# Key players and activities across the ERP life cycle: A temporal perspective

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*Enterprise Resource Planning (ERP) systems are enterprise wide systems that, because of their integration, automate all of a company's business processes. They have rapidly become the de facto industry standard for replacement of legacy systems. In this paper I analyze using an information theory approach the temporal aspects of key players and activities specific to Romanian SME's ERP implementations with focus on both generic and unique aspects.*
**Keywords:** *ERP life cycle, CSF, romanian business systems implementation.*

**I**ntroduction
ERP systems are comprehensive packaged software solutions that aim for total integration of all business processes and functions. Shanks and Parr (2000) defined ERP implementation as "the process of developing the initial business case and planning the project, configuring and implementing the packaged software, and subsequent improvements to business processes". Despite the fact that "the business world's embrace of enterprise systems may in fact be the most important development in the corporate use of information technology", broad-based empirical research in the ERP implementation in Romania are still very limited. Because an ERP implementation involves significant risks it is essential to focus on ways to improve the implementation process. Somers and Nelson (2003) elaborated a comprehensive framework by combining the factors view of implementation with the process perspective, and examined the issues that should dominate each implementation stage. In this paper I analyze using an information theory approach the temporal aspects of key players and activities specific to Romanian SME's ERP implementations with focus on both generic and unique aspects.

**Theoretical background**
*Critical Success Factors in SME's ERP implementation* - By studying literature, scientific papers and case examples I compiled a list of 22 relevant CSF - critical success factors - (21 relevant CSF applying the coding procedures from grounded theory [4]) associated with project/system implementations derived through a process that involved identification and synthesis of those critical requirements for implementation that have been recommended by practitioners and academicians through an extensive review of the literature [5]. Success factors identified in the academic and nonacademic literature suggests important factors, such as Top management support - Project champion - User training and education - Management of expectations - The partnerships between vendors and customers - Use of vendors' development tools - Careful selection of the appropriate package - Project management - Steering committee - Use of consultants - Minimal customization - Data analysis and conversion - Business process reengineering - Defining the architecture - Dedicated resources - Project team competence - Change management - Clear goals and objectives - Education on new business processes - Interdepartmental communication - Corporate culture - Ongoing vendor support [8].

*SME's ERP implementation stages* - The process approach of an ERP implementation is about a sequence of stages and seeks to explain how outcomes develop over time [1]. Researchers have described ERP transition with models having three to six stages: Deloitte Consulting's [2] three-stage model (first wave - ERP implementation, go live, second wave - stabilize, synthesize, synergize), Ross and Vitale's [3] five-stage model ( approach, the dive, resurfacing, swimming, jet-skiing). Rajagopal [4] frames ERP implementations in terms of the six-stage model of IT implementation consisting of initiation, adoption, adaptation, acceptance, routinization and infusion. The strength of this model is in the last two phases, which represent post-adoption behavior.

*Integration of the ERP's implementation CSFs within the ERP implementation stages* - It is important to analyze the information discrepancy between the hypothesized literature-based importance of each player and activity across stages and their actual importance derived from a research conducted among project team members at a Romanian ERP vendor specialized in targeting small- and medium sized enterprises, because the importance of the CSFs manifests different levels according to the stage of the ERP project life cycle – the CSFs are temporal.

**Research method**

*Data collection* - Data collection for this research was conducted by interviews. In order to establish each player and activity level of importance specific to Romanian SME's ERP implementations, I and conducted a series of interviews among project team members at a Romanian ERP vendor specialized in targeting small- and medium sized enterprises. Team individuals were pre-identified for study participation. To qualify for study participation, they were required to possess substantial involvement at high level, in any phase of the life cycle, with any of the modules implemented. The initial interviews showed that top management and project managers tended to have the most complete knowledge about the subject, thereby minimizing some of the problems of the key-informant technique used in my study. Respondents were provided with a list of relevant players and activities and they were asked to identify the degree of importance of each one througout the ERP life cycle stages (that were briefly described in order to avoid confusions), using a Likert scale, ranging from low to critical.

