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Pacific Asia Conference on Information Systems (PACIS)

December 2004

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Abstract

This study constructs a conceptual model to evaluate the performance and competitive advantages associated with ERP form SCM perspective. The resulting model can be used to assist an enterprise in evaluating the potential partnerships. The survey data was gathered from a trans-national textile firm in Taiwan. The training and learning model was based on the strategic thrust theory and used the Back-Propagation Network as an evaluation tool.

Keywords: Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Strategic Thrust Theory, Back-Propagation Network (BPN)

1. Introduction

Davenport (1998) stated that an integrated information system is a smart tool that can be used by a firm to solve problems associated with widely distributed information sources. Therefore, integrating SCM to an ERP system can facilitate information flow in the supply chain so that partners of the chain can streamline their operations and share information sources to provide timely and accurate services to their customers.

Strategic alliance plays an important role in establishing a firm's competitive advantage (Bowersox 1990; Konsynski & McFarlan, 1990). SCM emphasizes close collaboration between supply chain partners and the building of a strong alliance in their joint strategic business focus. Therefore, SCM and a firm's competitive advantage are closely linked. Traditional methods to evaluate ERP performance is limited to the internal departments of the company and do not include supply chain partners. From an academic perspective, Shin et al. (2000) emphasized that a firm's performance can be evaluated by one or more key competitive priorities. The five strategic forces of the strategic thrust theory can be independent or linked (Wiseman, 1985), and may relate to SCM performance.

This study uses a case to construct a conceptual model for the performance evaluation of an extended ERP (EERP) system from an SCM perspective. The Back-Propagation Network (BPN) is used as a tool to access tacit knowledge held by the firm's employees and the ERP consultants. This knowledge can be used to evaluate the extended ERP systems that conform to the SCM performances. The goals of this paper are as follows:

(1) To access the tacit knowledge, inherent in case firm's employees and its ERP consultant-expert, through the model learning process.
(2) To construct a BPN model to support a firm in evaluating its extended ERP performance from an SCM perspective and to test the competitive advantages gained by the ERP system.
(3) To produce results that will be useful to a firm when selecting partners.

2. Literature Review

2.1 Competitive Advantages and the Performance of EERP

Strategic Thrust Theory is proposed to assist firms in planning and implementing a strategic information system to gain competitive advantages (Wiseman, 1984; 1985). In network economy, ERP products were inadequate (Akkermans et al., 2003). Regarding the ERP, the principal problems of ERP systems are their inability to process data in real time (Kochan, 2000), and conflict with decentralized and flat organization models (Edwards et al., 2001; Kovacs and Paganelli, 2003). SCM, on the other hand, can offer a more proactive solution than the ERP system alone (Allen, 1998). An ERP system could potentially enhance transparency across the supply chain by eliminating information distortions and increase information velocity by reducing information delays (Akkermans et al., 2003).

In order to maximize a firm's competitive advantage, ERP systems should be extended to cooperatively plan and operate with all partners of the supply chain (Akkermans et al., 2003). Tarn et al. (2002) pointed out that there is a demand for the integration of SCM and ERP. They also emphasized that extended ERP systems compel firms to provide a communication and information flow among supply chain agents, thus overcoming natural boundaries. According to Tarn's et al.(2002) perspective, the performance of the EERP should be measured according to supply chain activities. Yeh (2001) adopts the criteria constructs developed by Skinner (1969), Leong et al. (1990), Gerwin (1993), Dornier et al. (1998) to develop five criteria constructs to measure SCM performance electronically. These five criteria are: Time, Cost, Quality, Flexibility, and Service. This paper developed the questionnaire based on Yeh's (2001) five criteria and Wiseman's (1985) five competitive advantages to measure extended ERP performance.

2.2 Neural Network

Neural networks are used in business and banking applications for decision-making, forecasting and analysis (Chen, 1998; Kuo and Xue, 1998). Neural networks can be classified as both a learning model and a network structure. A number of network models have been developed, the BPN is the one most favored by neural network researchers (Kane, 1998; Sexton et al., 1998). The structure of BPN consists of an input layer, an output layer, and the hidden layer may or may not exist. The numbers of the input and output layers nodes are decided by task requirements. The optimal number of the hidden layer nodes is determined by certain testing (Chen, 1998). Pao (1989) argues that a three-layer machine can form arbitrarily complex decision regions and increasing the number of hidden layers actually decreases the rate of learning in the random vector-pairing problem. Therefore, the BPN model of this study contains one hidden layer.

