Factors Determining the Enterprise Resource Planning Project-Success in Small and Medium Enterprises: Evidence from Indian Cases

R. Dhinakaran Samuel and N. Santhosh Kumar

Department Information Technology, Loyola institute of technology, Chennai, India
Department of management studies, SRM University, Chennai, India

Abstract: It is common to see more than 60% of Enterprise Resource Planning (ERP) implementation projects exceed timeline and budget because of people related factors than technical reasons. There are studies which measure the importance of players and activities across enterprise system life cycle but there is little effort to quantify the overall contribution of each player, also they do not cover different types of users and support groups involved in the projects especially in Small and medium enterprises (SMEs) where knowledge management initiative is lacking. The present study attempts to quantify the contribution through an empirical research conducted in SME segments of a developing economy like India. A descriptive study conducted in 52 SMEs shortlisted through multistage random sampling and analysed using discriminant analysis. The study develops a model for project-success using seven type of people related factors. It further proves that the group of knowledgeable employees called knowledge power-users in SME segments determines the success of ERP project than other stake holders involved in the ERP implementation.

Key words: Information systems • ERP • SME • Success factors • Knowledge management • Stakeholder analysis

INTRODUCTION

The business today is more complex, managing the whole operation throughout the business network requires information technology solutions, such as Enterprise Resource Planning (ERP) systems. The organizations which have been implemented the ERP systems are reaping the benefits of having integrated working environment, standardized business processes and achieved optimum operational efficiency. Not all ERP implementations are successful [1]. Recent survey held by an US consultancy services, 2000 responses from 61 countries, collected between February 2006 to May 2012, indicate 28% of implementation finished on time and 11% completed the project sooner than expected [2]. The consultancy said it is ‘distressingly common’ to see ERP projects running so late (61% of the implementations). The findings were again reconfirmed with 172 respondents through a survey held in the period of September 2012 to January 2013. The effort and money involved in the ERP implementation is huge, most of the time the investor realizes in the middle of the project that the decision to go in for ERP is not appropriate, but it is a tricky situation and difficult to come out. Is there any method to identify the causes of these delay upfront, before starting of the project? This research attempts to answer this question. Identifying the factors causing this delay is the focal point of this research. These ERP projects exceed budgets and timeline expectations due to many factors, including:

- Not devoting knowledgeable resources to create accurate project planning and to create a business case, design new business processes as well as testing the new processes in the new system.
- The Leadership that carried over by vendor sales pitches rather than the system that truly fit for their future state requirements at the time of selection of software.
- Leadership teams that fail to anticipate the magnitude of change management.

Corresponding Author: R. Dhinakaran Samuel, Department of Information Technology, Loyola Institute of Technology, Anna University, Chennai, India.
The project team, which focused mainly on the technical aspects of the system at the time of training than the new processes and user orientation.

The knowledge gaps which include gaps between external vendor, consultants and internal experts, the gaps between internal experts and end-users and the gaps between end-users from different business units.

Most of the above points are focusing on people involved in the project, hence a study of people involved in the ERP projects and their influence on success or failure is the first step in answering our question. The behavior of people can be studied upfront to predict the success or failure. There are studies [3-6] on people involved in the project. These studies do not cover the comprehensive list of people involved in the project, generally it takes into account top management, user, vendor, project team and consultants. In fact there are three groups of people involved in these projects:

- User Group,
- Internal support group (Top management, Project team / IT team),
- External support group (Vendor, Consultant)

ERP implementation is a change-process; it is the process of making ‘business transformation. There are number of barriers that can slow down the progress of this change process or even stop it altogether. One of the barriers that is most difficult to overcome centers on the attitude and behavior of the people who are affected by the change. Change management is a very important activity in the ERP implementation process. The user group is the one of the influencing groups, which will be affected more in the ERP implementation change management process. There are three types of users viz, (i). Transaction-users, (ii). Knowledge power-users (iii). Positional power-users.

