

APPLYING DEMATEL-ANP FOR ASSESSING ORGANIZATIONAL INFORMATION SYSTEM DEVELOPMENT DECISIONS

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Abstract:

More and more enterprises expect to improve operating efficiency and managerial decision making effectiveness by introducing information systems into the operational procedures. For enterprises, implementing resource management systems can enhance the administrative efficiency of resource management, and create competitive advantages for businesses. This study used DEMATEL (Decision Making Trial and Evaluation Laboratory) and ANP (Analytic Network Process) to solve the complex relations between criteria dimensions, in order to further select the ideal system implementation model. The results showed that, companies with limited resources prefer to choose an out-sourcing implementation model in order to save labor, cost, and time, while ensuring the stability of the system after implementation. Consequently, the competitive advantages of sustainable operation can be enhanced.

Keywords: Technology industry, Information system, DEMATEL-ANP, Out-sourcing, Co-sourcing

1 INTRODUCTION

In a global era of continuously improved information technology, enterprises face fierce competitions from international markets. In response, they strive to meet the ever-changing demands of competitive business environments and enhance managerial efficiency in order to realize business goals. Moreover, they aggressively enter international markets to increase corporate value. Therefore, establishing a comprehensive information system that can meet business needs, while strengthening corporate governance, is imperative. In particular, enterprises in technology-intensive industries face intense market competitions, high risk factors, and shorter product life cycles. These enterprises should introduce a real-time and efficient information management system that is able to integrate the internal resources of the organization into a corporate strategy for scientific and technological improvement. Hence, how to select an information system that is appropriate for technology-intensive and high value-added technological industries with limited resources is an important issue.

Due to rapid changes in the structures of technological industries, an issue of concern is how to effectively implement an information system (Burn and Ash, 2005; Daghfous and Al-Nahas, 2006; Plant et al., 2003). The commonly implemented information systems include ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), SCM (Supply Chain Management), KM (Knowledge Management), etc. Overall, a good information system can maximize the amount of data handled, minimize response time between enterprises and customers, and provide real-time information for users to lower costs and enhance operational performance. BSC (Balanced Scorecard) is a comprehensive framework that combines company vision, strategy, and performance evaluation, and can measure the financial and operational perspectives of enterprises, in order to achieve a balanced state for corporate performance evaluations. The four major dimensions of BSC (Dias-Sardinha and Reijnders, 2005; Figge et al, 2002) are FI (Financial perspective), CS (Customer/Stakeholder), IBP (Internal Business Process), and LG (Learning and Growth).

FI emphasizes how to manage and efficiently allocate resources with the ultimate goal of maximizing profits/shareholders' value. For enterprises, in both financial and non-financial dimensions, all implementation results will ultimately become financial figures. When a company has a comprehensive information system, all employees and executives can obtain the latest information in real time. Hence, FI can reflect the overall performance of an organization. CS focuses on whether the services provided by an enterprise can satisfy customer needs; thus, it is regarded as the lead indicator for the measurement of organizational performance. Enterprises manage customers by satisfying their demands, thus avoiding the risks of customer loss and declining business performance, in order to achieve financial goals. IBP emphasizes whether the operating performance of an organization satisfies the expectations of shareholders and customers. To attract more customers and enhance corporate value, organizations must continuously improve internal processes and maintain a high service level. LG stresses that employees should continue to learn and grow, which accumulates labor capital to strengthen the organizational structure, and enhance its capacity for sustainable development.

In general, there are three methods of introducing an information system into an enterprise, namely, in-sourcing, out-sourcing, and co-sourcing. In-sourcing refers to a company gathering the technology required for a self-developed information system, thus, lowering the cost of system implementation. Out-sourcing is to hire external suppliers to implement an information system with the professional technology and know-how of the system provider. Co-sourcing refers to an enterprise and system supplier jointly implementing the information system, with the enterprise providing the personnel required by the supplier to pass along the professional knowledge. Different implementation mechanisms can promote the success rate of introducing an information system, and selecting an appropriate system has greater results and benefits for the enterprise.

