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Case-Based Study of Interorganizational Information Systems Implementation Critical Success Factors

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Abstract

With the rapid diffusion of interorganizational information systems (IOS) as a strategic tool, enterprise concerns more about the IOS implementation critical success factors (CSFs) to gain the maximum benefit from it. However, previous researches have put little energy into the research of IOS implementation CSFs. This paper proposes a three-level model of IOS implementation CSFs with seven sub-factors in total. Supported by a real case study, this paper illustrates each factor in detail from both the proactive and reactive enterprise viewpoint, providing useful recommendations for practice.

Keywords: Interorganizational Information Systems (IOS), Critical Success Factors (CSFs), Case Study

1. Introduction

The furious competition in the global market is compelling enterprises to search for new ways to create and sustain their edges through technology innovation. As enterprises stress much more on the collaboration in a supply chain, they consequently transcend their traditional information system boundaries and link more tightly with partners. Interorganizational information system, as a powerful tool, has been used by many companies for strategic objective. Given more complex and higher risky IOS is, enterprises need to be rather knowledgeable about the critical issues they must pay attention to during IOS implementation. Yet, when we try to find answers from previous theories on either of IOS or CSFs, we found there is a large vacuum about this topic.

Consider the rapid diffusion of IOS in competitive industry environment, there is an urgent requirement for the theory evolution of IOS implementation CSFs to offer some guidelines for enterprises when they consider and adopt their IOS with partners. What's more, we should try to organize and present those CSFs for IOS implementation in a logical way using simple language so that managers in the real word of business can understand easily. That's the motivation and also the essential value of this research. This paper aims to provide a three-level model of critical success factors for IOS implementation by the research method of literature review and probative case-based study, the result of which serves as a valuable framework for practice guidance.

The remainder of this paper is organized as follows: Section 2 gives brief literature review on IOS and CSFs respectively. Section 3 presents out the IOS implementation CSFs structured in a three-level model and the detailed analysis for each factor are given in the following section

with real case to support. Section 5 is the conclusion of the whole paper.

2. Literature Review

2.1 Review on IOS

The research interest in interorganizational information systems can be traced back to as early as 1966. At that time, Kaufman had estimated that the inter-link of computer systems may bring huge changes to an organization's traditional operation style, and thus improve its productivity (Kaufman 1966). Yet, the formal term of "Interorganizational Information Systems" (IOS) had not come into being until Barrett and Konsynski first used it in 1982 (Barrett et al. 1982). Interorganizational information system is information and communication technology-based system that transcend legal enterprise boundaries (Bakos 1991; Chismar et al. 1992). Although historically, many scholars have given the description of IOS, the most prevalent definition of IOS recently is the application of systems that link various partners in a supply chain using a public or private telecommunications infrastructure (Premkumar 2001).

The earlier studies on interorganizational information systems mostly focused on topics such as the alignment between enterprise characteristics in supply chain and proper IOS capabilities (Shah and Goldstein, 2002), the workflow model to analyze IOS (Aalst 2000), the stimulation for enterprise to adopt IOS (Premkumar and Ramamurthy 1995; Johnston and Gregor 2000; Teo, Wei et al. 2003), the interdependency among partners (Hong 2002) and their mutual benefits (Riggins and Mukhopadhyay 1994), etc. As we see that although many endeavors have spent in various aspects of IOS, to the certain knowledge of the authors, there is no energy previously has been put into the study of critical success factors for IOS.

2.2 Review on CSF

As the forerunner of the CSF study, Rockart advanced the concept of CSF a lot. The definition of CSF he put forward in 1979 had been accepted widely among business and IT professionals and was employed in a variety of organizational contexts, which defines critical success factors as (Rockart 1979): The limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where "things must go right" for the business to flourish. If the results in these areas are not adequate, the organizations efforts for the period will be less than desired.

At a practical level, CSFs help the researcher and practitioner abstract from the complex, multi-dimensional reality of business activities, and focus on core activities that are critical for business success (Butler and Fitzgerald 1999). Also, it is found that companies that identified CSFs and implemented their usage, through proper measurement, feedback and management, received a higher return on equity when compared to companies that did not employ CSFs (Jenster 1987).