3. Methodology

3.1 The Constructing Procedures of Conceptual Model

A conceptual model is constructed to evaluate competitive advantage based on an SCM perspective after the subject firm has implemented an extended ERP system. There are four steps to obtain results of this study. First, in-depth interviews are conducted individually with three reputable consultants each having at least seven years consulting experience in ERP. This interview establishes the relationship between the criteria used for the firm's SCM performance and the competitive advantages of the strategic thrust theory. It also adjusts Yeh's (2001) measurement criteria to be applicable to the textile industry. Second, the executives of the textile firm are surveyed. The survey considers not only the SCM performance of the firm, but also estimates the value of the competitive gains produced by cooperating with partners. Third, these survey data are used to analyze the relationship between the criteria of SCM performance and the five competitive advantages proposed by Wiseman (1985). Finally, the conceptual evaluating model is constructed from the learning and testing models and then the competitive advantages of the firm and its cooperative partners are tested.

Figure 1 shows this conceptual evaluation model, that includes six key points. First, the learning model (12:12:5, 12 input nodes, 12 hidden nodes, 5 output nodes) extracts tacit knowledge from an ERP consultant company in Taiwan. This knowledge is used to help establish the competitive strategy used by the learning model. Second, the tacit knowledge extracted from the transnational textile firm in Taiwan is to provide the firm's SCM performance and to estimate the values of the competitive advantage. These sample data are used to train the learning model. Then, the tacit knowledge held by the executives of the firm is integrated into the learning model (see table 5). Third, by operating model, the training results of learning model are shifted to testing model and enable the evaluating model to test the competitive advantages of supply chain members in a "what-if" situation and assists in making selecting alliance decision. Forth, the acquired knowledge is used to assess the partner's competitive advantage based on extended ERP performance by the testing model. Fifth, the evaluating model uses the competitive advantage values from both the learning model and the testing model to evaluate the combined competitive advantage for its potential partners (see table 6). Finally, in this selection process, the firm uses these results to make alliance partner choices.

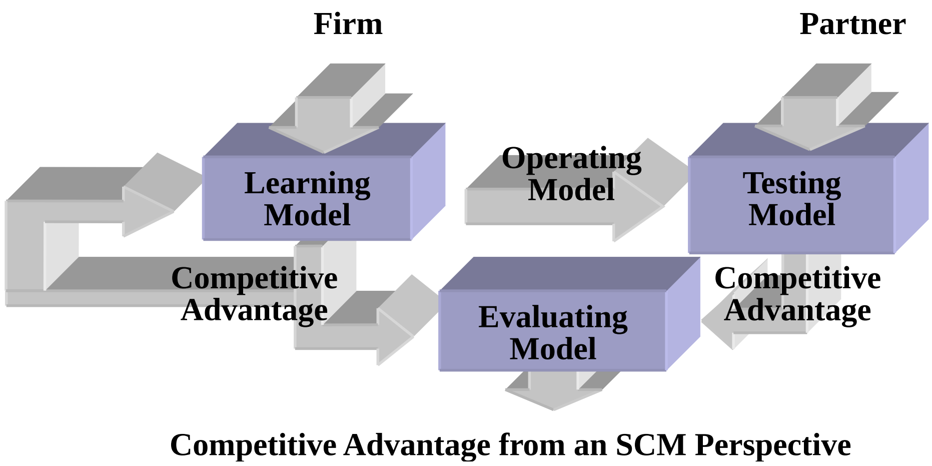

Fig 1 A Conceptual Evaluation Model of Competitive Advantage

The steps of constructing the conceptual model are as follows:

(1) In learning model, the weights are established by ERP consultants from competitive advantage and SCM perspective.
(2) In learning model, the tacit knowledge held by the executives of the firm is integrated into the learning network (see table 5).
(3) Operating model shifts the acquired knowledge from learning model to testing model.
(4) Using the testing model to view the competitive advantages that relate to the firm's upward and downward partners.
(5) In evaluating model, the case firm establishes the evaluating weights of the alliance and combines the competitive advantage for the firm and its potential partners (see table 6).
(6) Using the conceptual model to evaluate the competitive advantages of the alliance between the firm and its supply chain partners.

