A Quantitative Analysis of the Successful Integration of the ERP and CRM System


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Abstract

A comprehensive literature review suggested a lack of academic attention to the integration of the ERP and CRM system. In order to shed light on this subject matter, an attempt was made to study the CSFs that facilitated the implementation of the ERP and CRM integration. A set of CSFs on the integration of the ERP and CRM was initially collected from the pioneer work by Cheng et al. (2003). The measurements of the CSFs and the successful integration of the two IS systems operationalized by Cheng and Tsai (2003) were adopted to develop the questionnaire. A total of 32 questionnaires mainly from the electronic sector, the major ERP/CRM integration sector, were collected. The analysis shows that six CSFs confirm the literature review: top management support and commitment, the user’s appreciation on the success of the integration, a qualified project team, effective communication between project team and ERP/CRM staff, clear integration objectives and quantifiable performance indexes, and user training and education. Due to the consideration of the inevitable defects of the current study, a set of future researches is also provided.

Keyword: Enterprise Resource Planning (ERP), Critical Success Factor (CSF), Customer Relationship Management (CRM), Extended ERP (EERP)

1. Introduction

A recent call for the academic study of the integration of the enterprise resource planning (ERP hereafter) and customer relationship management (CRM hereafter) system has been identified by 2 recent papers, Cheng, et al. (2003) and Cheng and Tsai (2003). The former pioneered this subject matter by defining a set of critical success factors (CSF hereafter) that had greatest impact on the success of integrating the ERP and CRM system. The process of the research was through literature reviews on related papers and face-to-face interviews with key experts on this subject in Taiwan. A purification procedure was followed to consolidate a CSF research model. Nevertheless, the exploratory style with expert interview led to the latter research to be carried out. The latter research validates the significance of the CSFs identified by the former research through case studies. Four firms were selected to examine the notions of these CSFs. The project leaders in these firms were in depth interviewed. The evidences of it showed that the firms with success in all of the CSFs enjoyed the highest integration performance, while the firms fallen short with some of the CSFs made lower integration performance. In spite of the
latter research to validate the CSFs, its deployment of the case study style also brings about the consideration of a further confirmation of the CSFs by using quantitative style research, which is the attempt of this current research to lend evidences to the CSFs.

The structure of this paper is organized as follows. Mainly quoting from the papers of Cheng, et al. (2003) and Cheng and Tsai (2003), the rationales of the CSF of the integration of the ERP and CRM system will be discussed in Section 2. The definition and the characteristics of the success in the system integration will then be depicted in Section 3. The research methodology, data analysis, research result, and conclusion will be delineated and discussed in Section 4 to Section 6.

2. The Rationales and Hypotheses of the CSFs

The factors identified by Cheng et al. (2003) as the CSFs of the ERP/CRM integration include “top management support and commitment”, “ERP/CRM users’ appreciation on system integration”, “qualified project team”, “effective communication between project team and ERP/CRM staff”, “clear integration objectives and quantifiable performance indexes”, “business process reengineering” (BPR hereafter), and “user training and education”. The rationales of these CSFs will be depicted briefly, and the related hypotheses will be delineated below.

2.1 Top management support and commitment

Top management support and commitment are decisive determinants for any business activities, including various IS projects (see among authors, Rockart, 1982; Jang and Lee; 1998; Soliman et al., 2001; Ang et al., 2002). The proceeding of the integration of two systems will force ERP staff to face external environments, and alter their daily operation to adapt to dynamic circumstances. Under such a circumstance, during the proceeding, the magnitude of the hostility to the integration from ERP staff will be higher than that of the introduction of individual ERP modules. Besides, CRM staff will also bother with the opposition in coordination requests from ERP staff. When serious conflicts occur between two sides, the integration will break down.

Top management support and commitment will bring about serious/better attitude toward integration of internal employees and external consultants, and reduce the magnitudes of conflicts between back-end and front-end offices during the entire integration process. According to the above debate, $H_1$ is therefore formulated as follows:

$H_1$: Top management support and commitment are positively related to the success of the ERP/CRM integration.