The attitude and behavior of these users depend on the power they are authorized and their perception on the effect of change on them. Power is the ability to control all types of resources, such as information, people, expertise, assets, etc. Power does not rest with position alone. There is positional power and knowledge power. The positional power comes from official authority while the knowledge power is accrued over a period of time by an individual through the acquirement of critical knowledge related to organizational product and processes. As ERP focus on process integrations, this knowledge power-user plays a dominant role in the implementation stages such as business analysis; ‘to be’ process design, conference room pilot testing, data migration and post implementation. The transaction users are those who handle data entry or using the system for day to day transactions. The expectation from these three users from the ERP system is different and the amount of stake in the ERP success by each user type also different.

Therefore, including each user group as separate entity, we arrive at seven types of people involved in the ERP implementation process.

- User group: 1. Positional power user, 2. Knowledge power-user, 3. Transaction user
- Internal support: 4.Top management, 5.Project team (include Project manager and IT team)
- External support: 6. Vendor, 7. Consultants

This study is focused mainly on SME segments because ERP market today is mostly saturated for large scale organisations; globally the mid range and SME market continue to be major focus areas for ERP vendors according to Global market research agencies such as AMR research.

SMEs tend to provide an environment that is conducive to generate knowledge, mainly due to their size, often single site location and closer social relationships of employees, resulting in good communication flows and knowledge sharing [7]. Once the operations of SME expand to multiple sites, it will lead to the formation of multiple groups within the same department. This will reduce their ability to communicate with themselves and share knowledge. Many SMEs appear to lack strategic focus due to their pre-occupation with the day-to-day viability in the developing economy. Also, they lack absorptive capacity as they tend to be less effective in recognising the value of their explicit knowledge and are short of adequate resources, infrastructures and technology to disseminate and apply existing and new knowledge [8]. Hence islands of knowledge owners are created in the SMEs especially in the developing economy like India.

The lack of efficient interaction between the involved knowledge owners may lead to the failure of ERP implementation.[9]. ERP implementation is so knowledge-intensive that the fate of the whole project is in the hands of a group of knowledgeable employees within the organisation and the success of the project relies heavily upon the effective management of knowledge into, within and out of this team during ERP
life cycle [10]. Above studies confirm the importance of knowledge owners but there is a significant shortage of empirical research on this aspect. Hence the present study attempts to bring out an ERP project-success model with seven types of people related factors and identify the major contributor from them for the success.

MATERIALS and METHODS

Research Method:
Research Design: Descriptive study

Method: Questionnaire method

Administration: Personal interview and collected response for each question.

Study Population: SMEs implemented Tier-1 ERPs in Chennai, India. (Tier-1 ERPs are SAP, Oracle E-business suite, JDEdwards Enterprise one etc).

Sample Size: 52

Sampling Method: Multistage Random sampling

In the first stage, those SMEs, who implemented Tier 1 ERP in Chennai was selected, in the second stage, manufacturing and service sectors were chosen, in the third stage 5 industries in manufacturing sector and 3 industries in service sectors were chosen. In the fourth stage 85% of the sampling units from manufacturing sector and 15% of sampling units from service sectors were chosen using simple random sampling. In the manufacturing, more than one fourth (27%) of sampling units from Automobile industry and same % in FMCG, Electronics 14%, Pharma 10%, Chemicals 7% were chosen. In the service sector 15% chosen from Construction, IT, Education and Equipment services industries.

Reliability analysis carried out on the 80 questions related to the attributes of seven people related factors, the alpha value exceeds 0.8 in all the seven factors. (Vendor related 0.897, top management related 0.849, positional power user 0.916, knowledge power related 0.889, project team related 0.915, transaction user related 0.900, consultants related 0.814).

Theoretical Background: In order to derive a new implementation model for ERP, it is absolute necessary to study all the existing models, hence the approach for this study consists of three steps: 1. Identify various ERP implementation models and success measurements models, 2. Adopt an implementation model from these to develop an improved ERP implementation model with this seven people related factors as success factors., 3. Validate the model. Table 1 shows the key points of nine most important approaches for Information system (IS) / ERP success and success measurements.