3.2 Sampling
This study chose a transnational textile firm that had adopted an extended ERP system on the advice of three reputable ERP consultants. It was considered that a firm's performance would relate to integrated internal and external operation of the organization. Seventy executives belonging to the selected case firm were selected to evaluate the extended ERP performance and the firm's competitive advantage from an SCM perspective. The surveyed sample size is, therefore, 70. Sixty questionnaires were collected, with the assistance of the ERP consultants to come up an 85.7% efficiency rate. A factor analysis was used to reduce the learning model factors. Usually, the sample size is 4 or 5 times that of the measured items for factor analysis in practice. Comrey (1973) proposed that a sample size of less than 100 was not suitable for factor analysis. But Kaiser (1974) adopted the KMO (Kaiser-Meyer-Olkin) value to judge suitability for factor analysis. Kaiser considers that a KMO value greater than 0.7 should be good for factor analysis. The KMO value of this study is 0.743, therefore, is suitable for the use of factor analysis according to Kaiser.

3.3 Questionnaire Design
On considering the local culture in Taiwan, the initial questionnaire is referring to Yeh's (2001) SCM performance criteria and Wiseman's (1985) views on strategic thrust theory that considers differentiation, cost, innovation, growth and alliance as better sources of competitive advantage. The ERP consultants, with their practical experience, adjusted the initial questionnaire to make it more suitable for the extended ERP system. Before undertaking the training and learning processes, the study used canonical correlation analysis to confirm the relationship between the competitive advantages and the SCM performance criteria to ensure that the questionnaire is indeed suitable for the learning models.

3.4 Research Variables and Measurement
Table 1 lists the operative definitions and items of measurement. The items of measurement are taken from Yeh's (2001) criteria and Wiseman's (1985) five competitive advantages and are used to survey the executives of the case firm in the understanding of SCM performance and competitive advantages after adopting an extended ERP system.

Table 1 Operative definitions and measurement of research variables

Factors	Operative Definitions	Measurement Items (SCM performances)	Referred Matrix
Cost	On Wiseman's competitive advantages, the scale of the firm's SCM cost performance	Document processing for purchase, routine work referring to purchase, raw material and component storage for manufacture, storage for manufacturing products, storage for manufactured product, storage turnover rate	Wiseman (1985), Yeh (2001)
Time	On the Wiseman's competitive advantage, the scales of firm's SCM performance over time	Response of co-ordination factory, required time to confirm purchasing order and preprocessing	Wiseman (1985), Yeh (2001)
Quality	On the Wiseman's competitive advantage, the scale of the firm's SCM quality performance	Communication errors for purchasing scale, quality of imported material	Wiseman (1985), Yeh (2001)

4. Research Case

The case firm used to produce short staple and copied hair products. Due to the limited demand for these products the firm entered into the business of textile weaving and now produces spun cotton to be woven into cloth for making clothes. Recently, the case firm expanded in international operations and invested a factory in Mexico making ready-to-wear clothes. It has integrated American market channels and factory sites in Mexico and Asia area. The case firm has constructed a complete supply chain consisting of factories and markets and has established a textile supply chain prototype.

The customers of this firm include the top 5 purchasing companies of ready-to-wear clothes in North America. They are J.C.Penney, BK-Mart, BW-Mart, Bsears, and Target. In particular, the case firm is one of the top 60 suppliers of J.C.Penney. This integral manufacturing system produces product-lines of gauze, cloth, dye, and ready-made clothes and spreads in North American (Mexico) and Asia. The product innovation department is in Taiwan, manufacturing is in Mexico, and the major marketing channels are in the United States and China. It owns more than 150 retail outlets located in North America and China. It also constructively integrates the SCM's marketing and manufacturing activities to increase resource efficiency within the group enterprise.

By managing the logistics electronically, the case firm and its associated factories are integrated into a coherent supply chain system. This not only encourages efficient collaboration between the case firm and its allied factories, but also substantially shortens operating time, thus supporting the firm's strategy of entering the American market and the global economy.