2.2 ERP/CRM users’ appreciation on system integration
When it comes to the integration of two IS systems, the appreciation of users will play a critical role, which has been supported by the research conducted by Barki and Hartwick (1994) and Soliman et al. (2001). The understanding of roadblock and suffering during the process as well as final resultant benefits will reduce/release their opposition. This would help smooth future staff communication across the two-sides, and further let the staff to adapt to possible BPR (see Section 2.6), and accept required training courses in the following stages. Based on the above, $H_2$ is therefore proposed:

$H_2$: The ERP/CRM user's appreciation on system integration is positively related to the success of the ERP/CRM integration.

2.3 Qualified project team

Project team members should consist of internal coordinators that are familiar with ERP and CRM related departments and external consultants qualified with experiences. The responsibilities of the team are to deal with managerial and technical issues. Major managerial issue is the release of resistance on constant daily operation changes by ERP staff. Therefore, internal coordinators should be full of communication skills. Major technical issue is the Application Programming Interface (API hereafter) between ERP and CRM. Skilled coordinators (normally external consultants) know how to solve interface compatibility of the two systems (more serious challenges in the condition of the use of different vendors’ systems (Holley, 2002; Collett, 2000)). The debate leads to the formulation of $H_3$:

$H_3$: Qualified project team is positively related to the success of the ERP/CRM integration.

2.4 Effective communication between project team and ERP/CRM staff

Trough cross back-end and front-end offices communication, on one hand, the project team can fully grasp the requirements from both sides, and thus, adjust the best-integrated system to meet the demand; on the other hand, owing to the appreciation of the entire project, ERP and CRM staff will be less anxious and their attitude toward implementation will be more favorable (cf. Rainer et al., 1992). Nevertheless, it should be taken into account that the inheritance of narrow- and open-minded working attitudes toward change by ERP and CRM respectively (see Section 2.2), therefore, confrontation resulted from both sides are more severe than that from individual side. The above reasoning suggests the following:

$H_4$: Effective communication between project team and the ERP/CRM staff is positively related to the success of the ERP/CRM integration.

2.5 Clear integration objectives and quantifiable performance indexes
A critical reason why the project fails is the gap between top management expectations and the reality. The goal of implementing individual IS systems is normally quite clear; nevertheless, when it comes to integrating two IS systems, especially one from back-end office and another from front-end office, it is difficult to define the objective since the benefit of it is unlimited. Therefore, clear initial objective and related quantifiable performance indexes become critical. The objective and related indexes allow all participants of the ERP/CRM integration project to follow, and to set the priority of required tasks. Hence, the formulation of $H_5$ is made as below.

$$H_5: \text{Clear integration objectives and quantifiable performance indexes are positively related to the successful ERP/CRM integration.}$$

2.6 Business process reengineering

In the implementation stage of the IS system, some business workflow tasks may need more or less modification in order to match the system. Under the condition of ERP/CRM integration, project team need to tune both systems as a whole. This is to maintain the integrity of business rules, thus, the workflow can be passed between systems without any trouble (Tan et al., 2002). For the best practice of the integrated system, BPR may need to be followed. The argument recommends the following hypothesis:

$$H_6: \text{Business process reengineering is positively related to the success of the ERP/CRM integration.}$$

2.7 User training and education

The performance of ERP/CRM integration as a single IS system will also affected by user training and education (cf. Ang et al., 2002). While integrating, cross-site’s data will be received and new business process may be formed. Therefore, the offering of training and education is necessary for the ERP/CRM staff to understand the data coming across sites, and what their functions are and how to function in the new structures. This research according proposes $H_7$:

$$H_7: \text{User training and education is positively related to the success of the ERP/CRM integration.}$$

