Factors affecting ERP system implementation effectiveness

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Abstract

Purpose – Enterprise resource planning (ERP) systems enhance productivity and working quality by offering integration, standardization and simplification of multiple business transactions. The present study seeks to introduce a conceptual framework that investigates the way that human inputs (top management, users, external consultants) are linked to communication effectiveness, conflict resolution and knowledge transfer in the ERP consulting process, as well as the effects of these factors on ERP system effective implementation.

Design/methodology/approach – The examination of the proposed conceptual framework was made with the use of a newly developed questionnaire. The questionnaire was distributed to a group of 361 Greek companies that have implemented an ERP system. Information technology (IT) managers were selected as the key respondents of the questionnaire. After the completion of the four month research period (September to December 2008), 108 usable questionnaires were returned (response rate = 31 percent approximately). The empirical data were analyzed using the structural equation modelling technique (Lisrel 8.74).

Findings – The main findings of the empirical study can be summarized in the following categories: the assistance provided by external consultants during the ERP implementation process is essential; knowledge transfer is an extremely significant factor for ERP system success; knowledge transfer concerning technical aspects of ERP systems is more important than effective handling of communication, as well as conflict resolution among organizational members; the role of top management support seems to be of less importance that the one provided by users.

Research limitations/implications – The present study is limited by the poor definition of its population (due to lack of available data) and the relatively small size of the sample.

Practical implications – The paper points out areas that adopting companies should emphasize in order to successfully implement an ERP system and, therefore, harvest its potential benefits.

Originality/value – The paper proposes an enhanced conceptual framework that examines vital issues concerning ERP system effective implementation, thus, providing valuable outcomes for decision makers and academics. The originality of the paper lies in its three dimensional approach.

Keywords Enterprise resource planning, Internal support, External support, ERP system effective implementation, Linear structure equation modelling, Cost effectiveness, Resource efficiency

Paper type Research paper
1. Introduction

Individuals, companies and managers often face difficulties in comprehending the full spectrum of capabilities and attributes of ERP systems, due to the system’s complicated nature (Finney and Corbett, 2007; Markus and Tanis, 2000; Somers and Nelson, 2004). Marnewick and Labuschagne (2005) argue that an ERP system should not only be regarded as an information system (IS), but also, in order to be effectively implemented should be regarded as an integrated business system that surrounds all business functions. The same scientists define ERP as a software package that combines both business processes and information technology (IT) features.

Nowadays, ERP systems are being increasingly adopted by organizations of any kind and size, in order to avoid technical obsolesce and create sustainable competitive advantages (Al-Mashari et al., 2003; Willis and Willis-Brown, 2002). Dillard and Yuthas (2006) note that most multinational firms are using ERP software packages and even more small and midsize companies are on the route of adopting them.

ERP system acquisition and implementation generally enhance productivity and working quality, since the system offers standardization and simplification in multiple, complicated operational procedures across the company (Nah et al., 2001). Moreover, information can easily be transferred, shared and exchanged among users who are working at different business divisions (Amoako-Gyampah, 2007; Kemp and Low, 2008). In general, the literature has identified the following potential benefits of ERP system implementation (Al-Mashari et al., 2003; Amoako-Gyampah, 2007; Chang, 2004; King, 2005; Scott and Kaindl, 2000; Umble et al., 2003):

- improved coordination across functional departments;
- increased efficiency in doing business;
- reduced operating costs (lower inventory control cost, lower production costs, lower marketing costs, lower help desk support costs);
- facilitation of day-to-day management;
- rapid access to information for decision making and managerial control; and
- support of strategic planning (through the planning of available resources).

Despite the attributes and major advantages provided by ERP systems, the implementation of such systems is not always effective. Most enterprises are not able to fully justify their investments in ERP software, since the bulk of ERP benefits remain hidden. In their survey, Marnewick and Labuschagne (2005) reported that 25 percent of ERP installations exceed the initial cost and about 20 percent cannot be completed. Moreover, ERP systems often fail to meet organizational goals soon after their implementation. The cause of the general disappointment regarding ERP system effectiveness lies in a number of reasons, including a misconception about the system’s potential (Bradford and Florin, 2003; Hong and Kim, 2002; Marnewick and Labuschagne, 2005; Motwani et al., 2005).

