

FACTORS OF SUCCESSFUL IMPLEMENTATION OF ERP SYSTEMS

Arnoldina Pabedinskaitė

Vilnius Gediminas Technical University, Lithuania, arna@vgtu.lt

Abstract

The aim of this article is to establish the factors of the success of implementation and analyse differences in evaluations opinions experts and users of ERP systems. Implementation of enterprise resource planning systems is a highly complex process which is influenced not only by technical, but also by other factors. The problem of successful implementation of ERP is analysed in the majority of works considering the process of implementation and the factors determining a successful or unsuccessful result of this process. Different authors present different factors determining the success of implementation of ERP. The analysis and generalisation all of these factors makes it possible to identify the main factors determining the success of implementation of ERP. In order to establish the opinion of Lithuanian ERP specialists and users about the importance these factors the survey was conducted.

Keywords: enterprise resource planning systems, implementation, critical factors of implementation.

Introduction

Information technologies are becoming an inseparable part of a competitive business strategy. One of products of information technologies – enterprise resource planning systems (ERP) – are promptly making their way into the functioning of enterprises. In the present day business world, they have become an important instrument without which the majority of enterprises could no longer function. Enterprise resource planning systems are the principal infrastructure of information systems helping an organisation to prosper under the present day economic conditions. Successfully implemented enterprise resource planning systems create organisational synergy, which provides a stimulus for the development of particularly efficient processes necessary for the success of an organisation. As practice shows, implementation of an enterprise resource planning system frequently does not justify the expectations of an enterprise, costs much more than expected, and its implementation lasts for a considerably longer period of time than planned. Variety of results of implementation makes it necessary to analyse the process of implementation of ERP and to look in it what should be done for successful implementation.

The aim of this article is to establish the factors of the success of implementation and analyze differences in evaluations opinions experts and users of ERP systems.

Implementation of enterprise resource planning systems is a highly complex process which is influenced not only by technical, but also by other factors. The problem of successful implementation of ERP is analysed in the majority of works considering the process of implementation and the factors determining a successful or unsuccessful result of this process. The analysis and generalisation all of these factors makes it possible to identify the 16 main factors determining the success of implementation of ERP. In order to establish the opinion of Lithuanian ERP specialists and users about the importance these factors the survey was conducted.

Problems of ERP implementation

One the main problems of a project of implementation of ERP systems relates to a different perception the success of these projects. The success of ERP systems is an obscure and highly subjective concept (Zhang et al., 2002; King, 2005; Monk, 2008). The majority of sources of literature attempt to arrive at a definition of the concept of success of ERP systems, however, no uniform definition had been developed so far. Definition of the success of ERP implementation could be based on successful project criteria (Neverauskas et al., 2004) distinguished from the perspective of project management:

- Completion of a project within the specified time limits;
- Completion of the project without exceeding its budget;
- Ensuring of indicators of the quality of results;
- Minimal (harmonised) changes in the object-oriented part of the project;
- Continuity of the functional (basic) activities of an organisation;
- Preservation and fostering of the production culture and values of an organisation.

Methodology of assessment of the success of implementation an information system could be based on the following criteria (Laudon & Laudon, 2000):

- High degree of the use of a system;
- Satisfaction of users with the system;
- Positive attitude towards functionality of the system;
- Attained goals of the system;
- Financial return.

Practice also displays a variety of concepts of the success of ERP implementation. Project managers and consultants consider implementation as a successful one if it complies with both financial and time budgets. However, the businessmen viewing enterprise resource planning systems as a business instrument understand a successful implementation of the ERP systems as implementation of the directions of business improvement to be followed (Sousa and Collado, 2001).

J. Lian (Lian, 2001) also supports a twofold definition of a successful ERP implementation and claims that the added value provided by a system to an organisation should be considered as one of the principal measures of success. Therefore, an ERP implementation project could be considered as unsuccessful both for technical (exceeded time and financial budgets) and functional (failure to meet the needs of an organisation) reasons. The technical reasons usually pose a much greater danger than functional ones, because numerous cases are known when a several-fold increase in the time and financial budgets of a project influenced the collapse of enterprises' business (Nicolaou, 2005). The functional reasons for failures are less critical than the technical ones; however, functional discrepancies form a negative attitude towards enterprise resource planning systems, do not justify investment in them and contribute to universal scepticism in relation to the ERP systems.