### Table 1: IS / ERP success measurement models

<table>
<thead>
<tr>
<th>Model [reference]</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extended ERP systems success measurement model [14]</td>
<td>Above five plus additional two measures</td>
</tr>
<tr>
<td>1. Vendor/Consultant quality</td>
<td></td>
</tr>
<tr>
<td>2. Workgroup impact</td>
<td></td>
</tr>
</tbody>
</table>
All the nine models have specific strength and weaknesses and for every practical success measurement intention different needs occur. Some of the models are ERP specific, others on IS in general and may need adoption when used for ERP success measurement. Most models consider user’s point of view. Each stakeholder has a specific expectation of the outcome of the success measurement. A study by [6] used Stakeholders and few success measurement dimensions to compare different ERP success measurement approaches. The different stakeholders defined in this study are 1. Users, 2. Top management, 3. IT team 4. Externals. Three success measurement dimensions considered for classification by this study, which consolidates most of the measurements used by the above models, are 1. Process improvements, 2. Future needs 3.Financials. The present research moderates the above classification to study the stakeholder involvement in the ERP project-success.

The proposed study extends ERP success model developed by [5] for constructing industries as reference model as well as the success measurements study [6]. The reference model has three main dimensions: 1. Success factors, 2. Intermediate constructs, 3. Success indicators. The reference model success factors are broadly grouped into three stakeholder groups. Users, Internal groups and External groups. Fig 1 shows the proposed model, referred to as the conceptual ERP success model. This model combines the result of both the study referred above but primarily concentrates on the study of [5] and expands the stake-holder group used by that study. Expansions of the three stakeholder group are given below:

- Users group is divided into three, (i). Transaction users, (ii). Knowledge power-users and (iii). Positional power users.
- Internal Groups consists of (i) Top management, (ii) Project team ( IT team)
- External Group consists of (i) Vendor, (ii) Consultants

This conceptual model also includes four success indicators, the three dimensions of success measurements proposed by [6] and one more measures [5] called project-success.

**Statement of Work:** Hence the statement of research work includes:

- Test whether this seven type people related success factors contribute to the success indicator ‘project-success’
- Develop a prediction model for success using people related success factors based on discriminant analysis.
RESULTS AND DISCUSSIONS

This chapter reports all the findings of the research project on the problem statements listed above. Data collected from 52 companies were analysed using the software like SPSS and statistical techniques like ANOVA and Discriminant analysis. The findings are presented below. There are eleven constructs used in these analysis, seven people related success factors (Vendor, Top management, Positional power user, Knowledge power-users, Project team, Transaction users and consultant) and four success indicators (Project-success, Financial related benefits, Process improvement benefits and Future needs benefits).

Testing Whether this Seven Type People Related Success Factors Contribute to the Success Indicator ‘Project-success’:

One way ANOVA using SPSS carried out with ‘project-success’ as dependent variable and seven people related factors as independent variables. Findings of the seven analyses are given in the Table 2. The null hypothesis is rejected in all seven analyses. There is significant difference between ‘project-success’ with all seven people related factors.

Table 2: One way ANOVA-seven factors with project-success

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Null hypothesis Ho</th>
<th>F</th>
<th>Statistical inference</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>there is no significant difference between project-success and vendor</td>
<td>4.370</td>
<td>0.001p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>2</td>
<td>there is no significant difference between project-success and top management</td>
<td>2.265</td>
<td>0.025p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>3</td>
<td>there is no significant difference between project-success and positional power user</td>
<td>3.205</td>
<td>0.003p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>4</td>
<td>there is no significant difference between project-success and knowledge power-user</td>
<td>3.205</td>
<td>0.003p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>5</td>
<td>there is no significant difference between project-success and project team</td>
<td>7.435</td>
<td>0.001p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>6</td>
<td>there is no significant difference between project-success and transaction user</td>
<td>6.037</td>
<td>0.001p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
<tr>
<td>7</td>
<td>there is no significant difference between project-success and consultant</td>
<td>2.054</td>
<td>0.042p&lt;0.05 Significant</td>
<td>Null hypothesis rejected</td>
</tr>
</tbody>
</table>

