EurOMA

European Operations Management Association

15TH INTERNATIONAL ANNUAL CONFERENCE

TRADITION AND INNOVATION IN OPERATIONS MANAGEMENT:
CONNECTING PAST AND FUTURE

The impact of enterprise resource planning implementation phases on the task-technology fit

De Toni A. F. (University of Udine)
Fornasier A. (University of Udine)
Franchi M. (University of Udine)
Nonino F. (University of Udine)

15th-18th June 2008
University of Groningen
Groningen (Netherlands)

THE IMPACT OF ENTERPRISE RESOURCE PLANNING IMPLEMENTATION PHASES ON THE TASK-TECHNOLOGY FIT

Alberto F. De Toni, Andrea Fornasier, Mirco Franchi, Fabio Nonino

Management Engineering Laboratory, Department of Electrical, Management and Mechanical Engineering, University of Udine, via delle Scienze 208 33100 Udine (UD), Italy
Email: detoni@uniud.it – Tel. +39 0432 558330
Email: andrea.fornasier@uniud.it – Tel. +39 0432 558043
Email: m.franchi@alfasistemi.net – Tel. +39 0432 558043
Email: fabiononino@uniud.it – Tel. +39 0432 558043

ABSTRACT
A successful implementation of an Enterprise Resource Planning (ERP) is extremely important to future competitive strategy of a company. The ERP success can be measured as its reliability and utility perceived by users, which are dimensions of the so-called Task-Technology Fit model.
The data collected from four selected companies allowed to investigate the relationship between the quality of implementation phases and the ERP performance. The empirical evidences highlight a direct relation between the effectiveness of the implementation phases and the ERP success. The research results emphasize the importance of the intrinsic quality of the software, but especially the importance of the implementation phases, which require a strong ability of the team composed by people from the system integrator and the key user of a company. In other words the companies must be aware that a correct implementation of the methodology, strongly influenced by the team, impacts on the technology consistency and, therefore, on the system success.

Keywords: Enterprise Resource Planning, Task-Technology Fit, Multiple Case study.

INTRODUCTION
Enterprise Resource Planning (ERP) is a management Information System (IS) that optimizes the distribution of enterprise resources and helps a business to integrate all its resources for fast and effective application to improve its operational performance and enhance its competitiveness (Hsiao *et al.*, 2007). The ERP systems has been developed starting from the evolution of the information and communication technologies (ICT) which allowed to optimize and to streamline the companies employees' work. The benefits that can be attributed to these new technologies, so to the ERP, are an increase in productivity, a better warehouse management, an higher efficiency in the information flow, costs reduction and so on.

Nevertheless ERPs have high implementation costs; as a matter of fact the cost range is about 2 to 6% of annual sales, with the cost of the software being just a tip of the iceberg as reported by Mabert *et al.* (2001). In big firms the average cost to implement an ERP system is approximately equal to 1% of the firm's turnover and the average lead time (from business process analysis to Go Live) is about 20 months (PPRA, 2003); but the huge capital investments in ICT do not always determine a clear-cut link to the expected benefits and even, in some cases, they end in failure (Yi & Hwang, 2003; Legris *et al.*, 2003). Moreover Standish Group (2000) found that among the causes of IT project failures only 14% was due to incompetence of technologies whereas management deficiencies, due to the complexity of the business and of implementation processes, accounting for the remaining 86%.

A successful implementation of an ERP system is extremely important to future competitive strategy of a company (Ehie & Madsen, 2005). A complete understanding of the ICT investment effectiveness cannot ignore the analysis of the ERP success; in this regard, the literature provides different methods to evaluate the ERP success. In this direction the Task-Technology Fit (TTF) model studies the relationship between the use of the information system and its performances, through a consistent analysis of the software functions and the users' perceived needs (Dishaw & Strong, 1999). Specifically, the model aims at providing the basis for the analysis of those factors that explain the employment of an ERP system and the interactions with the users' performances through the study of the relationship between the clients' tasks needs and the system functionalities. Goodhue and Thompson (1995) demonstrate that TTF is a useful indicator of IS implementation success.

The focus of this paper is to identify the potential effects of the quality of the project phases for ERP implementation in an organization and some selected TTF items. In other terms, the aim is to understand the impact that the implementation methodology could have on ERP system's reliability and utility perceived by users.

