations, required capital investment and project inevitability
H top management participation	Top management participation in the project schedule and goals definition
Related to the project definition and organisation	
I linking with strategy	The implementation project linking with enterprise strategy (implementation as a method of the enterprise strategic goals achievement)
J implementation goals	The definition of implementation goals – defined in the economic terms at the whole enterprise level
K detailed schedule	The definition of detailed implementation scope, plan and schedule with responsibility allocation
L pre-implementation analysis	The enterprise analysis and diagnosis prior to the start of implementation, and the creation of the enterprise functioning model with the integrated system support
M organisation change	The change in the enterprise organisation and its business processes
N monitoring and feedback	The implementation monitoring and feedback – information exchange between the project team and end users
O implementation promotion	The implementation promotion – the information broadcasting about the project by the implementation team members to other enterprise employees
P fast effects	The visible fast partial positive results of the implementation
Q appropriate training	The adequate training program suitable to the enterprise needs
Related to the project status	
R investment plan	The formal introduction of the implementation project in the enterprise investment plan
S project team empowerment	The project team members empowerment to decision making and their high position in the enterprise hierarchy
T financial budget	The financial resources assured for during the implementation
U work time schedule	The work time assured for the implementation team members (work time schedule)
V IT infrastructure	The appropriate IT infrastructure assured for the implementation project
Related to information systems	
W system reliability	The ERP system reliability, its user friendliness and fit to the enterprise needs
X minimal customisation	The system minimal customisation – the use of defined patterns and solutions embedded in the system
Y legacy systems	The legacy systems adaptation for the operation in the ERP integrated system environment
Z implementation experience	The project team members experience gained during former information systems implementation

Similarly, the problems specific only to manufacturing enterprises (concerned for instance with manufacturing process or bill of material complexity) were not taken into consideration because of the more general goal of the research and

the attempt to cover the broader range of enterprises dealing not only with manufacturing.

The proposed ERP implementation success factors, exposed in Table 1, are divided to the groups regarding their broader aspect and in order to ease

the presentation. The separated groups consist of factors related to implementation participants, top management involvement, project definition and organisation, project status and information systems.

### 3 RESEARCH SAMPLE CHARACTERISTIC

The ERP system implementation success factors research was conducted twofold: firstly from the viewpoint of enterprises which had decided on ERP system implementation, and secondly from the perspective of ERP systems and services suppliers. In the first case, the research sample consisted of Polish enterprises implementing the ERP system in their organisations. In the second case, the research sample comprised the consultants and experts representing various suppliers of ERP systems.

The research done on the enterprises implementing the ERP system into their organisations was conducted with the use of a questionnaire, which was directed to the people playing leading roles in the implementation (the project leader if it was possible). 223 enterprises were contacted during the research and 68 (30%) answers were obtained from enterprises representing the whole country and various industries.

In order to examine the experts' opinions, the research questionnaire was directed to the specialists with the experience of implementing various ERP systems – those who were leading implementation projects from the supplier perspective and taking part in many implementations. During the research 45 people were inquired of and in the end 31 (69%) experts' opinions were gathered. The experts represented 22 firms supplying ERP systems and implementation services.

#### 3.1 The arrangement of data

The analysis of data from respondents from enterprises is being performed in three perspectives. Among the criteria defining division into perspectives are enterprise size, implementation scope and implementation duration. The analysis' perspectives are named: SIZE, SCOPE and TIME.

The criterion defining enterprise size was the number of employees. For the needs of analysis, enterprises have been divided into a group of small and large companies. The small firms comprised the enterprises employing less than 300 people. The rest of the companies formed the group of large enterprises. As a result of that division the group of

small firms counted 29 companies, and the group of large firms consisted of 39 companies.

The division regarding implementation scope was made by taking into consideration the modules of implemented ERP system. The following modules were taken into consideration: Finance, Purchasing, Inventory, Sales, Shop Floor Control and MRP Explosion. The full scope implementations were defined as the projects where the modules Shop Floor Control and MRP Explosion were implemented and also satisfying the condition that at least 4 modules were introduced. Given such definition, the group of full scope implementations comprised 31 projects, while the rest of the projects (37) created the group of partial implementations.