The present study aims to develop a conceptual framework that incorporates the main factors leading in the effective implementation of an ERP system. Motivated by the theoretical importance of ERP systems and the empirical failure in fully harvesting their potential, the proposed conceptual framework includes variables that, according to the best of our knowledge, have never been collectively examined before.
Built on the argument that the success of most ERP systems is decided during the initial steps of their implementation (Gargeya and Brady, 2005; Hong and Kim, 2002) and significantly depends on the cooperation with an external consulting group (Akkermans and van Helden, 2002), the present study develops an “ERP implementation process model” that investigates the impact of internal and external human inputs on ERP implementation effectiveness (see Figure 1).

The need to fully incorporate the role of external consulting support in the proposed conceptual framework is imposed by its wide accepted significance in the ERP implementation process (Wang and Chen, 2006). On the other hand, the influence of internal stakeholders (top management and users) in the ERP consulting process is equally important, since they are the ones that must understand and learn to use what...
is embedded in the system. By including both internal and external support, the present paper takes account of all the critical entities that could significantly impact the process and outcome of an ERP system implementation (Reimers, 2003).

More analytically, the proposed “ERP implementation process model” investigates whether external and internal human inputs affect the consulting implementation process related to effective communication, conflict resolution and knowledge transfer and whether these factors lead to ERP system effective implementation. Such an integrative approach has never been attempted in the literature before and is expected to yield significant findings for companies that are about to adopt ERP systems. In general, it is argued that the proposed conceptual framework adopts a holistic approach to ERP system implementation, sheds light in areas rarely investigated and leads to interesting practical implications.

The present study makes two contributions to the ERP implementation literature. First, it develops a conceptual framework that places the centre of attention on the ERP consulting process, arguing that the success of most ERP systems is decided upon their initial implementation and depends significantly on external consultation. Second, the study highlights the contribution of “people” (top management, users, external consultants) to the process of ERP implementation, based on the concept that most ERP systems, however how intelligent, need to be thoroughly adjusted to every business environment in order to be crystallized into workable ERP solutions.

The following section includes the presentation of the proposed conceptual framework of the study. In the third and fourth section, the research methodology and the results are being presented. The conclusions and the impact of the research are discussed in sections 5 and 6 respectively and, finally, section 7 includes study limitations and proposals for future research.

2. The conceptual framework of the study

The present study introduces a newly developed conceptual framework that places the ERP consulting process on the center of attention. According to Wang and Chen (2006, p. 1031), “one key to a successful ERP implementation is to maintain an effective and smooth consulting process”. The proposed “ERP implementation process model” consists of three dimensions (see Figure 1): human inputs; ERP consulting process; and consequence. The human input dimension includes variables about internal and external support; the ERP consulting process dimension includes variables that are likely to affect the ERP consulting process; while the consequence is the effectiveness of the implemented ERP, as it is perceived by its actual users.

The aim of the study is to examine the causal relationships between seven research variables that belong to these three dimensions:

1. top management support (human input > internal support);
2. user support (human input > internal support);
3. consultant support (human input > external support);
4. communication effectiveness (ERP consulting process);
5. conflict resolution (ERP consulting process);
6. knowledge transfer (ERP consulting process); and
7. ERP system effective implementation (consequence).
The proposed conceptual framework is based on previous studies by Wang and Chen (2006), Wang et al. (2007) and Thong (2001). The hypotheses of the study are presented below.

2.1 ERP consulting process
The consulting process that takes place during and after the implementation of an ERP system is of vital significance for every company (Wang and Chen, 2006). The following paragraphs discuss the three main factors that relate to the ERP consulting process: communication effectiveness (Bloomfield and Danieli, 1995; Wang and Chen, 2006); conflict resolution (King, 2005; Robey et al., 1993; Wang and Chen, 2006); and knowledge transfer (Wang et al., 2007), as well as their effect on ERP system effective implementation.

2.1.1 Communication effectiveness. Effective communication is a strong foundation of a trustworthy relationship between external consultants and organizational members (Attewell, 1992). The more consultants and users understand each other, the more effective the communication becomes during the consulting process. Insufficient communication of users’ needs, goals and aspirations to the consultants may undermine the implementation of the ERP system (Fleck, 1993; Wang and Chen, 2006). Thus, we hypothesize that:

$H1$. A positive relationship exists between communication effectiveness and ERP system effective implementation.