The paper is structured as follows. In the first part main features of Task-Technology Fit model are illustrated. In the second part the methods (the four case studies for the cross-case analysis, the data collection, the dependent and the independent variables) are described. Subsequently, the results of the regression analysis are presented. Finally the results of the research are discussed and some academic and managerial remarks are provided.

THE IMPACT OF IMPLEMENTATION ON TASK TECHNLOGY FIT

Task-Technology Fit is a model that studies the coherence of the software functions with user needs, that is the degree of consistency of the systems features with task needs.

The basic hypothesis of TTF is that a better technology coherence brings to better performances; in fact TTF is based on the "Cost/Benefit Framework" propositions (Payne, 1982; Smith *et al.*, 1982; Creyer *et al.*, 1990) that are:

1. user performances, that result from the use of technology, depend on technology itself and its coherence with task needs;
2. coherence influences users' task processes;
3. users are able to evaluate coherence and therefore choose the right technology.

The organizational structural contingency theories (Gralbraith, 1973) state that better organizational performances are the results of the fit between organization structure and the organization context. In this assertion, the context means the targets to pursue or "product" technology to use. Both contingency theories and TTF model are referred to the fit concept. Nevertheless the two theories differ in the different level of analysis: the first one refers to the organizational level, while TTF refers to the individual level.

TTF is based on the following constructs: task, technology, relationship between task and technology, effective use of the instrument (Goodhue and Thompson, 1995). The first one refers to the procedures followed by users to transform input in output; the second one refers to the instruments used to complete the user's tasks; the third one refers to the degree of assistance that technology gives to a user to help him doing a part of his own tasks; the fourth one refers to the behaviour in using technology while completing tasks.

The measurement of the coherence of technology and tasks is extremely difficult and many researches faced this argument. Nevertheless if it's difficult to measure performances obtained through the utilization of an IS, we can assume that if users positively evaluate a system, this probably can help increasing their performances. So these researches (e.g. Goodhue, 1994; Goodhue, 1995; Goodhue, 1998, Goodhue *et al.*, 2000) consider the user's evaluation to measure the success of an information system. This will be the criterion chosen also for the present study. The measurement of the coherence with tasks, according to Goodhue e Thompson (1995), is

structured in 8 components (see Table 1). The first five components (data quality, locatability of data, authorization to access data, data compatibility, training and easy of use) focused on the alignment of task needs for using data in "decision making"; the second two (production timeliness and systems reliability) focused on daily operational needs and the last component (IS relationship with users) focused on relationship among people.

The model wants to provide the basis to study the factors that explain the use of ERP systems and the relations with user's performances, observing the relationship between the users' needs and the functionalities offered by the system. TTF is characterized by:

1. the explicit focalization that explains the relationship between system and performances is based on the importance of task-technology fit;
2. the purpose of a detailed base for constructs finalized to:
   - compensation of the user impact involving on performances;
   - development of diagnosis instruments for information systems.

Even though many researches has identified the critical success factors that affect the ERP implementation (e.g. Esteves & Pastor, 2001; Kumar & Hillegersberg, 2000; Zhang *et al.*, 2002; Al-Mashari, 2002) like project management, user training, technological infrastructure, etc.., the existing literature seems to lack of an explicit relationship between the *quality of implementation phases* and *the ERP performance*. In our opinion this relationship is plausible and, if exists, the comprehension of which phases impact more on the system success leads to significant academic and managerial implications.

So the aim of our research has been to investigated the impact of the ERP implementation phase on the factors and dimensions of TTF that represent in the best way the ERP system's reliability and utility perceived by users, as already demonstrated in previous studies (Zanutto, 2005; De Toni e Zanutto, 2006a; 2006b) – see Table 1.

Table 1: TTF factors and dimensions investigated

	TTF factors	**Selected factors**	**Dimensions investigated**
1	Data quality		
2	Locatability of data		
3	Authorization to access data		
4	Compatibility	X	Consistency of the data
5	Easy of use/Training	X	Easy of use of hardware and software
6	Production timeliness	X	Production timeliness
7	Systems reliability	X	System reliability
8	Relationship with users		

In synthesis the questions, which have driven our research activities, are:

- How does Enterprise Resource Planning implementation impact on the Task-Technology Fit?

and, specifically:

- Which ERP implementation phases impact on
  - systems reliability?
  - production timeliness?
  - data compatibility?
  - easy of use?