5. Analysis and Results

5.1 Reliability and Validity Analysis

To measure the reliability of a questionnaire, it is common to use Cronbach's Alpha to measure the consistency of research variables. When Cronbach's α value is greater than 0.7, it is acceptable (Nunnally, 1978). Hair et al. (1998) also support this perspective and propose that the research variables should be rejected if the Cronbach's α value is less than 0.35. The Cronbach's α value of individual factor is listed in Table 2. It implies that this questionnaire has a high reliability.

This questionnaire was adjusted by three ERP consultants to validate the content. The construct validity of the questionnaire is listed in table 2. The selected research variables all meet the three conditions proposed by Hair et al. (1998): (1) the eigenvalue of the factor must be greater than 1; (2) after varimax rotating, the absolute value of the factor loading must be greater than 0.5; (3) the difference between each of the factor loadings must be greater than 0.3. In other words, the questionnaire used in this study has content validity and construct validity.

Table 2 The result of principal component analysis

Factors	Context of measurement items	Factor loading	Eigen-value	Explanatory variance (Accumulative variance)	Cronbach's α
Cost	Whether the document processes for purchase are reduced	.828	8.302	28.961 (28.961%)	.8595
	Whether the routine work referring to purchase is reduced	.793			
	Whether the raw material and component storage for manufacturing are reduced	.750			
	Whether the storage for manufacturing product is reduced	.720			
	Whether the storage for manufactured product is reduced	.709			
	Whether the storage turnover rate is increased	.582			
Time	Whether the response of the co-coordinating factory is faster	.919	3.056	21.332% (50.293%)	.8639
	Whether the required time to confirm purchasing order is shorter	.898			
	Whether the preprocessing time of purchase is shorter	.734			
Quality	Whether the communication errors for purchasing scale are reduced	.835	2.245	18.347 (68.640%)	.7805
	Whether the quality of imported material is more consistent	.777			
	Whether the quality of products is more consistent	.733			

5.2 Canonical Correlation Analysis

This study uses canonical correlation analysis to test the relationships between Yeh's (2001) criteria of SCM performance and Wiseman's (1985) five competitive advantages. Table 3 and table 4 show canonical correlation functions. The square values of canonical correlation of these functions are 0.808, which indicate a strong relationship between SCM performance and competitive advantage. The canonical correlation analysis results show that there is enough evidence to support the existence of this relationship. It also strengthens the rationalization of this study in viewing the competitive advantages of a firm from an SCM perspective.

Table 3 Measures of overall model fit for canonical correlation analysis

Canonical correlation functions	Eigenvalue	Proportion	Square of canonical correlation	Wilks' Lambda	Approx F	Hypoth. DF	Sig of F
1	4.209	90.079%	.808	.12838	10.58984	15.00	.000
2	.380	8.141%	.276	.66879	2.95207	8.00	.005
3	.083	1.779%	.077	.92323	1.49677	3.00	.226

* p-value=0.05

Table 4 Correlations(loading values) of canonical variables between independent and dependent variable

Correlations between COVARIATES and canonical variables			Correlations between DEPENDENT and canonical variables		
Can. Var. / Covariate	1	2	Function No. / Variable	1	2
X1	-.866	.268	Y1	-.753	.098
X2	-.693	-.721	Y2	-.834	.070
X3	-.736	.121	Y3	-.443	-.741
			Y4	-.753	-.414
			Y5	-.855	.331

5.3 Training, Testing and Evaluating Model for Competitive Strategy

This study used a survey to develop the evaluating criteria of SCM performance and the current operating conditions of the attack strategy for competitive advantages. It also derives the weights of the required criteria for a firm to evaluate its cooperative partners and the conditional weight of their alliance. Finally, using the neural network model (12,12,5) (see figure 2) we develop the business model best suited to co-ordinate the current conditions and potential advantages for an individual firm. After developing the best business model for the firm, we can then use the conceptual model to test the competitive advantages of the firm's partners. We also use the conditional data of alliance requirements for competitive advantage (see figure 3) as the learning data template of the testing model for cooperative advantages, by evaluating the current conditions and the potential for competitive advantage. To go a step further, a complete evaluating model is established after proceeding with learning through the constructed neural network model (10,10,5).