3. Successful ERP/CRM Integration

User satisfaction is the most general individual-user perceptual measure of information system success (Seddon and Kiew, 1996). In view of this, user satisfaction is taken as evaluation criteria to measure successful ERP/CRM integration. According to DeLone and McLean (1992) and Seddon and
Kiew (1996), user satisfaction on the IS system is the recipient response to the use of the output of an IS system; in addition, the level of usefulness will have direct impact on the level of user’s satisfaction; besides, it should have a beneficial impact on user’s decision-making if the IS system is successful. These explanations and related information offer the foundation for the research to clearly describe and define the characteristics of success. As the success ERP/CRM integration mainly benefits to the CRM department, successful integration can render from the following conditions:

- The integrated system can meet the individual requirements of the related CRM employees for daily operations.
- The results of integration can meet the expectations of the related CRM employees.
- The related CRM employees are satisfied with the information quality that the integrated system provides.
- The related CRM employees are willing to use the integrated system.
- The related CRM employees are satisfied with the whole integrated system.
- The related CRM employees are satisfied with the decision made with the help of the integrated system.

4. Measurement and data collection

The measurements of the seven CSFs and the success of the integration of the ERP and CRM system operationalized by Cheng and Tsai (2003) were deployed. Related items/questions are listed on Appendix 1.

As to data collection, a paucity of qualified firms that integrated the two systems within Taiwan’s environment was reported in Cheng and Tsai’s (2003) paper. A pre-survey of the current research on banking and electronic sectors, indicated by field experts about the majority of requesting the integration solution in Taiwan, confirmed this circumstance. For the quantitative type of the current research, a number of strategies were therefore utilized to cope with it. First of all, the authors cooperated with the MOE Outstanding Research Project members to acquire a list of possible firms which might integrate the two systems. One of the MOE Outstanding Research Project missions was to investigate the current application of the ERP system in Taiwan. Nevertheless, an inadequate number of firms, 20, were identified as qualified. The outcome led to the consultation of the field expert to acquire more, although limited, firms with the integration experiences. Again, unsatisfied number of qualified firms was obtained. Therefore, snow sampling was adopted for further collection of the qualified firms. A total number of 51 qualified firms were eventually obtained.

Prior to sending the questionnaires to these qualified firms, a call with a small number of questions related to the integration was made to ensure the completion of the integration project. Simultaneously, the project leader of the firm was informed about the significance of the current research and the cooperation of the research with the MOE Outstanding Research Project. The questionnaire was
then emailed to the project leader. Three days latter, if never received, a reminding e-mail/telephone was sent/made. In total, three waves of sending were carried out, and eventually 32 questionnaires were received.

5. Data Analysis and Research Results

5.1 Measurement Reliability

The reliabilities of the measures were assessed through Cronbach’s $\alpha$ (1951) test. Item-to-total correlations and $\alpha$ values were the two main indexes of the evaluation. The thresholds of the two were 0.3 and 0.6 respectively (Hair et al., 1998). With the exception of the measure of Business Process Reengineering (CSF6, hereafter), all the assessments were above the requirement (see Table 1).

Table 1: The Reliabilities of the Measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach’s $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management support and commitment (CSF1)</td>
<td>0.7877</td>
</tr>
<tr>
<td>ERP/CRM users’ appreciation on system integration (CSF2)</td>
<td>0.8615</td>
</tr>
<tr>
<td>Qualified project team (CSF3)</td>
<td>0.7827</td>
</tr>
<tr>
<td>Effective communication between project team and ERP/CRM staff (CSF4)</td>
<td>0.7806</td>
</tr>
<tr>
<td>Clear integration objectives and quantifiable performance indexes (CSF5)</td>
<td>0.8589</td>
</tr>
<tr>
<td>Business process reengineering (CSF6)</td>
<td>0.5712</td>
</tr>
<tr>
<td>User training and education (CSF7)</td>
<td>0.8217</td>
</tr>
<tr>
<td>The performance of the integration</td>
<td>0.8965</td>
</tr>
</tbody>
</table>