Excessive focusing on technologies is considered by B. Calogero to be one of the main factors determining a failure of ERP implementation. According to him, the history of information technologies does not know any single case evidencing the fact of solving a business problem by means of software (Calogero, 2005). A similar reason is also mentioned by A. Nicolaou, who claims that the projects initiated by a system (or technologies) are more likely to prove unsuccessful than business-initiated projects (Nicolaou, 2005). Technology-initiated projects are most frequently driven by such goals as replacement of an old system with a new one, improvement of integration of several systems, and support of new business processes or a new business model. Measuring and evaluation of system-initiated projects is a highly complicated task.

Ignored importance of identification of organisational needs is also one of the principal reasons determining unsuccessful implementation of ERP systems. Belated reorganisation of business processes and an enterprise resource planning system selected beforehand and failing to support the reorganised processes frequently prevent modernisation of business processes, which is the main goal of implementation of technologies (Calogero, 2005). A failure to evaluate a company's development strategy for at least three years in advance makes it highly probable that the implemented ERP system will be incapable of supporting new or altered business processes of the company.

Lack of user education and practical training is listed as another cause of a failure of ERP implementation projects. User trainings become the cause of unsuccessful implementation when they take place beforehand, are not of sufficient scope or are simply inappropriate (Nicolaou, 2005). Insufficient account is often taken and little time is devoted to education and practical training, which affects the understanding of employees about the changing functional processes of an organisation (Zhang et al. 2002).

The identified causes of unsuccessful ERP implementations have encouraged both researchers and practitioners to search for the ways of preventing such undesired results.

Success Factors in the Process of Implementation of ERP Systems

The sources describe approximately thirty factors determining the peculiarities of ERP's implementation and its result. It should be noted that different authors present different factors determining the success of implementation of ERP, although in the opinion of the majority, following factors are most important.

1. Top management support. This is one of the most significant factors determining a successful implementation of enterprise resource planning systems in an organisation. Its relevance is also proved by the fact that it is mentioned in almost all sources of literature analysing the factors determining the success of ERP implementation. The majority of research works have placed a particular emphasis on top management support as prerequisite for a successful implementation of ERP systems. The mission of top management is to create a favourable environment for the implementation of ERP systems and attaining of desired results. Top executives must be not only observers, but also participants. The role of top management a project of

implementation of enterprise resource planning systems covers formulation of real and justified goals based on the awareness of the opportunities and limitations provided by IT (Somers and Nelson, 2001; Zhang et al. 2002; Zuckweiler et al. 2003).

2. *Competent management of a project.* Project management is a professional activity based on contemporary scientific knowledge, experience, methods, means and technologies and focusing on high results. Considerably exceeded financial budgets of ERP implementation, frequent delays in respect of the planned time schedules and unsuccessful implementations of systems show that management of ERP implementation projects is a sufficiently complicated task. Management of ERP implementation projects is somewhat different as compared to management of any other information technologies project (Adam et al., 2005). Peculiarities of technical equipment and software as well as organisational and human resources stretch ERP implementation projects and make them unquestionably complex as well as requiring new project management abilities (Somers & Nelson, 2001). The complexity of ERP implementation projects particularly requires extensive methodical planning and weighted management. The knowledge, workmanship, abilities and proficiency of a project manager are viewed as the key factors determining the success of ERP implementation or its failure (Trepper, 1999; Akkermans & Helden, 2002).

3. *Detailed analysis of an organisation's vision and needs.* A company acquiring and installing an information system needs, first and foremost, to evaluate its business processes, rationalise and reorganise them, assess information needs at workplaces, and formulate a computerisation (informatisation) strategy. It is only subsequently when the company may set out logical and justified requirements for the information system to be purchased and installed (Paliulis et al., 2004). A detailed analysis of the organisation's vision and needs is of great importance at the pre-project stage, when acquisition of one or another enterprise resource planning system is being planned and analysed. Organisations very frequently select the systems which are not suitable for their business, because they lack a vision of optimisation of their business processes (Calogero, 2005). Selection of a proper system meeting the needs of an organisation in the best possible way is necessary with a view to attaining the result of minimum modification of the system and its successful implementation (Somers & Nelson, 2001).