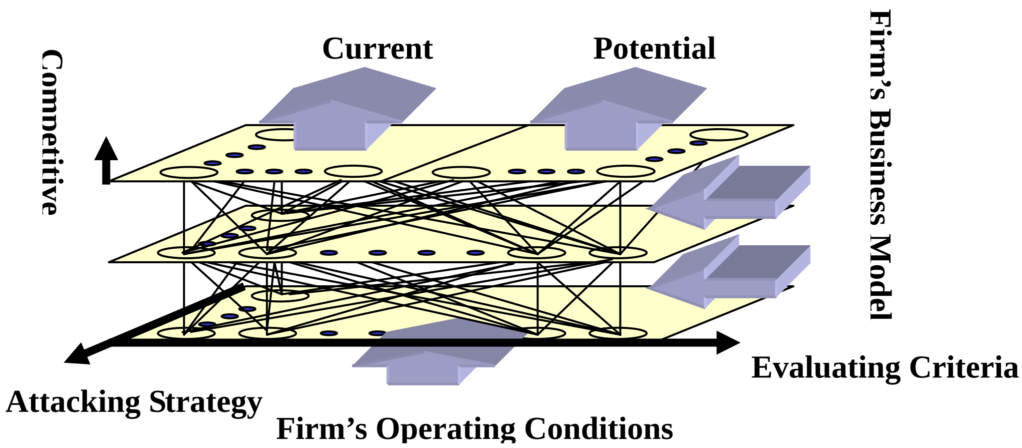

Fig2 Learning and Testing Models of Neural

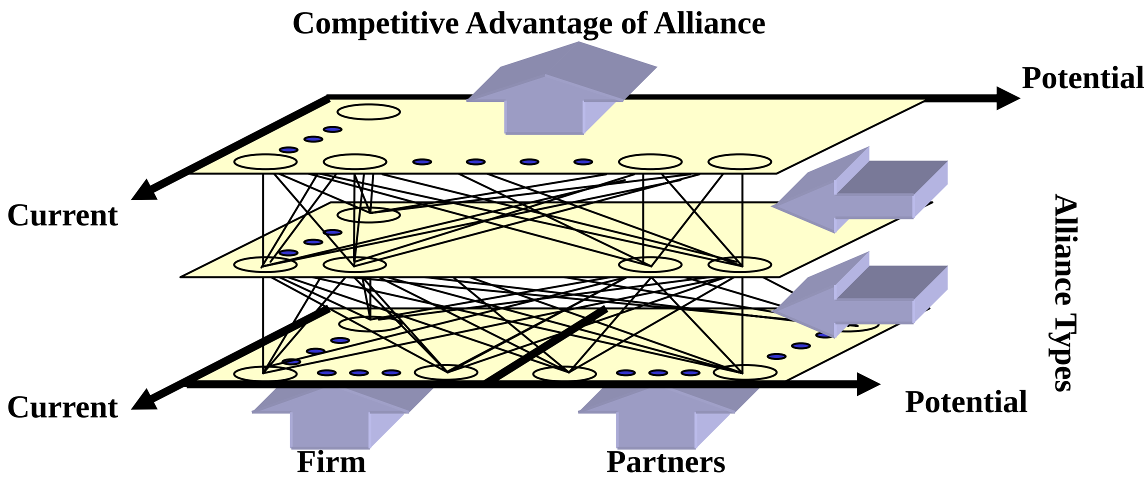

Fig 3 Evaluation Model of Neural Network

Table 5 lists the learning model of case firm. Table 6 lists the evaluating model of case firm and its partners. The results in Table 5 and Table 6 show that the model of competitive advantage is able to converge under an error tolerance of 5%. It is implied, therefore, that the evaluating model of competitive advantage has value in practical applications. It can be used to evaluate the competitive advantages of cooperative supply chain members and to understand the current conditions and potential for competitive advantage of an integrated supply chain.