Four items were included in the measurements of the CSF6 (please see Table 2 and Appendix 1). The corresponding Cronbach’s $\alpha$ was 0.5712, marginally acceptable for the exploratory type of measures. However, the item-to-total value of Item 1 suggested its elimination of Item 1, which could further increase the $\alpha$ value, or instead, the elimination of Item 2, 3, and 4. Through interviews with field experts, both from the academic community and industrial circles, Item 2, 3, and 4 of the CSF6 were eventually eliminated. The reason is because Item 2, 3, and 4 contributed to the performance of the whole systems. Nevertheless, both adjustment of the standard operation procedure (SOP hereafter) and the use of IS would speed up the whole systems. Therefore, it was difficult to exactly attribute the acceleration of operation procedures to Item 2, 3, and 4.

Table 2: The Items of the CSF 6 Measurement

<table>
<thead>
<tr>
<th>Item</th>
<th>Questions</th>
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<tbody>
<tr>
<td>1</td>
<td>Firm’s adjustments related to standard operation procedures (SOP).</td>
</tr>
<tr>
<td>2</td>
<td>After integration, the whole systems speed up the operation procedures within dept.</td>
</tr>
<tr>
<td>3</td>
<td>After integration, the systems speed up operation procedures between departments.</td>
</tr>
<tr>
<td>4</td>
<td>After integration, the whole systems speed up daily operation procedures of firms.</td>
</tr>
</tbody>
</table>
5.2 Hypotheses Testing and Results

The data set was analyzed by using the SPSS statistic program and a summary of the analysis is listed and presented in Table 3 and Figure 1. The regression results suggested, with the exception of H6, to accept the proposed hypotheses. According to that finding, the CSF 6, i.e. business process reengineering, has no significant impact on the success of the ERP/CRM integration. A possible reason for this can be the use of single item scale to gauge the CSF 6. Another explanation may be due to the prior painful experience of the BPR process, a conclusion from the further interview of field experts with the ERP or CRM background. The ERP system becomes mature in Taiwan, and the CRM system is still in the introduction stage. As the participant has already implemented the ERP system with a painful BPR process, and when it comes to the connection of the ERP and CRM system, the participant would attempt to avoid the troublesome BPR steps. In other words, the CRM system would be regarded as an extension of their original IS database. Under such a circumstance, BPR has no significant impact on the success of ERP/CRM integration.

Table 3: The Research Result

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>P value</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management support and commitment (CSF1)</td>
<td>0.080*</td>
<td>0.068</td>
</tr>
<tr>
<td>ERP/CRM users’ appreciation on system integration (CSF2)</td>
<td>0.001***</td>
<td>0.273</td>
</tr>
<tr>
<td>Qualified project team (CSF3)</td>
<td>0.020**</td>
<td>0.139</td>
</tr>
<tr>
<td>Effective communication between project team and ERP/CRM staff (CSF4)</td>
<td>0.000***</td>
<td>0.361</td>
</tr>
<tr>
<td>Clear integration objectives and quantifiable performance indexes (CSF5)</td>
<td>0.073*</td>
<td>0.073</td>
</tr>
<tr>
<td>Business process reengineering (CSF6)</td>
<td>0.504</td>
<td>0.008</td>
</tr>
<tr>
<td>User training and education (CSF7)</td>
<td>0.000***</td>
<td>0.390</td>
</tr>
</tbody>
</table>

*, **, *** Significant at the 10 percent, 5 percent, and 1 percent levels, respectively.