The consulting process is an undertaking that, in order to be effective, constant communication with the client is needed (Lee and Kim, 1999). With effective communication, information can be transferred and exchanged easier between both parties who realize, in that way, that sustaining this relationship is at their best interest. Such relationship, accordingly, generates trust between the client company and the consultant company. As a result, the two companies become allies in a common effort to minimize conflicts that may arise in their cooperation (Lee and Kim, 1999; Morgan and Hunt, 1994; Wang and Chen, 2006). Thus, we hypothesize that:

$H2$. A positive relationship exists between communication effectiveness and conflict resolution.

2.1.2 Conflict resolution. The implementation of an ERP system is a time-consuming process. During that process certain conflicts may occur between users and consultants (King, 2005). Such conflicts will possibly affect in an adverse way the output of the consultant-client relationship (McGivern, 1983). However, the emergence of disagreements during the implementation period should not be considered as a negative turn in the cooperation, but rather as a common incident during a long-lasting collaboration (Green, 1998). Effective management of conflicts may lead in an enhanced level of information exchange and group work, thus, improving the implementation of the ERP system (Scott and Kaindl, 2000). Thus, we hypothesize that:

$H3$. A positive relationship exists between conflict resolution and ERP system effective implementation.

2.1.3 Knowledge transfer. Knowledge transfer in the ERP consulting process can be described as a gradual procedure in which knowledge is being transferred from
external consultants and vendors to the internal environment of the company (Wang et al., 2007). An increased level of knowledge concerning the ERP system will enable the company to exploit the new technology to its full potential and continue to achieve benefits from the use of the system in the future. Thus, we hypothesize that:

\[ H4 \]. A positive relationship exists between knowledge transfer and ERP system effective implementation.

2.2 External consultant support
Consultants play a major part in the ERP implementation challenge, since they have the technical knowledge and expertise to assist users in filling the unavoidable knowledge gap that derives from implementing a new ERP system. Under that logic, the consulting process becomes a necessity for any company that is willing to implement an ERP system (Freeman and Dart, 1993; Wang and Chen, 2006). The solutions that consultants offer during and after the configuration of the ERP system directly influence the effectiveness of the implemented ERP, independent of their interactions with their client (Wang and Chen, 2006). Thus, we hypothesize that:

\[ H5 \]. A positive relationship exists between consultant support and ERP system effective implementation.

In order to achieve high-level communication with each client and be able to resolve conflicts that may probably arise, a consultant should be particularly skilled (McLachlin, 1999). A successful consultant possesses both sufficient technical background, as well as the ability to communicate knowledge and experience, in a way that he gains the client’s trust (McGivern, 1983; Wang and Chen, 2006). Only in such a case, the client feels safe and, as a consequence, a good level of communication and an effective negotiation procedure during the whole implementation process is achieved (Wang and Chen, 2006). Therefore, we hypothesize that:

\[ H6 \]. A positive relationship exists between consultant support and communication effectiveness.

\[ H7 \]. A positive relationship exists between consultant support and conflict resolution.

ERP systems are complex in their nature, as well as in their implementation. Therefore, each company must acquire the adequate know-how and understanding of the system in order to fully exploit its potential. Consultant support from specialists who know in detail the ERP system and have the experience of how the system operates is crucial in order to achieve the required knowledge transfer to the company. The more extended the consultant support is, the more successful the transfer of knowledge to the adopting company will be (Bessant and Rush, 1995; Wang et al., 2007). Therefore, we hypothesize that:

\[ H8 \]. A positive relationship exists between consultant support and knowledge transfer.

2.3 Internal consultant support
However competent a consultant may be, ERP implementation will not run smoothly unless the members of the client organization (top management and users) are committed to the adoption and the use of the ERP system (Wang and Chen, 2006).
2.3.1 Top management support. Top management support describes the extent to which executive managers of the adopting firm provide the attention, resources, and authority required for ERP implementation (Wang and Chen, 2006). Top management support is a prerequisite for the successful ERP system implementation. Top managers supervise the whole implementation procedure, enable resource distribution, and support conflict management (Wang and Chen, 2006). Moreover, top management has the responsibility to align the new ERP system with the current business practices and prepare the employees for the change brought by the new technology. When top management works closely with various ERP users in the direction of the successful implementation of the ERP system, the communication between business groups is being enhanced and conflict resolution becomes attainable (Thong et al., 1996; Thong, 2001). Thus, we hypothesize that:

H9. A positive relationship exists between top management support and communication effectiveness.