Table 5 Learning model, training parameters and training results

Module	Sample	Network structure			Learning rate	Moment um	Error tolerance	Transform function	Iteration number	Error rate
		Output nodes	Hidden nodes	Input nodes						
L1	50	5	12	12	0.7-0.2	0.6-0.2	20%	Sigmoid	623	--
L2	50	5	9	12	0.7-0.2	0.6-0.2	20%	Sigmoid	1,024	--
L3	50	5	5	12	0.7-0.2	0.6-0.2	20%	Sigmoid	>100,000	--
L4	50	5	9	12	0.7-0.2	0.6-0.2	15%	Sigmoid	3,612	--
L5	50	5	9	12	0.7-0.1	0.6-0.1	10%	Sigmoid	5,346	20%
L6	50	5	9	12	0.6-0.1	0.6-0.1	5%	Sigmoid	7,135	5%

* Although, the number of received questionnaire is sixty, we use fifty samples to train and ten samples to learn in learning model.

Table 6 Evaluation model, training parameters and training results

Module	Sample	Network structure			Learning rate	Moment um	Error tolerance	Transform function	Iteration number	Error rate
		Output nodes	Hidden nodes	Input nodes						
L1	30	5	10	10	0.7-0.2	0.6-0.2	20%	Sigmoid	489	--
L2	30	5	7	10	0.7-0.2	0.6-0.2	20%	Sigmoid	1,123	--
L3	30	5	5	10	0.7-0.2	0.6-0.2	20%	Sigmoid	1,467	--
L4	30	5	3	10	0.7-0.2	0.6-0.1	20%	Sigmoid	>100,000	--
L5	30	5	5	10	0.7-0.1	0.6-0.1	10%	Sigmoid	1,724	10%
L6	30	5	5	10	0.6-0.1	0.6-0.1	5%	Sigmoid	2,571	5%

* Although, the number of received questionnaire is sixty, we use thirty samples to train in evaluation model. Below sixty, the sample number for training can be flexibility in this paper.

6. Limitations and Contributions

6.1 Limitations

This study collected the training and learning data from a case firm, focusing on its executives. We realize, however, that only a few executives participate in all the business operations and the decision-making strategies in the firm. Furthermore, if the firm's partners do not do business electronically, then the extended ERP cannot promote integral competitive advantages. In this case, the values would be lower for ERP performance. This phenomenon also supports the use of this study in evaluating ERP performance from an SCM perspective.

This study also casts doubts as to the practical value of its application due to the results of the evaluation model. This arises from questions regarding the accuracy of the acquired knowledge from the ERP consultants and the case firm executives. To address this problem, our study selected as interviewers, three reputable consultants who each had at least seven years' ERP consulting experience and executives within a firm that had adopted an extended ERP system as the subjects of interview. In the training process, the model acquires the weights from different departments that enhance the result to suit real practice application.

6.2 Contributions

Most firms implement ERP systems with the assistance of ERP company consultants, but only a few reach their objective. This can be due to various reasons. First, the knowledge contained within the firm and the ERP consultant-company is tacit and lacks integration. Second, the ERP performance is evaluated from the firm-self traditionally. It ignores the performance is affected by its supply chain members. Third, the firm's ERP system cannot be integrated with its partners. These conditions reduce ERP system performance.

The conclusions of this study imply that extracting tacit knowledge from firms and ERP consultants to evaluate SCM performance within an ERP system is possible. Other firms can use the evaluation of these results in reviewing their own ERP systems and alliance partners. Based on the above discussion, the contributions of this study are listed below:

(1) The integration of the tacit knowledge inherent within the firm and the ERP consultants and avoidance of erroneous personal judgments.
(2) A well constructed evaluation model of competitive.
(3) A firm can use this competitive advantage evaluation model to determine its competitive advantages and competitive advantages of its partners after implementing an extended ERP system based on an SCM.
(4) Under limited resources, a firm can use this competitive advantage evaluation model to support decision-making when adjusting the focus of the ERP or the SCM system.
(5) Supplying a firm with the tools to make strategic alliance decisions.

6.3 Future Research Directions

This model is constructed to be applied on a case by case basis, the data come from a single transnational textile firm. In follow-up research, the survey can be extended to supply chain members in an upward or downward direction. After the survey has been done, the training and learning parts of the model can be used to increase its practical value. Specifically, future research can include more alliance types. By adjusting for the difference in alliance types, the model will become more flexible. The firm can also evaluate the integral competitive advantages of supply chain members and adjust the cooperative relationships with its partners to ensure satisfaction.

Reference

Allen, E., "Supply Chain Management Software Vendor Comparison and Analysis," Dissertation, University of Texas at Austin, 1998.