In the division considering project duration time, short implementations were defined as projects lasting up to one year, and those lasting more than one year were marked as long implementations. The group of short implementations comprised 33 enterprises; similarly 33 projects were recognised as long implementations. 2 projects were not finished when the research was conducted.

### 4 THE ANALYSIS OF FACTORS IMPORTANCE

#### 4.1 Data from enterprises

The respondents from enterprises expressed their opinions about the importance of listed factors in the implementation process. They were asked to use the scale from 0 to 5, where 0 stood for no importance at all and 5 meant the highest importance. The factors were marked with a subsequent letter of the alphabet from A to Z, and they were divided into groups.

In order to illustrate the respondents' opinions regarding the importance of proposed factors, an average was calculated for each factor. These calculations have been made for all researched enterprises as well as for defined groups using mentioned criteria (i.e. SIZE, SCOPE and TIME). The calculation effect is visible in Table 3. The average importance is located in column *Avg* and column *Rank* contains the rank obtained by the factor within a specific group on the basis of decreasing average importance calculated within a given group.

The Spearman rank correlation coefficients ( $r_s$ ) were calculated in order to explore the relationship between the factors' ranks in defined groups. The values of  $r_s$  coefficients are placed in Table 2. The value of  $r_s$  ranges from -1 to 1, and a value of -1 or

1 indicates perfect association between ranks, the plus sign occurring for identical rankings and the minus sign occurring for reverse rankings (see Walpole et al. 1998, p.630). The  $r_s$  coefficients were calculated for pairs of separated groups created by the analysis perspectives.

Considering responses from all inquired enterprises, the respondents on average recognised factor B – *team composition* (with average 4,6) as the most important element. The following positions were taken by factors: E – *co-operation with supplier*, G – *top management awareness*, W – *system reliability*, C – *team involvement*, V – *IT infrastructure* and K – *detailed schedule*.

As, on average, the least important factors respondents considered Y – *legacy systems* (with average 3,17), P – *fast effects*, X – *minimal customisation*, O – *implementation promotion* and H – *top management participation*.

Examining the SIZE perspective, it could be noted that  $r_s$  coefficient for complementary groups of small and large enterprises reached high value of 0,90. Judging from this value, one can say that regardless the enterprise's size, respondents are unanimous in factors' ranking regarding their importance for the project success.

Studying the SCOPE perspective, it could be observed that  $r_s$  coefficient for the projects with full scope of implementation and the projects with partial functionality being introduced reached quite high value of 0,84. This value allows us to claim that regardless of the implementation scope respondents are quite unanimous in factors' ranking concerning their importance for the project.

Analysing the TIME perspective, it could be noted that the value of  $r_s$  coefficient for complementary groups of long and short projects was equal to 0,89. On the base of this high value of  $r_s$ , one can say that regardless of the project duration time, respondents are unanimous in factors' ranking regarding their importance for the project.

The conclusion from the analysis of  $r_s$  coefficients is that respondents are unanimous in the judgement of factors importance for the project outcome, regardless of established division into groups.

## 4.2 Data from experts

Similarly to respondents from enterprises, the experts expressed their opinions regarding the importance of suggested factors in the implementations process. Additionally, they were asked to mark the factors whose occurrence, in their opinion, is necessary for the project success.

The experts, on average, considered factor F – *top management support* (with average 4,65) as the most important element for the project. The following positions were taken by factors: A – *project manager*, T – *financial budget*, B – *team composition*, K – *detailed schedule*, S – *project team empowerment* and U – *work time schedule* (see Table 3, column *Importance / Avg*).

As the least important factors for the implementation projects, the experts considered X – *minimal customisation* (with average 2,04), Y – *legacy systems*, D – *motivation system*, M – *organisational change* and H – *top management participation*.

The experts' answers to the question of what factors' occurrences during the project are necessary for the implementation success are presented in Table 3, column *Necessity / Number*. Most experts regarded factor A – *project manager* (23 answers) as the most necessary. The further positions were occupied by factors: K – *detailed schedule*, B – *team composition*, T – *financial budget*, F – *top management support*, S – *project team empowerment* and C – *team involvement*.

It is worth noting that none of the experts recognised factor X – *minimal customisation* as a necessary element in the project, and that factors P – *fast effects* and Y – *legacy systems* received only one positive answer.