4. *Appropriate and timely training and education of employees.* Many authors tend to identify two factors: *training of prospective users how to use a system* and *education of users relating to new business processes*. The absence of user training and lack of understanding as to how an enterprise resource planning system is going to change an organisation's business processes are often referred to as a problem resulting in a failed implementation of ERP systems. Education and training stand for a process in the course of which executives and employees are familiarised with the logic and idea of enterprise resource planning systems. Education helps all employees to develop a better understanding of how their work is related to other functional areas of a company. Companies are advised to train each user to use a system by explaining how his work relates to certain business processes and how his work is going to be affected by the new system (Zhang et al., 2002; Somers & Nelson, 2001; Hawking et al., 2004; Akkermans & Helden, 2002).

5. *Reorganisation of business processes.* A fairly serious problem of ERP implementation lies in a system's incompatibility with an organisation's business processes and its information provision needs. Certainly, this is not to mention the cases when a system completely unsuitable for a specific business is selected. When selecting a system, organisations usually consult specialists, who recommend the systems best meeting the needs of that branch of business. However, irrespective of the suitability of a system, no universal ERP system suitable for all enterprises exists. In the course of ERP implementation, an organisation almost always needs to decide whether to reorganise organisational business processes according to the logic proposed by a system or to modify the system by adapting it for existing business processes of the organisation. An enterprise resource planning system itself cannot improve an organisation's work until it restructures its business processes. In order to obtain a tangible benefit provided by enterprise resource planning systems, it is necessary to reorganise an organisation's business processes according to the logic proposed by a system. An enterprise must be prepared for the acceptance of the best practice contained in enterprise resource planning systems and modelling of its business processes according to their description in the system (Somers & Nelson, 2001; Zhang et al., 2002; Zuckweiler et al. 2003).

6. *Management of organisational changes.* K. Magnusen (Magnusen, 1981) defines changes as the alterations carried out with a view to improving or even fundamentally changing one or other elements of an organisation's lifestyle. Implementation of enterprise resource planning systems is an alteration determined by market changes and technological progress and bringing about further changes inside the organisation.

Implementation of enterprise resource planning systems causes a large number of the changes which may result in opposition, confusion and errors. Calculations show that almost a half of ERP implementations do not bring the expected results solely due to the fact that management of changes has been provided with sufficient attention. The success of ERP implementation is directly proportionate to an organisation's determination to undergo changes. Two principal sources of opposition to implementation of ERP systems are identified: the risk perceived and habits. The perceived risk is associated with the fear of employees to lose their work, a high-ranking position, etc. Habits are of particular importance for people, and their endangerment most frequently results in opposition (Aladwani, 2001; Somers & Nelson, 2001; Zhang et al., 2002)

7. *Clear and measurable goals of a project (or management of expectations)*. The majority of practitioners and researchers consider this factor to be among the key ones in working towards a successful project. It is possible to claim that everybody is well aware that the goals of a project and the ways of achieving them must be determined at the initial stage of the project, however to clearly determine them at the initial stage of the project is often a fairly complicated task. Each new project must have as its starting point the understanding of the goals of that project and provision for the possible ways of attaining those goals. Clear and measurable goals have a twofold effect, as they:

- assist the project team in focusing on key issues and thus ensuring the timely performance of the project's tasks;
- define a clear complex of the project's success and failure criteria and provide an opportunity for objective evaluation of the work of the project's team.

The absence of measurable goals of a project makes it almost impossible to determine the degree of the project's success or failure. The measurable goals of the project form a basis for assessment of the return of investment in an enterprise resource planning system. The project's mission must be related to business needs and be explicitly declared to all participants of the project (Fui-Hoon Nah et al., 2005; Akkermans & Helden, 2002, Somers & Nelson, 2001; Lian, 2001)

8. *Open and continuous co-operation within the entire organisation*. Almost all analysed sources of literature distinguish co-operation and communication as two separate factors affecting ERP implementation. The principal factor of a successful ERP implementation is an organisation's culture valuing trust between partners, employees and executives as well as stressing such values as rising of common goals above personal aspirations. An ERP is an integrated information system, so its designing, installation and use require a particularly close co-operation of employees of all business segments of an enterprise. A full and open communication influences success and facilitates the education of the organisation's employees. Close co-operation and communication among the employees of the organisation is referred to not only as the critical factor of a successful ERP implementation, but also as a benefit provided by a system (Akkermans & Helden, 2002; Somers & Nelson, 2001; Zhang et al., 2002; Zuckweiler et al. 2003).