H10. A positive relationship exists between top management support and conflict resolution.

Moreover, we hypothesize that a strong support from the top management towards the implemented ERP system will lead to enhanced knowledge transfer inside the adopting organization (Boynton et al., 1994; Cohen and Levinthal, 1990):

H11. A positive relationship exists between top management support and knowledge transfer.

2.3.2 User support. User support refers to the psychological state of business users toward the changes caused by the implemented ERP system, as well as toward the use of the system for performing their tasks (Wang and Chen, 2006). The users of an ERP system are usually the ones required to adjust their daily working practices to the new system’s requirements. Apparently, becoming familiar with a new ERP system is not an easy task and involves hard working and patience from the part of users (McLachlin, 1999; Soh et al., 2000; Wang and Chen, 2006).

In order to favorably affect users’ perceptions about new technology, the real benefits and advantages of using the ERP system need to be continuously reminded (Umble et al., 2003). Otherwise, users are not motivated to support the ERP system in that they are not willing to cooperate with the consultants and assimilate the knowledge transferred to them. This situation provokes conflicts in the consultant-client relationship and hinders communication (Wang and Chen, 2006). Therefore, we hypothesize that a high degree of user support will strengthen communication effectiveness and conflict resolution:

H12. A positive relationship exists between user support and communication effectiveness.

H13. A positive relationship exists between user support and conflict resolution.

Finally, we hypothesize, with alignment to H11, that a strong user support towards the implemented ERP system will lead to enhanced knowledge transfer inside the adopting organization (Boynton et al., 1994; Cohen and Levinthal, 1990):

H14. A positive relationship exists between user support and knowledge transfer.
Figure 1 summarizes all the above hypotheses, thus, presenting the proposed conceptual framework of the study.

3. Research methodology

3.1 Sample of the study
The conceptual framework of the present study was tested with the use of a newly developed questionnaire on a sample of Greek companies that have implemented an ERP system. Data concerning companies that could possibly be included in the sample of the study were obtained via the web sites of the leading ERP system providers that operate in Greece (e.g. Sap Hellas, Oracle Hellas, Synergy Hellas). Since no other database including companies using ERP systems exists, the use of the certain method was the only one able to provide usable information. Totally, 517 companies that have implemented an ERP system were identified.

3.2 Measures
The questionnaire of the present study is based on items (questions) that have been used by various previous researchers (Davison, 1997; Freeman and Dart, 1993; Jiang et al., 2000; Lee and Kim, 1992; Shin and Lee, 1996; Simonin, 1999; Sussman and Guinan, 1999; Wang and Chen, 2006; Wang et al., 2007). All questions were translated to Greek and then back to English by another person, so the detection and consequent improvement of any discrepancies was possible. The five-point Likert scale was used for the measurement of all variables (1 = “strongly disagree” to 5 = “strongly agree”). Table I demonstrates the seven research variables, the number of items used for their measurement and the studies from which they were adapted.

3.3 Data collection
The final questionnaire and a cover letter including all necessary clarifications, was sent to the IT managers of the companies of the sample. IT managers were selected as the key respondents, due to their experience and expertise. Questionnaires were sent only after telephonic contact with the IT manager in each company has been established. In order to send the questionnaire and the necessary clarifications to the person contacted by telephone, fax, traditional mail, or electronic mail services were utilized.

After making all necessary telephone calls, 361 questionnaires were distributed to 361 companies that agreed to participate in the survey. The research period lasted four months.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of items</th>
<th>Adapted from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management support</td>
<td>7</td>
<td>Lee and Kim (1992)</td>
</tr>
<tr>
<td>User support</td>
<td>6</td>
<td>Jiang et al. (2000)</td>
</tr>
<tr>
<td>Consultant support</td>
<td>10</td>
<td>Freeman and Dart (1993)</td>
</tr>
<tr>
<td>Communication effectiveness</td>
<td>4</td>
<td>Davison (1997)</td>
</tr>
<tr>
<td>Conflict resolution</td>
<td>4</td>
<td>Sussman and Guinan (1999)</td>
</tr>
<tr>
<td>Knowledge transfer</td>
<td>4</td>
<td>Simonin (1999), Wang et al. (2007)</td>
</tr>
<tr>
<td>ERP effective implementation</td>
<td>5</td>
<td>Shin and Lee (1996)</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Table I.
The measurement of the variables of the study.
months (September to December 2008). Totally, 112 questionnaires were returned, and after realizing all necessary controls 108 were used for data analysis (data analysis was conducted with the use of the statistical packages SPSS 14.0 and Lisrel 8.74). The 112 returned questionnaires represent a very satisfactory response rate of 31 percent.