METHODS

To address these questions the research adopted the multiple case study research design, as defined by Yin (1989) and McCutcheon and Meredith (1993). Four exemplar cases have been carefully selected and compared, as they show different market approaches and/or type of ERP implemented.

During a 12 months research time scale of the project multiple sources of evidence were used in the data collection phase to enhance both construct and content validity. The data used in the case study were obtained from a combination of secondary and primary sources. Primary data gathering involved IT managers from the organizations through semi-structured interviews. A survey was used to complement interviews information to enhance the understanding of the processes and to deeply analyze all the potential relevant variables affecting the ERP implementation and its success. Secondary sources (company database) were used to enhance the validity of the research through triangulation with multiple means of data collection (Voss *et al*., 2002).

To answer to our research question, we used a multiple regression analysis in which ERP implementation phases were the independent variables and the selected TTF items were the dependent ones.

Research sites

Each selected company operates in a different market (respectively high-technology, manufacturing, design and food), the turnover of the enterprises is between 25.000.000€ and 300.000.000€ and the ERP end-users are between 50 and 250. Two companies implemented EnterpriseOne (J.D. Edwards), while the other two respectively adopted Seven (Solgenia) and Sap/R3 (SAP Ag). The four case studies are heterogeneous as illustrated in Table 2.

Table 2: Main characteristics of the selected case studies

	Companies			
	A	**B**	**C**	**D**
Turnover (2006)	50.800.000€	300.000.000€	25.000.000€	250.000.000€
Main product	Nano PC and High Performance Computers	Panels in Medium Density Fibreboards (MDF)	Plush	Coffee
ERP system (vendor)	Seven (Solgenia)	SAP R/3 (SAP Ag)	Enterprise One (J.D. Edwards)	Enterprise One (J.D. Edwards)
Years since ERP implementation	2	7	4	3
Initial investment in ERP (% turnover)	650.000€ (1,2%)	1.800.000€ (0,6%)	600.000€ (2,4%)	5.000.000€ (2%)

Company A designs, develops and markets nano and high performance computers and its 2006 revenues amounted to 50,8 million euro. This company owns different branches working in Europe, America and Asia. It adopted the Seven ERP produced by the Italian company Solgenia and implemented between 2004 and 2005.

Company B produces medium density fibreboard (Mdf), wooden floors and office furniture. In 2006 it accounted revenues for 300 million euro. It owns branches in Italy and Slovenia. The ERP adopted is SAP/3 produced by the German company SAP plus others application package implemented in 2000.

Company C designs and sells plush, but in the last years it differentiated also into the apparel, sun glasses and jewellery sectors. In 2006 its revenues accounted for 25 million euro. It has several offices in the Far East, Germany and Spain. The ERP system adopted in 2003 is EnterpriseOne by J.D. Edwards.

Company D is a leading company in the coffee sector with four European branches and an American one. In 2006 the corporate revenues were 250 million euro. The ERP system implemented in 2004 is EnterpriseOne by J.D. Edwards.

Data collection

The research has been carried out through interviews with the IT managers, a data collection using the companies' database and a survey to the ERP key-users of each company.

The interviews aimed at understanding the main features of the ERP system and the implementation dynamics. The IT mangers were asked to describe the evolution of the ERP in their company and the several ERP modules implemented. The analysis then focused on the implementation phases of the system; each phase was accurately described and the problems arisen were indicated. Moreover a questionnaire was submitted to gather information on ERP characteristics such as initial investment, maintenance costs, etc. Finally, the IT managers provided a judgment of each ERP implementation phase.

The data gathering concerning the TTF selected dimensions was carried out through a survey. The sample dimension was defined on the basis of the total number of ERP end-users and on the basis of the IT managers' awareness of the end-users' level of competence. Consequently the questionnaire was sent only to the company key-users. As described by Hirt & Swanson (1999) the key-users have been selected from operating departments and generally familiar with business processes and having domain knowledge of their areas. In contrast to key-users, end-users are the ultimate users of the ERP system. They have only very specific knowledge of the parts of the system they need for their work. In particular, in order to have a more representative and homogeneous sample among the four cases, key-users have been selected according to the following features:

- *Functional unit*: this first driver in the sample selection aimed at select key-users from all the company functions allowing us to conduct a comprehensive analysis of all the ERP modules implemented.
- *Duration of use*: the users with more experience in the ERP utilization have been selected starting on the assumption that the best evaluators are those employees that use it more time.
- *Participation during ERP implementation project*: the third driver is the involvement of the end-user to the business process analysis and customization of the ERP system.