*The theoretic background for data analysis* - According to the information theory, the in-

formation and indetermination are proportional measures and because of this fact in order to measure the quantity of information we use the same measure as for indetermination. The quantification of indetermination was established by Shannon who referred to entropy as ''a measure of the uncertainty of agreement'' between the message sent and the message received. Information theory bridges research and practice, the difference between the current knowledge (expected importance of players and activities) and the actual outcome (observed importance of players and activities) constitutes the information content of the event, which is termed the entropy of the system and which provides a feedback mechanism for updating prior knowledge [6]. In order to establish the information inaccuracy or degree of divergence between the prior expectations and later observed importance of players and activities I utilize the Somers and Nelson model (2003) who developed their analysis based on a bivariate classification probability matrix using ERP life cycle stages (Y's) and players/activities (X's).

**Results**

According to the majority of the respondents the adoption stage is the most solicitating from all ERP life cycle stages in terms of players and activities. As the project progresses from initiation to infusion the most important activities (factors) tend to diminish in level of importance. According to the Somers and Nelson model I measure the overall bivariate information innacuracy I(X,Y) and the conditional innacuracies for each row and column that I present in Table 1 and Table 2 (the values of information innaccuracy presented in the mentioned tables are measured in $10^{-4}$ nits, according to the information theory).

| Variables $X_i$ Players and activities | $I(Y \mid X_i) = \sum_{j=1}^{n} \dfrac{q_{ij}}{q_{i.}} \ln\left[\dfrac{q_{ij}/q_{i.}}{p_{ij}/p_{i.}}\right]$ $\quad H(p_1, p_2 \cdots p_n) = -\sum_{i=1}^{n} p_i \log_2 p_i$ $\quad p_i \geq 0, \sum_{i=1}^{n} p_i = 1$ $\quad \forall i = \overline{1, n}$ | |
|---|---|---|
| | Average conditional inaccuracies for rows | |
| $X_1$ | Top management support | 252.87 |
| $X_2$ | The project champion | 71.16 |
| $X_3$ | The steering committee | 152.9 |

| $X_4$ | Implementation consultants | 1836.61 |
| $X_5$ | The project team (competencies) | 1413.36 |
| $X_6$ | Partnership between vendor and customer | 556.12 |
| $X_7$ | Use of vendor's development tools | 75.97 |
| $X_8$ | Ongoing vendor support | 1361.26 |
| $X_9$ | User training and education | 760.13 |
| $X_{10}$ | Management of expectations | 321.76 |
| $X_{11}$ | Careful package selection | 544.08 |
| $X_{12}$ | Project management | 286.29 |
| $X_{13}$ | Minimal Customization | 436.8 |
| $X_{14}$ | Data analysis and conversion | 130.86 |
| $X_{15}$ | Business process reengineering | 34 |
| $X_{16}$ | Defining the architecture | 459.46 |
| $X_{17}$ | Dedicating resources | 379.13 |
| $X_{18}$ | Change management | 861.25 |
| $X_{19}$ | Establishing clear goals and objectives | 352.58 |
| $X_{20}$ | Education on new business processes | 537.93 |
| $X_{21}$ | Interdepartmental communication and cooperation | 242.15 |
| $X_{22}$ | Corporate culture | 4550.66 |

Table 1 Information innacuracies in players and activities

The values of information innacuracies presented in Table 2 suggest that major contributors to ERP implementations innacuracies are the initiation and infusion stages and that the adoption stage is a minor contributor confirming that the role of players and activities are very well understood at this level of the ERP implementation. *These differencies between empiric and hypothezed data suggest that initiation, routinization and infusion stages of implementation are less understood by interviewees.*

| Variables $Y_j$ ERP life cycle stages | $I(X \mid Y_j) = \sum\limits_{i=1}^{m} \frac{q_{ij}}{q_{.j}} \ln[\frac{q_{ij}/q_{.j}}{p_{ij}/p_{.j}}]$ Average conditional inaccuracies for columns | |
|---|---|---|
| $Y_1$ | Initiation | 831.73 |
| $Y_2$ | Adoption | 40.96 |
| $Y_3$ | Adaptation | 75.06 |
| $Y_4$ | Acceptance | 110.66 |
| $Y_5$ | Routinization | 563.58 |
| $Y_6$ | Infusion | 1890.56 |