Several researched have carried out field study or survey-based study on certain kind of enterprise internal information system implementation success factors. For example, Poon and Wagner revisited the CSFs for executive information system (EIS) and found three top

important factors for EIS success (Poon and Wagner 2001). Butler and Fitzgerald tried their best to identify both the generic and collective CSFs in order to map the interrelationship between them (Butler and Fitzgerald 1999). Some others investigated MRP CSFs (Ang et al. 2002) or did special effort to category CSFs of lodging yielding management systems (Grifflin 1995). Moreover, Guynes and Vanecek probed the CSFs particularly in data management (Guynes et al. 1996). Besides, Teo and Ang examined the CSFs in aligning IS plan with business plan (Teo et al. 1999).

All in all, implementation success cannot be taken for granted. Even for those internal information systems within the same firm, the CSFs for one kind of information system are not necessarily suitable for another, let alone for the interorganizational systems. Thus, what are the CSFs for interorganizational information system? From all the existent CSFs research that available, we are aware that little existing research has been carried out concerning this subject matter.

3. Interorganizational Information Systems Implementation CSFs

From a great deal of reviews on the theory of interorganizational information system and critical success factors, as well as some real case study experience, we suggest the 3-level model of CSFs for IOS implementation with several sub-factors for each level respectively. The first level is the decision motivation (L1), which includes the incentive drive from both internal and external (L1.1) and the clear articulation of business strategic vision (L1.2). The second level is the implementation process (L2), which includes three sub-factors, namely, the cross-organizational implementation team (L2.1), the high integration with internal information systems (L2.2), and the technical innovation (L2.3). The third level is the infrastructure condition with two sub-factors: the advanced legacy system (L3.1) and the shared industry standards (L3.2). Table 1 illustrates the model. The detail explanation for each factor will come in the following section with a real case study to testify the model.

CSFs for IOS Implementation		
L1: DECISION MOTIVATION		
L1.1: Incentive Drive (Internal+External)	L1.2: Clear Articulation of Business Strategic Vision	
L2: IMPLEMENTATION PROCESS		
L2.1: Cross-Organizational Implementation Team	L2.2: High Integration With Internal Information Systems	L2.3: Technical Innovation
L3: INFRASTRUCTURE CONDITION		
L3.1: Advanced Legacy System	L3.2: Shared Industry Standards	

Table1: The Three-Level Model of CSFs for IOS Implementation

4. Detail Analysis for Each Factor with Case

4.1 Case Background and Method

This paper took a deep and careful study of the implementation of an interorganizational information system based on B2B RosettaNet standard between Cisco Company and its 1st-tier distributor in greater China, the X.T. Company. The time scope of this IOS implementation lasted from May 2001 to Oct. 2002 (the first five phases). This IOS implementation case between Cisco and X.T. Company is reported to be the first successful one which strictly conforms to XML protocol and e-Business RosettaNet standard in China.

The processes of X.T. Company operation involved in this case are closely related with PO (Purchase Order) execution, including product information update, product configuration, PO submission, PO status update, and invoice pre-check-in. This case study summarizes the interorganizational information systems implementation critical success factors for enterprises based on the qualitative and quantitative analysis. The primary research methods adopted are: 1. Questionnaires; 2. Interview with core personnel in the enterprise; 3. Literature review and data analysis. We selected around 7 key persons in this case to take face-to-face interview, including the CEO and the CIO of X.T. Company, the IT director from the third implementation vendor and the key staff in PO operation, inventory and logistics. Besides, we also arranged telephone interviews with another two senior managers of Cisco, who supervise (both business and IT) the IOS project with X.T. Company. Every formal interview, no matter face-to-face or through telephone, lasted for one and half an hour or two hours, followed by questionnaires sending and collecting so as to investigate some quantitative measures, more information on enterprise background and the degree of implementation success in this case.

4.2 Proactive/Reactive Enterprise

Premkumar and Ramamerthy proposed that in an interorganizational system, invariably, one firm in a supply chain proactively initiates the action for adoption of IOS with another firm, and the other firm reactively decides to adopt the IOS based on the proactive firm's initiatives (Premkumar and Ramamerthy 1995). From this point of view, all the enterprises that implement IOS can be categorized into Proactive ones and Reactive ones. This is a very interesting study perspective in that these two kinds of enterprises have their different traits and consequently have different emphasis in their IOS implementation success respectively.

Generally, to be a proactive or a reactive one optimally is determined by the objective conditions and situation that the certain firm in. Proactive enterprises usually are those who are in the dominant position in a supply chain, owning more power to influence other partners in industry. Proactive ones initiate IOS project not because someone else compel it to do, but mostly because of their own strategic needs. The proactive one usually bears more risk in that heavy resources should be allocated, very complex situation it must handle, strong IT capability it should has and the success depend on the counterpart cooperation in a degree. Just name a few. Contrarily, reactive one usually is forced for certain reason to accept and follow what proactive one proposed, such as the process requirement and technical standard. This paper will follow this category for further analysis.