## 4.3 Opinions from enterprises vs. experts' beliefs

In order to compare the opinions of the respondents from enterprises with the experts' beliefs, the Spearman ranks correlation coefficient  $r_s$  was calculated for the ranks obtained in the all enterprises group and in the set of experts. The value of  $r_s$  coefficient is equal to 0,77, which suggests quite a strong relationship between ranks in the two examined groups.

Table 2: Spearman  $r_s$  coefficients for pairs of projects groups

Complementary groups projects	$r_s$
Small – Large	0,90
Full scope – Partial scope	0,84
Short – Long	0,89

Table 3: The factors' importance in the opinions of respondents

Factor	Respondents from enterprises														Experts			
	All		Enterprise SIZE				Implementation SCOPE				Duration TIME				Importance		Necessity	
			Small		Large		Full		Partial		Short		Long					
	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Avg	Rank	Number
A	12	4,23	13	4,07	13	4,34	10	4,37	13	4,11	9	4,33	15	4,06	2	4,61	1	23
B	1	4,60	3	4,45	1	4,72	1	4,68	3	4,54	1	4,64	2	4,61	4	4,58	3	20
C	5	4,46	5	4,36	8	4,53	2	4,58	8	4,37	3	4,52	8	4,38	8	4,35	7	17
D	21	3,77	20	3,68	21	3,84	21	3,87	21	3,69	21	3,73	22	3,77	24	3,06	20	4
E	2	4,54	4	4,38	2	4,66	12	4,30	1	4,73	4	4,47	3	4,61	11	4,14	9	16
F	8	4,40	10	4,21	5	4,54	11	4,35	6	4,43	12	4,21	5	4,55	1	4,65	5	18
G	3	4,51	2	4,45	4	4,56	3	4,58	5	4,46	6	4,42	4	4,61	10	4,26	10	14
H	22	3,66	22	3,45	22	3,82	24	3,68	22	3,65	23	3,45	20	3,85	22	3,26	17	6
I	17	4,00	19	3,76	15	4,18	16	4,13	17	3,89	15	4,03	19	3,97	13	3,97	13	9
J	19	3,90	21	3,61	16	4,10	18	4,10	20	3,72	19	3,79	18	4,00	14	3,90	16	7
K	7	4,44	7	4,31	6	4,54	4	4,58	9	4,32	5	4,45	7	4,39	5	4,55	2	21
L	15	4,09	12	4,17	18	4,03	14	4,19	15	4,00	14	4,09	14	4,12	12	4,00	12	11
M	20	3,84	18	3,80	20	3,88	20	3,92	19	3,79	20	3,77	21	3,85	23	3,08	23	2
N	11	4,31	9	4,24	12	4,35	7	4,50	11	4,17	10	4,32	13	4,23	15	3,88	14	9
O	23	3,54	24	3,40	23	3,65	23	3,71	23	3,43	22	3,55	25	3,58	21	3,27	22	3
P	25	3,31	25	3,11	26	3,46	25	3,35	26	3,28	25	3,22	26	3,45	20	3,32	24	1
Q	16	4,02	16	3,92	17	4,09	15	4,16	16	3,91	16	4,00	16	4,04	17	3,54	21	4
R	14	4,13	14	3,93	14	4,28	17	4,10	12	4,16	17	3,94	12	4,27	18	3,35	15	8
S	10	4,40	11	4,21	7	4,54	8	4,42	7	4,38	8	4,39	9	4,36	6	4,42	6	18
T	9	4,40	8	4,24	9	4,51	5	4,55	10	4,27	11	4,30	6	4,48	3	4,61	4	20
U	13	4,22	15	3,93	10	4,44	9	4,42	14	4,05	13	4,15	11	4,27	7	4,39	8	17
V	6	4,46	1	4,48	11	4,44	13	4,26	2	4,62	2	4,61	10	4,30	9	4,29	11	14
W	4	4,51	6	4,36	3	4,62	6	4,54	4	4,49	7	4,42	1	4,65	16	3,56	18	6
X	24	3,48	23	3,42	25	3,53	22	3,74	24	3,31	24	3,42	24	3,58	26	2,04	26	0
Y	26	3,17	26	2,67	24	3,57	26	2,95	25	3,31	26	2,87	23	3,64	25	2,29	25	1
Z	18	3,93	17	3,88	19	3,97	19	4,08	18	3,83	18	3,81	17	4,04	19	3,35	19	5