Table 2 Information innacuracies in ERP life cycle stage

In order to examine the importance of all stages combined simultaneosly with all the players and activities of ERP implementation I analyze the entropy values I(X,Y) (overal innacuracies equals $1669,75*10^{-4}$nits) and the total average conditional innacurencies for ERP life cycle stages $I(X/Y_i)$ in comparison with the total average conditional innacurencies for players and activities presented $I(Y/X_i)$ in Table 1 and Table 2. The analysis reveals that players and activities information innacurancies are higher than ERP implementation stage information innacurancies. The existing innacurancies show that are surprinsingly big diferencies between the hypothezied data and the empirical data especially in concerning the players and activities involved in ERP implementation *sugesting that the temporal nature of key players and activities is less understood than their overall importance.*

In the initiation phase the importance of es-

tablishing goals and objectives is major underestimated while the use of implementation consultants and project management are major overestimated. The empirical data also stems that project champion during adoption phase, user training and education during routinization phase are considerably underestimated. The infusion stage shows the highest degree of overall innacurencies due to highest values in underestimating the importance of corporate culture, dedicating resources, user training and education and ongoing vendor support. The next highest register entropy value is dedicated to the initiation stage according to the underestimated values of the next players and activities: establishing clear goals and objectives, the project champion, project management, business process reengineering, defining the architecture. The acceptance stage of implementation registers the minimum overall information inaccuracy due to minimum differences in underestimating and overestimating the role of players and activities across this stage.

The results of the research also reveal that:

1.    The initiation, routinization and the infusion stage of an SME's ERP implementation are not well understood by the people involved in it.

2.    The majority of the respondents considered that project management was underestimated at all the ERP life cycle stages allowing me to conclude that respondents may have misinterpreted this question as asking for project management; if this is the case the firm experiences problems concerning methods and tools utilized to assure proper project management and in consequence there may be the case of improper use of implementation methodology.

3.    The majority of the respondents considered that (in order of importance) the subsequent players and activities: partnership between vendor and customer, minimal customization, use of vendor tools were overestimated at all the ERP life cycle stages.

4.    Contrary to my expectation the user training and education not only appear to be important at routinization stage but it also registers the highest overall information in-

accuracy ($72.77*10^{-4}$ nits). This phenomenon is due to the fact that in post implementation stages for maximizing the utility of the system, end users skills improvements are neccessary.

5.    The use of implementation consultants at infusion stages was overestimated and this fact raises questions about the understanding of the player's involvement during systems upgrades

6.    The differences between empiric and hypothesized data reveals that corporate culture is underestimated in almost all stages which shows that the value of sharing common goals over individual pursuits and the value of trust between partners, employees, managers and corporations is highly regarded in ERP implementations.

7.    Despite the fact that in literature interdepartamental communication and cooperation is considered critical especially in ERP implementations that involve significant business process reeingineering this activity is overestimated at adaption, adaptation and routinization stages of the ERP life cycle. This fact raises questions about the methods and tools utilized to assure proper project communication management.

**Conclusions**

The differencies between empiric and hypothezed data suggest that initiation, routinization and infusion stages of implementation and the temporal nature of key players and activities are less understood by interviewees than their overall importance. This study brings contributions concerning the temporal aspects of the CFS's involved in an romanian SME's ERP implementation beyond the adoption and routinization phase and raises questions about the lack of comprehension of implementation team members about the involvement of a particular player and a particular activity at a certain stage of ERP life cycle.

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