4.3 Analysis for Each Factor

This section provides the detailed analysis for interorganizational information systems implementation critical success factors in three-level from both proactive and reactive enterprise point of view.

4.3.1 Level 1: Decision Motivation (L1)

When enterprises are considering IOS, those decision motivations stimulating them to adopt IOS are extremely significant for their future success. In the multi-level analysis of CSFs in this paper, level 1 Decision Motivation includes two sub-factors: the intensive drive and the clear articulation of business objective.

■ Intensive Drive (Internal + External) (L1.1)

How intensive the driving force is determines how well the result would turn out to be. For those proactive enterprises, usually they are in the dominant place in an industry, and possess the comparatively strong competition advantage. In short term, it seems that they need no worry about their leading position in the market. Whereas, either due to the macro industry environment downturn, or they are willing to take precautions to further stabilize their preponderant position, the proactive enterprises still hold considerable huge desire to establish the interorganizational information systems with upstream and downstream partners. The competition in the modern age is no longer merely the competition between two single firms, but the competition among supply chains (Ma and Chen 2000). To take the advantage of information technology and implement the IOS with partners in supply chain (Champy 2002) so as to sustain competitiveness in long term has been the most intensive drive for proactive enterprises to make adopt decision. For those reactive enterprises, the intensive drives they face mostly are the three: firstly, the pressure from competitors in the same industry; secondly, the pressure from upstream or downstream partners in the supply chain; thirdly, the internal operation efficiency pressure. These characters are obvious in the case under our study.

The X.T. Company in this case has quite a gap in the market share and revenue (2001) with its direct competitors D, P, and I (abbreviate for confidential reason), another three major distributors of Cisco in China. This is the pressure from its competitors that X.T. Company faces. Premkumar, Ramamurthy as well as Provan and Beyer point out that the enterprises implementing IOS generally have some kind of interdependency with each other (Premkumar, Ramamurthy 1995; Provan, Beyer 1980). Cisco is X.T. Company's significant supplier. To maximize the reciprocal benefits and gain its own better development situation, X.T. Company cannot but remain consistent and cooperate with its principal supplier Cisco's business strategy. This is the pressure from its upstream enterprise in the supply chain that X.T. Company faces. However, according to the data analysis of our quantitative questionnaires in this case, X.T. Company performed not so well in this aspect before the IOS implementation with Cisco, the satisfactory score of which is only 3.3. Whereas the satisfaction score improved to 4.3 after the successful system connection with each other.

Finally, X.T. Company has great pressure from its internal operation efficiency. From the

result of our quantitative questionnaires in this case, we see that X.T. Company's staff deem that for the sake of better development in market, it is of high importance to cut the logistic cost and decrease the procurement cost (average score is 4.67). While in the time of investigation, X.T. Company performed not very well and its staff only perceived the satisfactory score of nearly 3 in this aspect. This indicates that X.T. Company needs imminent improvement in the elements which have great influence on its competition. (Note: all the maximum score above are 5.0)

■ **Clear Articulation of Business Vision (L1.2)**

Although the IOS implementation belongs to the concept of technology at first glance, it is always immensely important to align properly the business objective with IT activity. In order to let the IOS to be an enabler to realize business requirement, first of all, we must think seriously and articulate out clearly the business vision. This is proved to be a vital element for IOS success through our study (Poon and Wagner 2001; Teo and Ang 1999; Feeny, Edwards and Simpson 1992). Armed with the unambiguous business vision among managerial and technical staff, all people in a firm can focus on the high-priority task at-hand and form a resultant force to commit in IOS implementation. For both proactive and reactive enterprises, despite their business visions are exactly the same, this factor is equally crucial for them.

In the case study of Cisco and X.T. Company, we got to know this at the first beginning of our investigation. As the proactive one, Cisco aims to improve the transparency of its distribution channel and acquire as much information of sales and marketing as possible. X.T. Company hopes to lower cost and faster response time so as to enhance its comprehensive competition in supply chain. Neither of them can release their business vision without the collaboration of partner. So they come together naturally through the link of IOS.

4.3.2 Level 2: Implementation Process (L2)

■ **Cross-Organizational Implementation Team (L2.1)**

In the traditional implementation process of enterprise internal information systems, people emphasize much on the implementation team as human-related element (Poon and Wagner 2001; Teo and Ang 1999; Premkumar and Ramamurthy 1995). Similarly, team also plays as a (or even more) significant factor during the implementation process of IOS. What's more, due to the unique characteristic of IOS, it requires a cross-organizational team to ensure the implementation process go smoothly and successfully.