Research results

The aim of the survey was to establish the opinion of Lithuanian ERP specialists and users regarding the importance of the factors determining the result of implementation of ERP (Pabedinskaitė, 2008; Pabedinskaitė, 2009). Respondents of the survey have been divided into two different groups:

- *Experts* (specialists) – this group includes employees of the companies implementing enterprise resource planning systems in Lithuania;
- *ERP users* – project participants of the organisations which have implemented or are implementing enterprise resource planning systems.

The sample of the survey was formed in the way of selection – the expert poll included employees of several companies implementing ERP in Lithuania, and the ERP user interview included customers of one of the companies implementing the systems. The selected sample of ERP experts (41) comprises approximately one sixth of all Lithuanian specialists of business management systems. In order to evaluate the importance of each factor, the five-level evaluation scale has been employed (particularly critical and important for the success of the project – 5 scores, neither critical nor important – 1 score).

Characteristics of experts. The largest part of the respondents – as much as 29 % – consisted of the specialists who had participated in over twenty ERP implementation projects. 20 % of the respondents had participated in 10–20 of implementation projects. 24 % of the respondents were the specialists having the experience of implementation of 5-10 ERP projects. 12 % of the surveyed specialists included the specialists having the experience of implementation of 3–5 of ERP projects.

Characteristics of users. The majority of the respondents (62 %) were experienced users working with the implemented enterprise resource planning system for a period exceeding three years. 56% of the respondents are managers of ERP implementation projects, 25 % – members of the implementation team.

The factors influencing the process of ERP implementation and grouped by sequence order according to the evaluation score are presented in Table 1.

Table 1. Results of experts' and users' evaluation

No according experts	Factors under analysis	Evaluation by experts	Evaluation by users	No according users
1	Clear and measurable goals of the project	4,39	4	5
2	Thorough analysis of the organisation's needs and vision	4,00	3,94	3
3	Competent management of the project	3,98	4,19	7
4	Control of implementation of the project's time budget and tasks	3,88	3,31	1
5	Competent team of the project	3,85	4,31	2
6	Thorough and competent planning of the project	3,80	3,38	9
7	Competent external consultants (the supplier)	3,66	4,19	10
8	Management of organisational changes	3,59	3,63	8
9	Support by top management	3,49	3,88	14
10	Close co-operation with the external supplier of the system	3,34	3,75	11
11	Well-organised transfer of data	3,29	3,44	12
12	Reorganisation of business processes	3,27	3,44	16
13	Appropriate and timely training of employees	2,90	3,25	6
14	Optimal balance between the business and technological part of the project	2,80	3,47	4
15	Involvement of employees in the project	2,78	3,19	13
16	Open and continuous communication within the organisation	2,68	3,44	15
Average evaluation:		3,481	3,676	
Variation		0,210	0,135	

Correlation coefficient between experts' and users' evaluation scores equals 0,641 and statistically is significant ($t=3, 12 > t^{kr}=2, 14$), it means that opinion of experts' and users' about factors importance in general are similar. Differences in experts' and users' evaluation are presented in Figure 1.

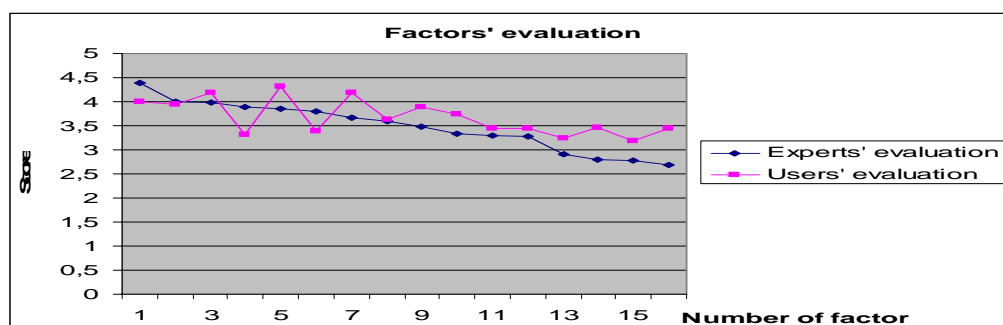


Figure 1. Differences in experts' and users' evaluation

The before mentioned 16 main factors determining successful ERP implementation could be divided into three categories:

- *internal*, depending on an organisation undergoing the process of implementation of an ERP system (Detailed analysis of the organisation's needs and vision; Clear and measurable goals of the project; Top management support; Management of organisational changes; Reorganisation of business processes; Appropriate and timely training and education of employees; Involvement of employees in the project; Open and continuous communication within the entire organisation);
- *external*, depending on external consultants (Competent external consultants);

- *mixed*, depending both on the organisation itself and on external builder (Optimal balance between a business and technological parts of the project; Thorough and competent planning of the project; Competent project team; Competent management of the project; Close co-operation with the external system vendor; Control of implementation of the project's time budget and tasks; Smoothly organised transfer of data).

Internal factors affect the process of ERP implementation through an organisation. Mixed factors affect the process of implementation of an ERP system both through an organisation and through its external builder. Therefore, both parties to a project are responsible for the impact exerted by the factors belonging to this group on the ERP implementation process.

The sole competence of builder's consultants attributed to the group of external factors shows that responsibility for the success of a project falls to a large extent on an organisation itself, which influences as many as eight out of sixteen main factors affecting the ERP implementation process. It should be noticed that experts' and users' opinion about internal factors are very similar ($r=0,897$, $t=4,96 > t^{kr}=2,45$, Figure 2).

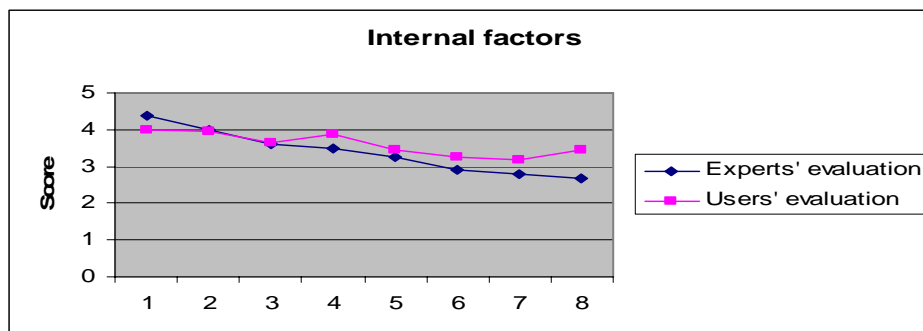


Figure 2. Differences in experts' and users' evaluation of internal factors

For mixed factors evaluation of importance for process of ERP implementation differ more significantly ($r=0,395$, $t=0,96 < t^{kr}=2,57$, Figure 3).

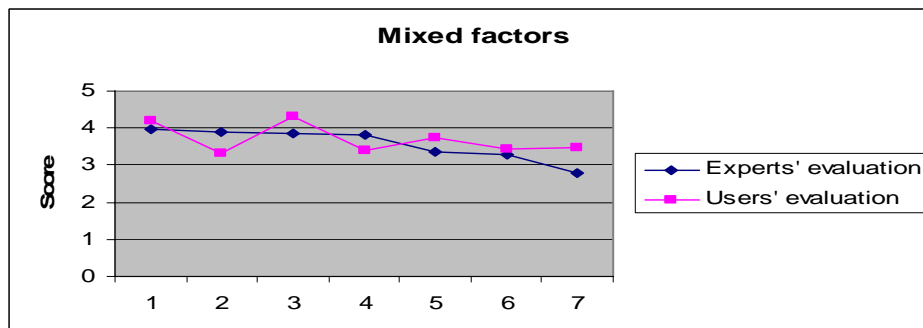


Figure 3. Differences in experts' and users' evaluation of mixed factors

Evaluation is close for two factors (Competent management of the project, Well-organised transfer of data) and differ for other five (Control of implementation of the project's time budget and tasks, Competent team of the project, Thorough and competent planning of the project, Close co-operation with the external supplier of the system, Optimal balance between the business and technological part of the project).

Conclusions

Users of ERP consider as the most important factors determining the success of implementation are factors relating to management of project of implementation. In the list of evaluation of critical factors as compiled according to the opinion of ERP experts, the first two places are occupied by internal factors, i.e., the factors depending on an organisation itself: clear and measurable goals of the project and thorough analysis of the organisation's needs and vision.