The majority (24.7 percent) of the companies of the sample belong to the “Informatics” industry (sector), while 14.8 percent to the “Electronic” and 12.3 percent to the “Food” industry. Moreover, the 37 percent of the companies of the sample employ 101 to 500 employees, 30.9 percent employ 51 to 100 employees, while only 6.2 percent and 12.3 percent of the companies employ less that 50 and more that 1,000 employees respectively. Accordingly, the results indicate that the annual sales of the 32.1 percent of the companies of the sample are between 10,000,000 and 50,000,000 Euros, while the second larger category (29.6 percent) includes companies that have annual sales between 1,000,000 and 10,000,000 Euros. The majority of the respondent companies (34.6 percent) have been using an ERP system for more than two years, 29.6 percent less than two years and 35.8 percent less that one year. Finally, about half of the Greek companies of the sample (49.6 percent) have chosen “SAP Ltd” as their ERP system provider, 26.7 percent “Oracle Ltd” and 23.7 percent have chosen another supplier.

3.4 Reliability and validity

The instrument (questionnaire) that was used in the present study was tested for both its content and construct validity. The control for the content validity was conducted prior to the beginning of the survey and included consultation with academics of the field, consultation with experienced practitioners, and pilot testing.

The control for the construct validity was conducted in two steps. Each of the seven research variables was evaluated for its unidimensionality and reliability, for the goodness of fit to the proposed research model.

The estimation of the unidimensionality of each of the seven variables was conducted using explanatory factor analysis with the method of principal component analysis. Moreover, for the estimation of the reliability of the research variables, the statistical measure Cronbach’s alpha was used (the statistical package SPSS was used in both cases).

All tests concluded that all the scales used, after minor amendments (extraction of items), are valid and reliable (see Table II for the main results).

Furthermore, the evaluation of the goodness of fit of each of the seven research variables to the proposed model was conducted using confirmatory factor analysis, with the use of the statistical package LISREL 8.71.

All tests conducted produced satisfactory results (see Table III for the main results concerning the estimation of the goodness of fit). Finally, after the successful completion of the control for the construct validity of the questionnaire, the final score of each variable was calculated using the mean of the items used in each case.

4. Results

The conceptual framework of the present study suggests that top management support, user support and consultant support are positively related with ERP system effective implementation, through communication effectiveness, conflict resolution and knowledge transfer (see Figure 1). The examination of the conceptual framework and the verification of the 14 hypotheses were conducted with the use of the "structural
equation modeling technique”. The certain multivariate technique was used because of its ability to simultaneously examine a number of depended linear relations, where one or more construct (variable) is both dependent and independent according to the relation it belongs (Hair et al., 1995; Kelloway, 1998). For the conduction of the appropriate analysis the statistical package LISREL 8.74 was used.

The estimation of the structural model was conducted with the maximum likelihood estimation method, which is the most widespread method of estimation (Anderson and Gerbing, 1988; Kelloway, 1998). The covariance matrix was used as the table of entry, because the control of the hypotheses in the structural equation modeling technique is based on the hypothesis that the matrix that will be analyzed is the covariance matrix. Thus, even though the use of the correlation matrix has widespread use in a lot of applications, the use of the covariance matrix is recommended (Kelloway, 1996). Finally, the extraction of the standardized completely solution was requested.

To evaluate the fit of the overall model the chi-square value ($X^2 = 712.69$ with 447 degrees of freedom) and the $p$-value ($p = 0.05060$) were estimated. These values indicate a good fit of the data to the overall model. However, the sensitivity of the $X^2$ statistic to the sample size enforces to control other supplementary measures of evaluating the overall model, such as the “Normed-$X^2$” index (1.59), the RMSEA index (0.087) the CFI (0.95) and the GFI (0.93), that all indicate a very good fit. For the control
of the measurement model the significance of the factor loadings, the construct reliability and the variance extracted were estimated. Results indicated that all loadings are significant at the $p < 0.05$ level. Additionally, the construct reliability and the variance extracted measures for all constructs are satisfactory.