The questionnaire provided to each key-user contained a first part concerning the general information (age, gender, functional unit, time lag of use, etc.) and a second one regarding the TTF selected items. Out of 135 possible respondents, 120 completed the survey for a response rate of 89% (Table 3).

Table 3: Characteristics of the ERP users

	Companies				
	A	**B**	**C**	**D**	**Total**
ERP end-users	60	250	50	150	510
ERP Key-users (% end-users)	20 (30%)	43 (17%)	25 (50%)	47 (31%)	135 (26%)
Respondents (%)	17 (85%)	41 (95%)	20 (80%)	42 (89%)	120 (89%)

Independent variables

Starting from the ERP implementation phases described in literature (Markus & Tanis 2000; Berchet & Habchi, 2005; Ehie & Madsen, 2005) and carrying out a comparative analysis of the four case studies, we identified ten phases for the ERP implementation:

1. *Software installation:* the ERP installation phase in standard configuration with an initial set of modules in the servers of the companies.
2. *Business process analysis*: the "As Is" and "To Be" processes' analysis and the check of the compatibility of ERP modules with the involvement of the key-users (usually one person for each functional unit).
3. *Set-up and prototype development*: starting from the previous phase, the ERP system has been parameterized and key-users feedbacks are gathered for the customizations.
4. *Customization*: additional development of customized ERP modules based on the information gathered in the previous phase.
5. *Data recovery*: set-up of the data alignment and transfer interfaces and uploading of the previous database in the "new" ERP system.
6. *System test*: all the previous phases converge in the test of all the business processes and that is formalized at the beginning of the project.
7. *Training*: in each functional unit a focused training has done to end-users, while every key-user participates to the prototype development; the key-users get an informal training due to the active participation in the ERP system customization and implementation phases.
8. *System delivery*: all the ERP customized packages implemented in the set-up phase are tested with a fist run in a simulated environment to avoid real system crashes.
9. *Go Live*: the final assessment and the refinement; the old ERP system is interrupted and the new one starts to run.
10. *After delivery assistance:* the support to end-users in the first period of the ERP utilization; in particular the deadline is usually associated with the first drafting of the VAT journal report; from this moment the ERP implementation project is considered released.

The effectiveness of the ERP implementation phases have been evaluated by IT managers, in tune with the main key-users, through a 5 point Likert scales (1= "Strongly disagree" 5= "Strongly agree").

Dependent Variables

The TTF factors selected has been measured through representative items found in literature (see Appendix A). These ones are the dependent variables of our statistical model, in particular:

- *Systems reliability*: probability that the ERP system continue to run under certain conditions for a defined period of time (Lucas & Spitler, 1999);
- *Production timeliness*: quickness of the ERP end-users to gather information thanks to interfaces and rapidity of the system response (Bailey e Pearson, 1983);
- *Data compatibility*: level of completeness, accuracy and effectiveness of the information processed by ERP system (Saarinen, 1996);
- *Easy of use*: employees' perception of easiness in the use of the ERP system without efforts (Davis, 1989; Goodhue, 1995).

ANALYSIS AND RESULTS

The data collected, provided by IT managers during the interviews and gathered through the key-user questionnaires, has been analyzed to evaluate the impact of the ERP implementation phases on the single constructs of the TTF. The dependent and independent variables of the models have been analyzed using a correlation analysis and a multiple regression analysis.

First of all we studied the ten independent variables using the correlation analysis with the aim to identify a potential multicollinearity. The correlation analysis showed that ten ERP implementation phases are correlated among themselves; for this reason, after a principal component analysis, we decided to maintain only the three main variables, the most representative of each group, which are:

1. *Software installation*;
2. *Customization* (representative also of business process analysis, set-up and prototype development, data recovery, after delivery assistance);
3. *System test* (representative also of training, system delivery, go live).

Table 4: Results of regression analysis: the impact of ERP implementation phases to TTF selected items

	Systems reliability	*Production timeliness*	*Data compatibility*	*Easy of use*
Intercept	1.27	0.49	0.63	0.92
Software installation	1.16	**2.06****	**3.40******	**2.74*****
Customization	**2.02****	**7.10******	**1.86***	**2.19****
System test	1.01	**2.00****	0.63	0.55
R^2	**0.11**	**0.36**	**0.15**	**0.12**

**** p < 0.001 *** p < 0.01 ** p < 0.05 * p < 0.1

As we supposed the regression analysis confirmed a causal relation between the implementation phases and constructs representing ERP system's reliability and utility perceived by users (Table 4).