Based on the above, this study employs the four BSC dimensions: FI, CS, IBP, and LG, to evaluate information system implementation decision making. Section 2 discusses literature on information systems and system implementation decision making; Section 3 establishes the information system implementation model; Section 4 presents the empirical analysis on information system implementation of technology industries; Section 5 offers the conclusions and suggestions of this study.

2 INFORMATION SYSTEM IMPLEMENTATION DECISION MAKING

Traditional information systems often focus on enterprise goals, while neglecting the overall operating environment and the importance of real-time information. With rapid Internet and information technology developments, modern enterprises face intense competitions, and the international operations of the enterprises make the business management even more difficult and complex (Poter and Stern, 2001). Therefore, with sufficient budget, enterprises should implement information systems that can meet the market trends and corporate needs in order to establish a new business model in response to changing business environments. The evaluation criteria used in this study are common information systems used by enterprises, including FAS (Tsamenyi et al., 2006; Weisenberger and Angelkort, 2011), MAS (Bouwens and Abernethy, 2000; Gerdin, 2005; Gul and Chia, 1994; Mia and Clarke, 1999); APS (Chen and Ji, 2007; Gould, 1998; Lee et al., 2002), SCM (Akkermans et al., 2003; Bayraktar et al., 2009; Humphreys et al., 2001; Williamson et al., 2004); CRM (Davids, 1999; Du Plessis and Boon, 2004; Pai and Tu, 2011), KM (Du Plessis and Boon, 2004; Prusak, 1997; Probst et al., 1999), executive information system (Elam and Leidner, 1995; Koh and Watson, 1998; Rainer and Watson, 1995; Walstrom and Wilson, 1997), and DSS (Anderson et al., 2008; Blanning, 1993; Haynes and Wilczynski, 2010; Hogue and Watson, 1983; Ma, 1997; Shim et al, 2002; Todd and Benbasat, 1992).

2.1 Types of Information System

FAS (Financial Accounting System) - Financial accounting is usually referred to as external accounting, where the information is the company's overall message. The financial information provided by FAS is mainly for external users (e.g., tax authorities, shareholders of the listed companies, banks, security regulators, etc.) as a reference. Meanwhile, enterprises engage in business activities according to the standards provided by the government and customary practices (e.g., enterprise accounting system, accounting standards, corporate accounting system, etc.), and provide financial statements in specified formats. Tsamenyi et al. (2006) argued that organizations that apply FAS to business activities can bring about positive results for the enterprise. Weisenberger and Angelkort (2011) suggested that the integration of FAS and MAS can enhance the performance of enterprises. The most important feature of FAS is that it can provide accurate, international, and real-time financial information of an enterprise, and when coupled with external and internal accounts receivables and payables, can shorten the cash turnover period. In particular, it can facilitate the long-term planning of overseas investment to enhance business operating efficiency. Hence, these financial statements are often used in investment decision making, evaluations of overall operating conditions, and as a method to monitor an enterprise for violations of regulations and laws.

MAS (Management Accounting System) - Management accounting is often referred to as internal accounting. There is no consistent scholastic definition of MAS. Some scholars argue that MAS is an information system controlled by the organization to provide information to managers (Bouwens and Abernethy, 2000; Gul and Chia, 1994). MAS is the official information system used by organizations to affect the behaviors of management in order to achieve the organizational goals (Gerdin, 2005). MAS provides internal enterprise users, such as the management, the production department, and the R&D department, with the financial information of the enterprise. Such financial data facilitate the implementation of decisions regarding internal production in-sourcing, out-sourcing, etc.