Table IV illustrates all relations between research variables, as they have been determined by the hypotheses of the study (see paragraph 2). For the verification (or the rejection) of every research hypothesis, two controls have been conducted: the value and the direction of the relation between the two latent variables; and the significance of the relation, indicated by the $t$-value, were examined. According to Hair et al. (1995), when the $t$-value is above 1.96 and below $-1.96$, the hypothesis is significant at the significance level of 5 percent. Otherwise, the hypothesis is statistically insignificant.

Results offer support to 8 research hypotheses ($H_2$, $H_4$, $H_5$, $H_7$, $H_8$, $H_{10}$, $H_{12}$, $H_{14}$), while six hypotheses are not verified by the empirical data ($H_1$, $H_3$, $H_6$, $H_9$, $H_{11}$, $H_{13}$). The analysis of the results gives room for interesting observations and offers guidelines to ERP implementing companies.

4.1 *General observations*

In general, it should be highlighted that the empirical results suggest that only knowledge transfer and consultant support can directly and positively influence ERP effective implementation ($H_4$ and $H_5$), while the postulated effect of communication effectiveness and conflict resolution is insignificant ($H_1$ and $H_3$). Between these two significant paths, consultant support seems to be of greater importance that knowledge transfer (0.41 and 0.25 respectively).

4.2 “ERP consulting process” dimension

The only variable of the “ERP consulting process” dimension that has a direct positive impact on ERP effective implementation is knowledge transfer ($H_4$). Results failed to

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path</th>
<th>Effect</th>
<th>$t$-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_1$</td>
<td>Communication effectiveness $\rightarrow$ ERP system effective implementation</td>
<td>$-0.76$</td>
<td>$-1.46$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_2$</td>
<td>Communication effectiveness $\rightarrow$ conflict resolution</td>
<td>$0.73$</td>
<td>$3.09$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_3$</td>
<td>Conflict resolution $\rightarrow$ ERP system effective implementation</td>
<td>$1.20$</td>
<td>$1.90$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_4$</td>
<td>Knowledge transfer $\rightarrow$ ERP system effective implementation</td>
<td>$0.25$</td>
<td>$2.36$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_5$</td>
<td>Consultant support $\rightarrow$ ERP system effective implementation</td>
<td>$0.41$</td>
<td>$2.46$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_6$</td>
<td>Consultant support $\rightarrow$ communication effectiveness</td>
<td>$-0.09$</td>
<td>$-0.71$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_7$</td>
<td>Consultant support $\rightarrow$ conflict resolution</td>
<td>$0.49$</td>
<td>$3.26$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_8$</td>
<td>Consultant support $\rightarrow$ knowledge transfer</td>
<td>$0.22$</td>
<td>$2.35$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_9$</td>
<td>Top management support $\rightarrow$ communication effectiveness</td>
<td>$-0.28$</td>
<td>$-2.00$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_{10}$</td>
<td>Top management support $\rightarrow$ conflict resolution</td>
<td>$0.19$</td>
<td>$1.99$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_{11}$</td>
<td>Top management support $\rightarrow$ knowledge transfer</td>
<td>$0.01$</td>
<td>$0.14$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_{12}$</td>
<td>User support $\rightarrow$ communication effectiveness</td>
<td>$0.53$</td>
<td>$3.33$</td>
<td>Accepted</td>
</tr>
<tr>
<td>$H_{13}$</td>
<td>User support $\rightarrow$ conflict resolution</td>
<td>$0.04$</td>
<td>$0.29$</td>
<td>Rejected</td>
</tr>
<tr>
<td>$H_{14}$</td>
<td>User support $\rightarrow$ knowledge transfer</td>
<td>$0.22$</td>
<td>$2.46$</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

Table IV. Direct effects between research variables (test of hypotheses)
establish a significant relationship between communication effectiveness and conflict resolution, on the one hand and ERP system effective implementation on the other (H1 and H3). It seems that these two variables do not have the capacity to directly influence the outcome of the ERP implementation process, mostly because they are not as equally significant as knowledge transfer and consultant support. They may be necessary for maintaining a good working environment while the implementation process takes place, but they fail to directly influence the overall success of this process.