The system reliability is strongly influenced only by customization phase ($p<0.05$) and the variance is explained for 11%. Instead the production timeliness is strongly influenced by all the implementation phases and in particular by customization ($p<0.001$), with an explained variance higher than the previous one (36%). The data compatibility seems to be strongly influenced by the installation ($p<0.001$) and weakly by the customization ($p<0.01$) as such as the easy of use construct. In both cases the explained variance is similar to the model that considers systems reliability.

DISCUSSION

The results of the statistical analysis on the empirical data collected support our idea of a causal relation between the effectiveness of implementing an ERP system and its success within an enterprise. It is possible to deepen the results by discussing each item.

System reliability is influenced by the business process analysis, the set-up and prototype development, the customization, the data recovery and the after delivery assistance. The explanation, confirmed by interviews with IT managers of the companies, could be that an incorrect implementation of these phases could lead to potential ERP system crash (repeated blocks of software modules). Consequently, it is possible to assert that these events create in the end-users a low consideration about the reliability of the ERP system. Since the construct analyzed considers also the reliability of the ERP system in terms of information accuracy, it is possible to deduce why there is an impact of data recovery phase that cause wrong accesses during the query in the case of data transfer is not correctly done. Also the after delivery assistance represents an important phase in guaranteeing the right execution of the procedures that otherwise could cause the system crash.

All ERP implementation phases impact to production timeliness, from software installation to after delivery assistance. In the D case study we discovered that an inefficient ERP implementation has been done caused by several criticalities (change in ERP advisor, change in the IT manager, etc.). In this company there is major slowing down in the end-use ERP system interaction and the activities are not be carried out on time. The most important phases are business process analysis, set-up and prototype development, customization, data recovery and after delivery assistance. In fact, delays can occur when interacting with the system due to the incorrect business process analysis that might have caused errors in data recovery, which were required during a query. The

same effects are produced by poor implementation of customization or recovery data phases. However, as regards the assistance, potential delays are due to non-presence or incompetence of the consulting firm's staff that supports users who need help.

Data compatibility is strongly influenced by the installation phase, that is the intrinsic quality of the ERP solution adopted by the company. Certainly, the basic programming rules give the right exchange of information among the several ERP modules implemented; a stability platform allows to obtain right data (not contradictory) creating in the key-users a sense-making of security towards the ERP system. Moreover, data compatibility is influenced also by the business process analysis, the customization, the data recovery and the after delivery assistance phases. A not correct implementation of these ones could give to the key-users incomplete or wrong information during a query to the system.

Easy of use, the construct that represent the measure of the easiness in the utilization and the user-friendliness of ERP modules, is influenced by the installation phase; in fact the user interfaces of the ERP system implemented can deal to a more or less difficult of use. Moreover there is an impact also due to business process analysis that allows to better fit with the routines of the end-users and consequently a better easy of use; the same happens with the customization phase. The correct process of data recovery allows to achieve right, complete and exact data which involve a reduction of the work for the end-users. This means that the end-used don't need to check the data with other databases or, in a worst case, with the paper version of the document. Finally, it seems to be important the after delivery assistance that allow the end-user to solve their doubts regarding the incomprehension of the ERP task logic creating a more easiness in the utilization.

In conclusion our analysis highlights the importance of a correct implementation of an ERP system in a company. In particular we want to underline that the most important phase are the software installation and the group of customization, business process analysis, set-up and prototype development, data recovery, after delivery assistance. If the first one is representative of the intrinsic quality of the ERP system, the others depend on the ability of the team composed by people from the system integrator (typically the consulting firm) and the key user of the company.

The analysis and personalization activities are important because strongly impact the final coherence of technology with the user requirement, while the training and the release phases seem to influence less the ERP system's reliability and utility perceived by users.

Two companies (B and D) had many difficulties during the implementation of the ERP. In the case D the change of the consulting firm and of the ERP system vendor created several criticalities never overcome and demonstrated by ineffectiveness of the system; in the case B we have observed that an excellent internal team has limited the difficulties during the system integrator change. Consequently the empirical evidences coming from the case analysis suggest that it's fundamental to maintain the internal skills of the key-users in order to guarantee the continuity of the project also if there is a change of the system integrator.