Figure 1: A Diagrammatic Summary of the Research Hypotheses

*, **, *** Significant at the 10 percent, 5 percent, and 1 percent levels, respectively.
6. Conclusion

The result from the findings of the study suggests the manager in all organizations to continuously monitor the few key areas to gain the competitive edges during the ERP and CRM integration process. These areas include the decisive factor of top management support and commitment, which will smooth the progress of the ERP and CRM integration. Besides, the user’s appreciation on the success of the integration is also a key issue, and the approval of it indicates that firms should take more responsibilities on releasing its staff from the resistance. In addition, the performance of the integration would be facilitated by the use of a qualified project team. The qualified project team will utilize a better algorism that documents any single piece of useful records and would like to share practical experiences with the firm, which will allow all the project members to gain a better insight into the integration. What's more is that, the understanding of all project team members will be enhanced by effective communication between project team and ERP/CRM staff. Through the communication, the whole systems can meet the individual requirements of the relevant ERP and CRM employees for daily operations. The other significant factor of the integration is clear integration objectives, and quantifiable performance indexes will help alleviate the gap between expectations and reality, and also allows all participants of the integration project to set the priority of required tasks. Of course, user training and education also ensure every related user to be capable of operating the systems, and at the same time, the use of the systems will promise a better perform of the integration system.

The approval of the above factors offers practitioners a set of checklist to monitor the implementation of the integration of the ERP and CRM system, and further to facilitate its progress. Nevertheless, failure to support the BPR process in the success of the integration may indicate its unremarkable role upon the integration. In order to alleviate the chaos of the integration, managers should deliberate upon the necessity of the BPR step.

For the future research, due to the nature of the study, the inevitable defects occurred. First of all, the sample size may constrain the further analysis of the data. To gain more implications on this issue, it is necessary for further research to enlarge the sample size. Secondly, the relative lack of content validity on the CSF 6, i.e. BPR, should be solved. The investigation of the influence of BPR is worthy of future study. In addition, the diversity of interviewed cases should be expanded. During the data collection process, a lack of motives for service sectors to introduce ERP was found; on the contrary, a pressing need for introducing the CRM system was identified. The reason of it is simply due to the industrial characteristics. Under such a circumstance, the consideration for BPR, at least in service sector, could differ from the manufacturer sector. The phenomena raises the issue of the variance consideration across industries, and moreover, country levels such as local IT development that will also influence the acceptance of the IS system. Therefore, future research may investigate the current issue across various environments, a more broad view upon the current topic.
References


Appendix 1: The Measurements of the CSFs

Top management support and commitment
Top managers assign project team to advocate ERP/CRM integration.
Top managers care about the progress of the project.
Top managers often attend the meeting of ERP/CRM integration. All departments are willing to provide necessary information. Firm provides sufficient financial support to ERP/CRM integration. Top managers are willing to solve related problems.

**ERP/CRM users’ appreciation on system integration**
Project team holds meeting for explaining what they try to do regularly. Related employees are willing to attend related meetings. Related employees are willing to solve problems of integrations. Related employees are willing to comply with progress of project.

**Qualified project team**
External consultants are full of experiences. External consultants address complete proposal and methodology for the integration. Team members from internal employees are in charge of related dept. Team members from internal can affect related employees. External consultants are familiar with both ERP and CRM systems.

**Effective communication between project team and ERP/CRM staff**
Team members from top management can convince employees about benefits of integration. Team members from middle managers can convince top management about the impact of integration. Team members from middle managers can convince related employees about benefits of integration. Team members from operational level can affect managers and make them adopt their suggestions. Related employees keep in touch with project consultants directly through e-mail during the project.

**Clear integration objectives and quantifiable performance indexes**
Firm has clear integration objectives and quantifiable performance indexes for the integration. Performance indexes and results are included in annual reports. Performance indexes are included in monthly or quarterly statements. Firms will review performance indexes regularly.

**Business process reengineering**
Firm adjusts related standard operation procedures (SOP). After integration, the whole systems speed up the operation procedures within dept. After integration, the whole systems speed up the operation procedures between ERP/CRM dept. After integration, the whole systems speed up the daily operation procedures of the firms.

**User training and education**
Firm has clear planning for user’s training and carries out the planning. Firm has clear planning for key users and carries out the planning. Project team holds different training courses for different dept. Related employees know integration systems well. Related employees are able to operate systems. Related employees are capable to check results and to correct wrong answers.