The list of critical factors compiled according to evaluations of ERP users is sufficiently close by its contents to the list compiled on the basis of the experts' opinion; however the ERP users consider the factors

stressing the importance of competence of the project team and the project manager more significant than the internal factors depending on the organisation.

Correlation and regression analysis of experts' and users' evaluations of factors shows high correlation between experts and users evaluations scores. Experts' and users' opinion about internal factors are very similar although for mixed factors evaluation of importance for process of ERP implementation differ more significantly. Average score of factors in user's opinion is higher than in experts' opinion while variation is lesser; it means that users' evaluations are on a smaller scale.

References

1. Adam F., Sammon D., Carton F. Project management issues in implementing ERP – towards an approach more suited to ERP projects, Available from Internet: http://www.aim2004.int-evry.fr/pdf/Aim04_Adam_Sammon_Carton.pdf
2. Akkermans H., Helden van K. (2002) Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors// *European Journal of Information systems*, 11. Available from Internet: http://fp.tm.tue.nl/beta/publications/working%20papers/Beta_wp59.pdf
3. Aladwani A.M. Change management strategies for successful ERP implementation// *Business process management journal*, Vol. 7, No.3, 2001, Available from Internet: <http://web.njit.edu/~jerry/OM/OM-ERP-Papers/ERP-10-Success.pdf>
4. Calogero B. Who is to blame for ERP failure? Available from Internet: <http://www.serverworldmagazine.com>
5. Fui-Hoon Nah F., Lee-Shang Lau J. Critical factors for successful implementation of enterprise systems, Available from Internet: <http://www.emerald-library.com>
6. Hawking P., Stein A., Foster S. (2004) Revisiting ERP systems: benefit realisation. *System Sciences - 37th Hawaii International Conference*. Available from Internet: <http://www.hicss.hawaii.edu>
7. King W. R. Ensuring ERP Implementation Success. *Information Systems Management*, Volume 22, Issue 3 June 2005, p. 83-84.
8. Lian J. (2001) A study of prerequisites for successful ERP implementations from the Project management perspectives. Available from Internet: http://www.injuryresearch.bc.ca/projects_education.html
9. Laudon C.K., Laudon P.J. (2000) *Management Information systems*. Sixth edition – Prentice Hall.
10. Magnusen K. (1981) *Organization design. Development and behaviour*. New York: McGraw-Hill.
11. Monk E., Wagner B. (2008) *Concepts in Enterprise Resource Planning*. Third Edition.
12. Neverauskas B., Stankevičius V., Viliūnas V., Černiūtė I. (2004) *Projektų valdymas*, Kaunas: Technologija.
13. Nicolaou A.I. ERP systems implementation: Drivers of post-implementation success, Available from Internet: <http://www.ittoolbox.com>
14. Pabedinskaitė, A. (2008) Peculiarities of Implementation of ERP. In *Selected Papers of Conference “Business and Management‘2008”*. Vilnius: Technika, 2008, p. 460–467
15. Pabedinskaitė, A. (2009) Successful Implementation of ERP system. In *Proceedings of the 9 th International Conference „Liberec Economic Forum 2009“* p. 275-283.
16. Paliulis N., Chlivickas E., Pabedinskaitė A. (2004) *Valdymas ir informacija*. Vilnius: Technika.
17. Somers M.T., Nelson K. The impact of critical success factors across the stages of enterprise resource planning implementations. *System Sciences – 34 th Hawaii International Conference*, 2001, Available from Internet: <http://www.hicss.hawaii.edu>
18. Sousa J.E., Collado J.P., Towards the unification of the critical success factors for the ERP implementations, 2001, Available from Internet: <http://www.technologyevaluation.com>
19. Trepper Ch. ERP Project management is a key to a successful implementation, 1999, Available from Internet: <http://itmanagement.earthweb.com>
20. Zhang L., Lee M.K.O., Zhang Z., Banerjee P. Critical success factors of enterprise resource planning systems implementation success in China. *System Sciences – 36 th Hawaii International Conference*, 2002, Available from Internet: <http://www.hicss.hawaii.edu>
21. Zuckweiler K.M., Lee-Shang Lau J., Fui-Hoon Nah F. ERP implementation: Chief information Officers' Perceptions of Critical Success Factors. // *International Journal of Human-Computer interaction* 16 (1), 2003, Available from Internet: <http://www.informatik.uni-trier.de/~ley/db/journals/ijhci/ijhci16.html>