Moreover, communication effectiveness has a quite large effect (0.73) on conflict resolution (H2). This is quite logical, since the higher the communication between business entities, the better the possibility to resolve the problems that occur during the implementation of an ERP system.

4.3 “Human input” dimension
User support is the only variable of the “human input” dimension that has an influence on communication effectiveness (H12). This finding indicates that the willingness of users to support the project and accept the corresponding organizational changes motivates them to openly express themselves regarding their thoughts and requirements during the implementation process.

Moreover, both consultant support and top management support are positively associated with conflict resolution (H7, H10). Consultants can enhance the ERP implementation process by facilitating conflict resolution, thus, reducing the occurrence of persistent conflicts. Top management support is also critical to inter-unit conflict resolution, since top managers are responsible for coordinating the various business departments and provide compulsory guidelines and instructions.

Finally, it is found that user and consultant support influence knowledge transfer (H8, H14) with the same intensity (0.22). The support of users and consultants during the implementation period leads to higher levels of knowledge transfer, meaning that the organization absorbs more knowledge about the use of the system, the knowledge gap between users and consultants is eliminated and, thus, the ERP implementation better satisfies the requirements of the company. This finding is very important, since knowledge transfer is one of the two research variables that have a direct impact on effective ERP implementation. Hence, it is supported that user and consultant support have an indirect impact on ERP system effective implementation, an impact that is mediated through knowledge transfer.

Figure 2 presents the revised form of the proposed conceptual framework, in which only the significant paths are shown.

5. Conclusions
The present study has proposed a conceptual framework that investigates the main factors leading in the effective implementation of an ERP system. To the best of our knowledge, it is the first empirical evidence that demonstrates the relationship between human inputs, variables that are connected with the ERP implementation process and the final outcome of this process. The examination of the conceptual framework was made with the use of a newly developed structured questionnaire and the results offer interesting implications to ERP adopting companies. The presentation of the
conclusions follows a structured path, so as to enhance their clarity and avoid any possible misinterpretation.

5.1. Consultant support
The study empirically shows that the support of external consultants is crucial for the effective implementation of ERP systems. The assistance provided by external consultants is essential, even more important than that provided by top managers. The contribution of the consultants’ involvement and support in the implementation process has also been verified in the studies of Wang and Chen (2006), Chang (2004) and Finney and Corbett (2007).

Since consultant support is a factor with such a significant influence on ERP system effective implementation, companies should focus on hiring the right consultant group for the specific business environment. Efforts towards consultant selection should not be viewed as a time wasting procedure, since the experience of consultants in similar business contexts, the commitment towards achieving mutual goals and the shared mentality of the two contactors are of crucial importance for successful implementation.

Consultants should not only acquire technical skills, but should also have a broad understanding of the individual business practices and a genuine commitment towards resolving every-day issues considering ERP system implementation. It would be
advisable for adopting companies to make a contractual connection between the fees paid to the consultant team and the improvement in certain areas of business activity. In general, the consultant group should be viewed as a valuable “ally” in the ERP implementation process: consultants need the support and the acceptance of the company personnel in order to be able to fully integrate their valuable expertise and make a substantial difference in the implementation of ERPs. If system users adopt a negative attitude towards working together with a professional team of consultants, the implementation procedure will surely produce poor results.

5.2 Knowledge transfer
The present survey has statistically indicated that knowledge transfer is a significant factor for ERP system success. On the same vain, the study of Wang et al. (2007) has produced the same results. On the other hand, no significant relationship was found between communication effectiveness, conflict resolution and ERP system effective implementation. Wang and Chen (2006), also found no relationship between communication effectiveness and ERP system success, but established a relationship between conflict resolution and ERP system success. Apparently, the incorporation of knowledge concerning technical aspects of ERP systems is more important than effective handling of communication, as well as conflict resolution among organizational members of Greek companies.

From the above, it is apparent that ERP adopting companies should build the necessary structures in order to facilitate the procedure of knowledge transfer. System users not only need to be taught the newly implemented ERP technology, but they, furthermore, need to learn more about their new organizational responsibilities. Moreover, they should actively try to acquire maximum results from the use of the ERP system, since passive attitude is not a path that leads to successful ERP implementation.