Cross-case analysis allows us to give further results. The percentage of initial investment in the ERP compared to the turnover don't seem to impact to the final result. As a matter of fact we observed the best implementation results respectively in the case C and B which shows a big difference in the investments, while the worst case (D) invested an amount of money similar to the best one (C).

REFERENCES

Al-Mashari, M. (2002), **"**Enterprise resource planning (ERP) systems: a research agenda", *Industrial Management & Data Systems*, Vol. 102, No. 3, pp. 165-170.

Bailey, J.E., Pearson S.W. (1983), "Development of a tool for measuring and analyzing computer user satisfaction", *Management Science*, Vol. 29, No. 5, pp. 519-529.

Berchet, C., Habchi, G. (2005), "The implementation and deployment of an ERP system: an industrial case study", *Computers in industry*, Vol. 56, No. 6, pp. 588-605.

Brynjolfsson, E., Hitt, L. (1996), "Paradox lost? Firm-level evidence on the returns to information systems spending", *Management Science*, Vol. 42, No. 4, pp. 541-558.

Bruno, G., Esposito, G., Iandoli, L., Raffa, M. (2004), "The ICT service industry in North Africa and the role of partnership in Morocco", *Journal of Global Information Technology Management*, Vol. 7, No. 3, pp. 5-26.

Creyer, E.H., Bettman, J.R., Payne, J.W. (1990), "The Impact of Accuracy and Effort Feedback and Goals on Adaptive Decision Behavior", *Journal of Behavioral Decision Making*, Vol. 3, No. 1, pp. 1-16.

Dasgupta, R, Granger, M., McGarry, N. (2002), "User acceptance of E-collaboration technology: an extension of the technology acceptance model", *Group Decision and Negotiation,* Vol.11, No.2, pp.87-100.

Davis F.D. (1989), "Perceived usefulness, perceived easy of use, and user acceptance of information technology", *MIS Quartely*, Vol. 13, No. 3, pp. 319-340.

De Toni, A.F., Zanutto G. (2006a), "Measuring Information Systems Success: a Literature Review", *Proceedings of the 17th Annual Conference of the Production and Operations Management Society,* Boston, USA.

De Toni, A.F., Zanutto, G. (2006b), "Web based information system success: a measurement model of technology acceptance and fit" *EuroMOT Conference*, Birmingham, United Kingdom.

Dishaw, M.T., Strong, D.M. (1998), "Supporting software maintenance with software engineering tools: a computer Task-Technology Fit analysis", *Journal of Systems and Software*, Vol. 44, No. 2, pp. 107-120.

Ehie, I.C., Madsen, M. (2005), "Identifying critical issues in enterprise resource planning (ERP) implementation", *Computers in Industry*, Vol. 56, No. 6, pp. 545-557.

Esteves, J., Pastor, J. (2001), "Analysis of critical success factors relevance along SAP implementation phases", *Proceedings of the 7th Americas Conference on Information Systems* (AMCIS), Boston, USA.

Goodhue, D.L. (1994) "Task system fit as a basis for user evaluation of information systems: a new instrument and empirical test", *Working paper series*, MISRC-WP-93-05, University of Minnesota.

Goodhue, D.L. (1995), "Understanding user evaluations of information systems", *Management Science*, Vol. 41, No. 12, pp. 18-27.

Goodhue, D.L., Thompson, R.L. (1995), "Task-Technology Fit and individual performance", *MIS Quarterly*, Vol. 19 No. 2, pp. 213-236.

Goodhue, D.L. (1998), "Development and measurement validity of a task-technology fit instrument for user evaluations of information systems", *Decision Science*, Vol. 29, No. 1, pp. 105-139.

Goodhue, D.L., Klein, B.D., March, S.T. (2000), "User evaluations of IS as surrogates for objective performance", *Information & Management*, Vol. 38, No. 2, pp. 87-101.

Gralbraith, J. (1973), *Designing complex organizations*, Etaslibri, Milano.

Hirt, S.G., Swanson, E.B. (1999), "Adopting SAP at Siemens Power Corporation", *Journal of Information Technology*, Vol. 14, No. 3, pp. 243–252.

Hsiao, Y.D., Yang, C.C., Lin, W.T., Lee, W.C. (2007), "A study on key failure factors for introducing enterprise resource planning", *Human Systems Management,* Vol.26, No. 2, pp. 139–152.