Both groups of respondents, those from enterprises and experts, recognise balanced team composition, definition of detailed implementation schedule and implementation team involvement as the most important and necessary factors for implementation project successfulness. Additionally, respondents from enterprises indicate good co-operation with supplier and top management awareness to be of paramount importance. On the other hand, the experts suggest project manager presence, financial budget, top management support and project team empowerment as the very important and necessary factors for project prosperity.

Experts underestimate factor W – *system reliability*. They perceive this factor as not important (rank 16) and not necessary (rank 18) element for project successfulness. On the other hand, respondents from enterprises treat system reliability as one of the most important factors for project successfulness.

The respondents from enterprises and experts unanimously indicate the least important and unnecessary factors for implementation project success. They are legacy systems adaptation, ERP system minimal customisation, visible fast partial positive effects, implementation promotion, top management participation and the existence of motivation system.

## 5 SUMMARY

The general conclusion which can be drawn from the research is that people participating in an implementation project are most important for project successfulness. There are three factors related to project participants among the most important factors indicated by respondents. These factors are: B – *team composition*, E – *co-operation with supplier* and C – *team involvement*.

Apart from project participants, respondents recognise also the importance of correctly functioning ERP system and whole IT infrastructure. Respondents from enterprises indicate system reliability as one of the most important factors. Moreover, factor V – *IT infrastructure* reached very high rank for projects in small enterprises, for projects with partial functionality being introduced and also for projects with short duration time. Hence, one can say that IT infrastructure is especially important for small implementation projects.

The presented results of the research should be useful for the professionals who are leading implementation projects and those making decisions for the first time on ERP system implementation in a particular enterprise. The awareness of the aspects regarding the factors importance could have a positive effect on decisions made during such a complicated endeavour like ERP system implementation. The author hopes that the conclusions drawn in this paper will be interesting for people professionally dealing with ERP implementations and will at the very least be an inspiration for project enhancement.

## REFERENCES

- Burns, O. M., Turnipseed, D., Riggs, W. E., 1991. Critical Success Factors in Manufacturing Resource Planning Implementation. *International Journal of Operations & Production Management*. Vol.11. No.4. MCB University Press. pp.5–19.
- Esteves, J., Pastor, J., 2000. Towards the Unification of Critical Success Factors for ERP Implementations. In *10th Annual BIT conference*. Manchester. UK.
- Fui-Hoon Nah, F., Lee-Shang Lau, J., Kuang, J., 2001. Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*. Vol.7. Number 3. URL: <http://www.emerald-library.com>.
- Holland, C., Light, B., Gibson, N., 1999. A Critical Success Factors Model for Enterprise Resource Planning Implementation. In *7th European Conference on Information Systems ECIS*. Copenhagen. Denmark.
- Ip, W. H., Yam, R. C. M., 1998. The successful implementation of MRPII via a hierarchical modelling approach. *Logistics Information Management*. Vol.11. No.3. pp.160–170.
- Parr, A., Shanks, G., Darke, P., 1999. Identification of Necessary Factors for Successful Implementation of ERP Systems. *New Information Technologies In Organizational Processes – Field Studies And Theoretical Reflections On The Future Of Work*. Kluwer Academic Publishers. pp.99–119.
- Skok, W., Legge, M., 2001. Evaluating Enterprise Resource Planning (ERP) Systems using an Interpretative Approach. In *ACM SIGCPR 2001 Conference on "The IT Personnel Crisis: Finding and Retaining the Skilled Workforce"*. San Diego. USA.
- Stewart, G., Milford, M., Jewels, T., Hunter, T., Hunter, B., 2000. Organisational Readiness for ERP Implementation. In *Americas Conference on Information Systems AMCIS*.
- Walpole, R. E., Myers, R. H., Myers, S. L., 1998. *Probability and Statistics for Engineers and Scientists*, Prentice Hall International, Inc. Upper Saddle River, New Jersey, 6<sup>th</sup> edition.