In the interest of realizing the mutual benefits brought by IOS, each party should be enthusiastically involved into setting up the implementation team. For those proactive enterprises, they take their advantages of implementation experience to offer some valuable instruction in project planning, technical support and overall architecture designing; Correspondingly, those reactive enterprises should energetically keep close communication and cooperation with the proactive ones.

The success of the case this paper studied is quite a proof of the importance of

cross-organizational implementation team. The implementation team for the IOS in this case consists of three parties, i.e. X.T. Company, Cisco and the third-party implementation vendor, and four sub-teams were built, namely, the management team, the business team, the technical team and the partner team. See Figure 1. Management team is composed by top executives of the company, and is the organizer of the whole project directly contacting with the other three teams. Technical team mainly consists of the technicians from the 3rd party vendor, quite a profession team with strong technological ability. Business team is composed of persons from the business departments related with this IOS project. Partner team refers to X.T. Company's business partner Cisco who was a highly active part of the whole IOS project. During whole implementation process, the four teams from different organizations coordinated closed to ensure the final success.

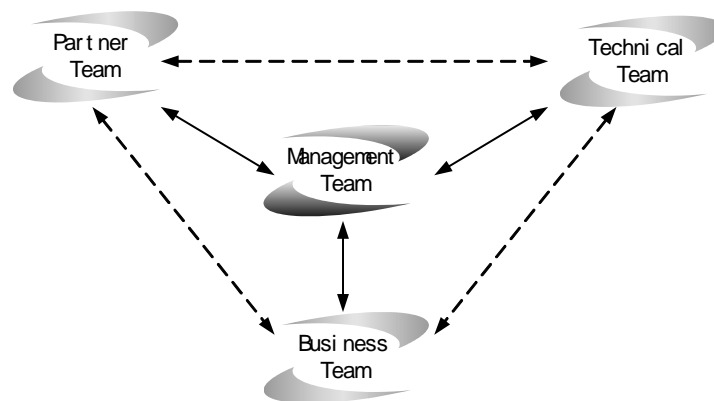


Figure1: Cross-Organizational Implement Team

As for X.T. Company, the reactive one in this case, from the project initiation to the plan deployment and to the whole implementing process, it never deviated from the effective communication and close cooperation with Cisco, the proactive one in this case. Cisco also shared its abundant knowledge and experience accumulated via IOS implementation previously with other partners in other countries. Even more, Cisco proposed the detailed planning schedule to X.T. Company and timely provided important parameter configuration to the new system directing the implementation process to go smoothly throughout the project life cycle.

■ **High Integration with Internal Information Systems(L2.2)**

One indicator of IOS implementation success is whether it can bring real value to enterprises operations, such as faster response time, higher data integrity (Riggins and Mukhopadhyay 1994). All of these are the direct reflection of enterprise internal operation performance. To build an interorganizational information system between two enterprises is not the ultimate goal. The smooth exchange of data and information between two enterprises is the genuine value of IOS. The true potential of IOS is realized only when it is fully integrated with the other internal information systems (Premkumar and Ramamurthy 1995). It is the truth regardless of proactive enterprises or for reactive enterprises. Proactive enterprises might have rather stronger conscious in this point themselves; comparatively, reactive enterprises

may need proactive ones to “pull” (offer aids) or “push” (give pressure) so as to achieve better integration with its internal information systems.

In the case under research, we also observe this kind of behavior. The IOS implemented between Cisco and X.T. Company has much tight integration with both internal information systems (ERP) respectively. The IOS plays the role of “Bridge” linking two organizations. Correspondently, the internal information systems (e.g. ERP) in the two organizations are like “Roads”. Suppose there is only bridge, but no road linked to this bridge, then what’s the use of the bridge? The higher the degree of the integration with internal information systems, the greater the value of IOS.

■ **Technical Innovation(L2.3)**

The technical problems encountered in all projects were not insoluble, which call for significant technical skills and expertise of developers. The technology implication standards for the IOS are keeping evolving continuously. One possible situation is that the industry normative standards lag behind the practical requirement of enterprise. Some new standards are exactly born from the innovative practices of enterprise. The earlier EDI, or present WBI (Web Based Inter-exchange), or the RosettaNet e-Business standard in this case, regardless of adopting which standard, enterprise probably encounter the situation that existing technology and standard can not satisfy all their needs. This requires enterprise take technical innovation bravely. With the employment of enterprise successful practice, these innovations will gradually turn into the industry normative standards.