Kumar, K., Hillegersberg, J. (2000), "ERP experiences and evolution", *Communications of the ACM*, Vol.43, No.4, pp. 23-26.

Yi, M.Y., Hwang, Y. (2003), "Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model", *International Journal of Human-Computer Studies*, Vol. 59, pp. 431-449.

Legris, P., Ingham, J., Collerette, P. (2003), "Why do people use information technologies? A critical review of the technology acceptance model", *Information & Management*, Vol. 40, No. 3, pp. 191-204.

Lucas, H.C., Spitler, V.K. (1999), "Technology use and performance. A field study of broker workstations", *Decision Sciences*, Vol. 30, No. 2, pp. 291-311.

Mabert, V.A., Soni, A., Venkataramanan, M.A. (2001), "Enterprise Resource Planning: Common Myths Versus Evolving Reality", *Business Horizons*, May–June, pp. 71–78.

Markus, M.L., Tanis, C. (2000), "The enterprise system experience – from adoption to success", in Zmud, R.W. (Eds), *Framing the Domains of IT Research: Glimpsing the Future Through the Past*, Pinnaflex Educational Resources, Cincinnati, OH.

McCutcheon, D.M., Meredith, J.R. (1993), "Conducting case study research in operations management", *Journal of Operations Management*, Vol. 3, No. 11, pp. 239-256.

Payne, J.W. (1982), "Contingent Decision Behavior", *Psycological Bulletin*, Vol. 92, No. 2, pp. 382-402.

Malone, T.W., Jates, J., Benjamin, R.J. (1987), "Electronic Markets and Electronic Hierarchies", *Communications of the ACM,* Vol. 30, No.6, pp. 484-497.

PPRA (2003), "Utilisation et amélioration des ERP dans le milieu industriel, resultats de l'enquete optimisation de s ERP en Rhône-Alpes", *Pôle Productique Rhône-Alpes,* 09.

Saarinen, T. (1996), "SOS: An expanded instrument for evaluating information system success", *Information & Management*, Vol. 31, pp. 103-118.

Shih, H. (2004) "Extended technology acceptance model of internet utilization behavior" *Information & Management*, Vol. 41, No. 6, pp. 719-729.

Smith, J.F., Mitchell, T.R, Beach, L.R. (1982), "A cost-benefit mechanism for selecting problem solving strategies. Some extensions and empirical tests", *Organizational Behavior and Human Performance*, Vol. 29, pp. 370-396.

Standish Group, (2000), "CHAOS", *Standish Group Report*.

Venkatesh, V., Davis, F. D. (2000), "A theoretical extension of the technology acceptance model: Four longitudinal field studies" *Management Science*, Vol. 46 No. 2, pp. 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., Davis, F. D. (2003), "User acceptance of information technology: Toward a unified view" *MIS Quarterly*, Vol. 27, No. 3, pp. 425-478.

Voss, C., Tsikriktsis, N., Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 195-219.

Yin, R. (1994), *Case study research: Design and methods* (2nd ed.), Sage Publishing, Beverly Hills, CA.

Zanutto, G. (2005), "Web based information system success: a measurement model of technology acceptance and fit", *Ph D. Dissertation*, Padua, Italy.

Zhang, L., Zhang, Z., Banerjee, P. (2002), "Critical Success Factors of Enterprise Resource Planning Systems Implementation Success in China", *36th Hawaii International Conference on System Sciences*, IEEE.

APPENDIX A – Example Questions selected from Survey

Systems reliability
The Information System is very reliable (Lucas & Spitler, 1999).

Production timeliness
Regular Information System activities are completed on time (Goodhue & Thompson, 2005).
The access procedure of the Information System allows a quick interaction with it (Bruno *et al*., 2004).

Data compatibility
Data are stored in a easy way so they can be used effectively (Goodhue, 2005).
There are so many different systems or applications, but it is not hard to understand which one to use in a given situation (Goodhue, 2005).
The information coming from different sources are not contrasting (Goodhue & Thompson, 2005).

Easy of use
I find the ERP system easy to use (Goodhue & Thompson, 2005).
My interaction with the system is clear and understandable (Dasgupta *et al.*, 2002; Davis, 1989; Dishaw & Strong, 1998; Shih, 2003; Venkatesh & Davis, 2000; Venkatesh *et al.*, 2003).