Akkermans, H.A., Bogerd, P., Yucesan, E. and van Wassenhove, L.N., "The Impact of ERP on Supply Chain Management: Exploratory Findings from a European Delphi Study," European Journal of Operational Research, (146: 2), 2003, p.284.

Bowersox, D.J., "The Strategic Benefits of Logistic Alliances," Harvard Business Review, 1990, pp. 37-45.

Chen, S.L., "The Application of Neural Networks to Pattern Recognition of Tradition Chinese Sphygmology," Ph.D. Dissertation, Department of Electrical Engineering of National Sun Yat-Sen University, 1998.

Comrey, A.L., "A First Course in Factor Analysis," New York: Academic Press, 1973.

Davenport, T. H., “Putting the Enterprise into the Enterprise System,” Harvard Business Review, (76: 4), 1998, pp.121-131.

Dornier, P.P., Ernst, R., Fender, M. and Kouvelis, P., “Global Operations and Logistics: Text and Cases,” NY: John Wiley & Sons, Inc, 1998.

Edwards, p., Peters, M. & Sharman, G., “The Effectiveness of Information Systems in Supporting the Extended Supply Chain,” Journal of Business Logistics, 22(1), 2001, pp.1-27.

Gerwin, D., “Manufacturing Flexibility: A Strategic Perspective,” Management Science, 39, 1993, pp.395-410.

Hair, J., Anderson, R., Tatham, R., and Black ,W., “Multivariate Data Analysis,” Prentice Hall, New Jersey USA,1998.

Kaiser,H.F., “An Index of Factorial Simplicity,” Psychometrika, 39, 1974, pp.31-36.

Kane, J.S., “A Smart Pixel-Based Feedforward Neural Network,” IEEE Trans. On Neural Networks, (9:1), 1998, pp.159-164.

Kochan, A., “Real Timely,” Works Management, (53:8), 2000, pp.24-6.

Konsynski, B.R. and McFarlan, F.W., “Information Partnership - Shared Data, Shared Scale,” Harvard Business Review, 1990, pp.114-120.

Kuo, R.J. and Xue, K.C., “A Decision Support System for Sales Forecasting through Fuzzy Neural Networks with Asymmetric Fuzzy Weights,” Decision Support Systems, Amsterdam, (24:2), 1998, pp.105-126.

Kovacs, G.L., & Paganelli, P., “A Planning and Management Infrastructure for Large, Complex, Distributed Projects─Beyond ERP and SCM,” Computers in Industry, 51, 2003, pp.165-183.

Leong,G.K., Snyder, D.L., and Ward, P.T., “Research in the Process and Content of Manufacturing Strategy,” OMEGA, (18:2), 1990 , pp.109-122.

Nunnally,J.C., “Psychometric Theory,”2nd Edition, New York: McGraw-Hill,1978.

Pao, Y. H., “Adaptive Pattern Recognition and Neural Networks,” New York: Addison-Wesley, 1989.

Sexton, R.S., Dorsey, R.E., and Johnson, J.D.,“Toward Global Optimization of Neural Networks: A Comparison of the Genetic Algorithm and Backpropagation,” Decision Support Systems, Amsterdam, (22:2) , 1998, pp.171-185.

Shin, H., Collier, D.A., and Wilson, D.D., “Supply Management Orientation and Supplier/Buyer Performance,” Journal of Operations Management, 18, 2000, pp.317-333.

Skinner, W., “Manufacturing—The Missing Link in Corporate Strategy,” Harvard Business Review, (47:3), 1969, pp.136-145.

Tarn, J.M., Yen, D.C. and Beaumont, M., “Exploring the Rationales for ERP and SCM Integration,” Industrial Management & Data Systems, (102: 1), 2002, pp.26-34.

Wiseman, C., “Creating Competitive Weapons from Information Systems,” Journal of Business Strategy (pre-1986), (5:2), 1984, pp.42-49.

Wiseman, C., “Strategy and Computers: Information Systems as Competitive Weapons,” Dow Jones Irwin, Homewood, 1985.

Yeh, K. H., “A Study on the Performance Indicators of e-Supply Chain Management,” Information Management Research (IMR), (3:2), 2001, pp.57-71.(In Chinese)