Chenhall and Morris (1986) suggested that MAS has the following features: 1) wide range; 2) timeliness; 3) summation; and 4) integration. Wide range refers to non-financial information related to the external environment of the enterprise. Timeliness provides managers with the latest information in the shortest time. Summation refers to data, which are summed through the analysis model, calculated by time or functional regions. Integration includes specific goals that explain the interactive effects among the departments; it is the information regarding the impact of the decisions of a certain department on the operations of other departments. Tsui (2001) indicated that information with a wide range and timeliness can help managers to settle on more informed decisions, which affect organizational performance. Mia and Clarke (1999) suggested that the use of MAS information by managers is positively correlated to organizational performance. Management accounting information is the most needed information for the internal management of an enterprise, as well as the most important part of DSS of the enterprise. MAS can provide detailed and accurate cost information, including the basic information for a variety of managerial activities, such as product pricing, product

cost control, out-sourcing decision making, and departmental performance evaluations. Hence, as an information system that provides accurate cost information will deliver more commercial interest to an enterprise, it is a necessary investment.

APS (Advanced Planning and Scheduling) - From the perspective of planning content, APS solutions include material planning, production planning, capacity planning, finite capacity planning, etc. In cases of a company with multiple production factories, the headquarters must clearly know each factory's production information, as company internal processes and efficiency affect the smooth implementation of overall planning (Kerschbamer and Tournas, 2003). APS can simulate and calculate expected delivery times and quantity of orders in order to immediately respond to customer demands, thus achieving timely deliveries and improved productivity.

Fleischmann et al.(2000) proposed that APS has features of synchronized concurrent planning, optimization planning, real-time planning, and decision support capability. Since APS can simulate the planning of raw materials and capacity resource limits, it can help decision makers to carry out synchronized concurrent planning of raw materials and production capacity, and quickly generate an optimized production schedule. In sum, APS can help decision makers with limited resources in the timely determination of optimal plans and corresponding decisions. Moreover, APS has received considerable attention in the information systems of the enterprises (Chen and Ji, 2007; Gould, 1998; Lee et al., 2002).

SCM (Supply Chain Management) - SCM can increase the flexibility of production processes, transport speeds, available information, and manage complexity in production. In recent years, many scholars have explored topics regarding SCM capabilities and performance (Closs and Mollenkopf, 2004; Davids, 1999; Du Plessis and Boon, 2004; Pai and Tu, 2011; Park et al., 2007). The major focus of SCM is the application of the information system for the integration of purchases, operations, and logistics, from raw materials to finished products that meet customer demands (Kovacs and Paganelli, 2003). Closs and Mollenkopf (2004) argued that all activities relating to delivering a product to market are a part of a supply chain.

Park et al. (2007) suggested that SCM is an important part of an enterprise, and used the four dimensions of the BSC model as the evaluation factors to measure SCM performance. Closs and Mollenkopf (2004) pointed out that SCM capabilities include customer integration, integration of raw materials, service supply, integration of technology and planning, and integration of measurements and relations, which integrate the major internal and external SCM activities, and enhance its performance. Hence, SCM has become an important resource for enterprises to improve organizational productivity and strategies that enhance operating efficiency.

CRM (Customer Relationship Management) - With ever-increasing consumer demands, enterprises can query and access complete customer data by the CRM system. Through a complete collection of the basic data and shopping preferences of customers, enterprises can develop optimal selling plans and strategies for different types of customers, thus fully utilizing the resources. CRM is the management system for the overall strategy of an enterprise, which integrates business functions, including selling, customer service, marketing, and quick responses. By CRM, enterprises can predict customer needs to enhance organizational effectiveness and efficiency (Du Plessis, and Boon, 2004). CRM uses highly efficient information technology to rapidly collect and analyze customer information, and implement efficient customer interactive services that enhance customer satisfaction and loyalty (Davids, 1999).

Using CRM, enterprises can increase market opportunities, improve organizational competitiveness, and create high customer value. However, when implementing the CRM system, enterprises should integrate information technology, information resources, and organizational resources in order to obtain optimal efficiency and effectiveness (Pushkala, et al., 2006). Hence, to develop products and services that meet customer needs, enhance customer loyalty, and generate higher profits, enterprises should establish a complete customer information system to manage relations between enterprises and customers.

KM (Knowledge Management) - In the 21st century, knowledge has taken the leading place over