4.3.3 Level 3: Infrastructure Condition (L3)

■ **Advanced Legacy System (L3.1)**

Although the existing system capability is not the prerequisite for whether choose IOS or not, how advanced and capable the legacy systems are will make crucial influence on the implementation difficulty and the value to be realized. Firms with necessary legacy IT capability will perceive lesser risk and derive more benefits from IOS (Premkumar and Ramamurthy 1995). For those proactive enterprises, due to their strong competition in the industry, they usually have possessed mature internal information systems which prepared well for the IOS. Contrarily, the conditions in the reactive enterprises are likely to vary from very preliminary to moderate mature. This is an essential problem that proactive enterprises face when they consider to choose the targeted party to build IOS with it, a pretty critical point should keep in mind is to exam how advanced the legacy system is in the counterpart.

By now, Cisco has done quite well in its own information system. Over 90% of Cisco’s global business is fulfilled on Internet. In this case under study, we see that besides X.T. Company, as the same 1st-tier distributors of Cisco in greater China, there are other powerful competitors, like D, P and I company (abbreviate for confidential reason), why Cisco selected X.T. Company? Because before made decision, Cisco carried a deep investigation about the advanced degree of legacy systems in each distributor, particularly the ERP system. X.T. Company’s ERP modules have covered almost every aspect of its operations, such as

procurement, finance management, order management, logistics, inventory management, etc. What's more, all the modules are integrated streamlessly. The evaluation result showed that X.T. Company owned the best condition in this aspect to carry out IOS, and naturally become the ideal partner to Cisco.

■ Shared Industry Standard (L3.2)

IOS necessarily require two organizations adopt a common technology standard, which as if two persons come from two countries speaking two different languages, they must use one common language such as English that they can understand mutually so as to communicate with each other. As the IOS initiator, proactive enterprise generally will propose one kind of IOS standard, or continue to use one standard which had been adopted successfully with other organizations previously. This standard usually has been widely recognized in industry. While reactive enterprise usually will accept and follow the standard proposed by proactive enterprise.

Enterprises used to adopt the EDI as the standard to set up IOS in the early age. The requirement for enterprise to use EDI is very high, because EDI technology is somewhat complex and has low flexibility which results in terrible construction cost. In the case of Cisco and X.T. Company, they adopted the RosettaNet standard, a popular standard in hi-tech industry nowadays. RosettaNet is a non-profit consortium of more than 400 of the world's leading Information Technology (IT), Electronic Components (EC), Semiconductor Manufacturing (SM) and Solution Provider (SP) companies working to create, implement and promote open e-business process standards. RosettaNet has very good practicability and flexibility. Besides the case this paper provides, there are still many other successful cases based on RosettaNet in the U.S (Olson and Williams 2001; Nelso and Shaw 2002), which provide good examples for China enterprises to learn.

5. Conclusion

This paper analyzes the interorganizational information system implementation critical success factors in a multi-level way from the proactive and reactive enterprise viewpoint. As we see, in the analysis of many factors, the different traits of proactive and reactive enterprise determine different working emphasis for each. However, at the same time, we should notice that, there is no absolute and distinct boundary between proactive and reactive enterprise. Reactive enterprises probably take the attitude of "just follow" at the beginning and let the proactive ones to lead and push them. Yet, when the reactive ones invested certain amount of energy (funds and manpower) and perceived the benefits from IOS as well as accumulated valuable experience of implementation, they usually have strong desire to expand IOS into more other organizations, such as its upstream and downstream partners, so as to obtain economy of scale. At that time, reactive enterprises might evolve into proactive ones, and consequently their behavior and implementation CSFs will change as well.

This paper's major contributions include: Firstly, this paper explores the interorganizational information systems implementation critical success factors, whereas the past researches are limited only the IOS or CSFs discipline separately. Secondly, this paper presents the CSFs for

IOS implementation creatively in a multi-level and systematic way, while most of the existing researches only list CSFs one by one or roughly categorized at most. Thirdly, this paper justifies its standpoint through a real case of China enterprise, yet seldom China firm is examined in existing researches.

The research has some limitations that should be recognized. Although the authors have done the great length to probe the most essential CSFs for interorganizational information systems implementation, the three-level factor model might not be complete, because it is single case based study. With more cases are available, supplementary factors can be added into this model given its flexibility and extendibility. Besides, the interaction between all these CSFs in the three-level model has not been examined deeply, which is an interesting research point in the next step.

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