In order to do so, the adopting company should, firstly, understand that with the use of an ERP system every employee is being continuously trained. Therefore, companies should provide opportunities for employees to enhance their skills by providing training opportunities on a continuous basis, in order to meet the changing and complex needs of the business environment (Bingi et al., 1999).

Moreover, the adopting company should make sure that the knowledge transfer procedure is not short or inconclusive, since the literature recognizes the limited consultation period as a factor that undermines possible positive effects (Nah et al., 2001). Furthermore, since it is difficult for consultants to pass the knowledge to computer illiterate employees, the adopting company should organize computer seminars prior to the implementation of the new ERP system. Finally, the adopting company should appoint its most prominent employees (from all functional business areas) to follow the implementation procedure step by step, so as to be able to play the role of the “internal consultant” after the withdrawal of the professionals.

5.3 Top management support
According to the statistical analysis, the role of top management support seems to be of less important that the one provided by users, since top managers assist only in the resolution of conflicts (a factor that has no relationship with ERP system effective implementation), while user support influences both communication effectiveness and,
more importantly, knowledge transfer (a factor that is related with ERP system effective implementation). These findings are in line with the corresponding ones in the studies of Wang and Chen (2006) and Wang et al. (2007).

On a practical level, the above imply that a company needs to ensure user support in order to be led into a successful ERP implementation. This can be achieved by allowing future users to:

- report their views on the necessity of the implementation;
- contribute to the specifications of the system;
- participate in the implementation process; and
- collect various rewards upon successful use of the implemented ERP system.

Without the active participation and the overall acceptance of its users, every ERP system, no matter how expensive and elegant, is destined to produce less positive results that the ones anticipated, or even fail miserably.

5.4 Overall conclusions
In general, the present study argues that consultant support and knowledge transfer are the two key factors for ERP system success. The consultants may improve the performance of ERP systems directly, through their experience and technical expertise and indirectly through the effective transfer and sharing of ERP system knowledge among various inter-organizational members. In other words, the transfer of knowledge from the consultants may raise the level of user know-how, then users subsequently should be able to successfully maintain and further modify the ERP system without consultant engagement.

Therefore, practical efforts in hiring the right consultants are essential, especially since the consulting fees are quite significant. Moreover, ERP adopting companies should improve their knowledge management capabilities in order to successfully facilitate the transfer of knowledge from consultants. In order to pursue a successful ERP implementation and gain sustainable competitive advantage, companies need to develop their internal knowledge capabilities before implementing an ERP system. The building of these capabilities will ensure that the knowledge offered by consultants is properly disseminated throughout the organization. Organizational practices, culture, and structure should be reinforced to address this necessity (Nonaka and Takeuchi, 1995).

6. Impact of the research
The empirical research included in the present paper has a dual impact. On the one hand, offers important guidelines to companies implementing an ERP system and on the other, develops a coherent conceptual framework that thoroughly investigates the process of the effective implementation of an ERP system, thus, broadening the understanding on the issue. Given the influence of ERP systems on business success, such a dual contribution seems rather significant for both practitioners and academics.

7. Limitations and future research
A limitation of the present study is the relatively small size of the sample. This may be attributed to the nature of the population of the study (Greek companies that have
implemented an ERP system), which is rather small and difficult to be defined due to lack of available data. In addition, IT managers were often hesitant to reveal inside information about the company’s policies, as well as information regarding the ERP system performance. Given that companies in Greece are mostly small and medium-sized, most of them do not have an autonomous IT department and are using external IT specialists to assist with the system’s implementation and operation. As a result, it was not always possible to contact the internal staff of each company, and, therefore, gather an overall and consistent evaluation of the ERP system implementation.

The present study has emphasized the vital role of the consultants in enhancing the performance of the ERP system, by means of their experience and the transfer of their knowledge and technical expertise to the ones that have acquired and are using the ERP system. Further research on the effective implementation of the ERP systems is suggested with larger samples that would, probably, offer more information and strengthen the initial outputs of the present research. Moreover, it would be interesting to include additional variables to the proposed conceptual framework of the present study (e.g. change management, team morale and motivation, training, job redesign) and finally, gather empirical data from all company personnel, so as to achieve a rounder view of the subject under investigation.

References


Further reading

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