Table 3: Discriminant function coefficients

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Canonical Discriminant Function Coefficients</th>
<th>Standardized Canonical Discriminant Function Coefficients</th>
<th>Eigen-values</th>
<th>Canonical Correlation</th>
<th>Wilks' Lambda</th>
</tr>
</thead>
<tbody>
<tr>
<td>vendor related</td>
<td>.026</td>
<td>.200</td>
<td>.693</td>
<td>.640</td>
<td>.591*</td>
</tr>
<tr>
<td>top mgt related</td>
<td>.001</td>
<td>.003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>positional power user</td>
<td>.122</td>
<td>.528</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>knowledge power related</td>
<td>.174</td>
<td>.900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>project team related</td>
<td>.206</td>
<td>.636</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>transaction user related</td>
<td>.042</td>
<td>.246</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>consultants related</td>
<td>.002</td>
<td>.010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>-6.171</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Structured matrix and classification

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Structure Matrix</th>
<th>Group Centroids</th>
<th>Classification Results (Predicted Group Membership)</th>
</tr>
</thead>
<tbody>
<tr>
<td>vendor related</td>
<td>.964</td>
<td>Success</td>
<td>-0.348</td>
</tr>
<tr>
<td>top mgt related</td>
<td>.778</td>
<td>Failure</td>
<td>1.914</td>
</tr>
<tr>
<td>positional power user</td>
<td>.698</td>
<td></td>
<td></td>
</tr>
<tr>
<td>knowledge power related</td>
<td>.634</td>
<td></td>
<td></td>
</tr>
<tr>
<td>project team related</td>
<td>.518</td>
<td></td>
<td></td>
</tr>
<tr>
<td>transaction user related</td>
<td>.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>consultants related</td>
<td>.278</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ D = (0.026 \times \text{Vendor}) + (0.001 \times \text{Top management}) + (0.122 \times \text{Positional power}) + (0.174 \times \text{Knowledge power}) + (0.206 \times \text{Project team}) + (0.042 \times \text{Transaction user}) + (0.002 \times \text{Consultant}) - 6.171 \]

The discriminant function coefficients (\( b \)) or standardized form beta both indicate the partial contribution of each variable to the discriminate function controlling for all other variables in the equation. They can be used to assess each variable’s unique contribution to the discriminate function and therefore provide information on the relative importance of each variable.

The structure matrix shown in table 4 indicates the correlations of each variable with each discriminate function. These Pearson coefficients are structure coefficients or discriminant loadings. They serve like factor loadings in factor analysis. By identifying the largest loadings for each discriminate function the researcher gains insight into how to name each function. Here we have top management and consultants related attributes (low score) which suggest the function that discriminates between Success and Failure of ERP implementation. A further way of interpreting discriminant analysis results is to describe each group in terms of its profile, using the group means of the predictor variables. These group means are called Centroids. These are displayed in the Group Centroids. Success has a mean of -0.348 while Failure produces a mean of 1.914.

Finally, there is the classification phase. The classification table, also called a confusion table, is simply a table in which the rows are the observed categories of the dependent and the columns are the predicted categories. When prediction is perfect all cases will lie on the diagonal. The percentage of cases on the diagonal is the percentage of correct classifications. The classification results reveal that 94% of respondents are classified correctly into ‘Success’ or ‘Failure’ project.

**CONCLUSION**

In summary, the study concluded with the following observations:

- By conducting one way ANOVA, it is identified that all the seven people related factors contribute to the success of the project,
- By discriminant analysis, Project team and Knowledge power related attributes were the strongest predictors. Top management attributes was a less successful as predictors.
- The discriminant function can help to predict the success or failure upfront on measuring the attributes of the seven people related factors before starting of the project.

Further, the study emphasizes the greater role of knowledge power-user in the implementation of ERP in SME segments than top management and other stakeholders, which moves away from conventional practice. It proposes a different approach for SME segments because SMEs in developing countries, though they have conducive-environment for knowledge generation, they lose focus on dissemination of knowledge because of various economical reasons. Hence the knowledge on product, processes, customers, vendors, special situations are lying with the few individuals in the organisations.

This model can be used by ERP project manager during pre-assessment stage or before starting the project to identify the magnitude of risk.

**REFERENCES**


