

Study of the Decision-Making Model of Outsourcing Service Provider Selection

En-lin Li

*Post-doctoral Research Working Station of North-east Asia Outsourcing Research Center, Harbin University of Commerce, Harbin 150028, China
Management School, Harbin Institute of Technology, Harbin 150001, China
50023588@qq.com*

Abstract

Many major shipbuilding enterprises outsource the professional IT work to reduce costs and improve efficiency. In recent years, shipbuilding enterprises have become one of the most important IT outsourcing customers all over the world. In this paper, the key influence factors of the choice of outsourcing service providers are analyzed by AHP to support the decision of shipbuilding enterprises.

Keywords: *IT outsourcing; AHP; Decision-Making Model*

1. Introduction

As globalization, diversification of Products and progress of science and technology, social division of labor is becoming more and more finely as time passing, while market competition is more widespread and intense, it becomes more and more difficult for enterprises to match the changing market demand and competition only relies on its own abilities and resources. Therefore, how to strengthen market competitive ability by combining outside resources and inside core competence becomes one of company's realistic issues. Now a days, many enterprises chooses to outsource its non-core business to other enterprises to reduce cost and increase the efficiency. Because the core business of shipbuilding enterprises are not IT, it not only costs a lot to set up its own IT department but also difficult to retain top IT talents, so most of the shipbuilding enterprises chose outsource to IT business [1]. When searching for a vendor, for example, companies often try to spend as little as possible. However, spending more at the search stage reduces hidden costs throughout the outsourcing effort and saves considerable expense later. Companies should include certain clauses in the contract, select a trustworthy vendor and be certain about the vendor's role [14]. How to choose an appropriate IT outsourcing services provider turns to be a key issue that the shipbuilding enterprises are facing, the decision-making influence factors of choosing IT outsourcing services provider are analyzed based on AHP analysis model in this paper, it provides the theory basis and the effective reference for this kind of decision making. With the rapid development of information technology and pervasive adoption of IT in enterprises, IT outsourcing has become an importance IT management model. This paper focuses on complexity and dynamic in the IT outsourcing decision process based on a AHP model. It has explored the key impact factors in IT outsourcing process, and construct multi-stage IT outsourcing decision model. By using multiple methods and tools, including literature meta-analysis and survey, a decision-making model of outsourcing service provider selection based on AHP is built.

2. Literature Review

2.1. IT outsourcing

Chyan Yang(2000) draw the conclusion that Information systems outsourcing has been one of the critical issues facing IS management recently, but it still stays in the stage of conceptual discussion about how to outsource the IS activities. The determinants used so far, for instance, transaction costs and “strategic” or “commodities” characteristics, are too narrow to help the end users determine if their system should be outsourced. This paper argues that five factors, including management, strategy, economics, technology and quality, should be considered for outsourcing decisions. Furthermore, the paper proposes a decision model, which uses the analytic hierarchy process (AHP) method to help users in structuring the outsourcing problems. The decision model generates numeric values for users to decide whether they should adopt the outsourcing strategy for each IS systems under consideration [15]. Figure 1 is the structure of outsourcing problem provided by Chyan Yang.

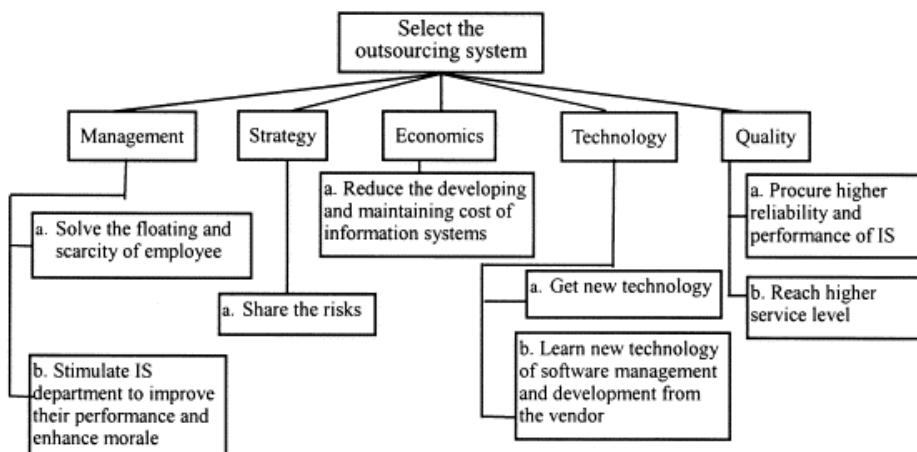


Figure 1. The Structure of Outsourcing Problem

Myun J Cheon (1995) argued the critics that the field of information systems (IS) lacks a coherent theoretical framework. This paper attempts to further the theoretical development of a critical and pervasive contemporary phenomenon, outsourcing of IS functions, by synthesizing four theoretical models (resource-based theory, resource-dependence theory, transaction cost theory and agency theory) that are useful for understanding determinants of a firm's outsourcing strategy. From these theoretical models, a contingency model of outsourcing is developed which can be used to direct empirical research.

Jae-Nam Lee (2001) said that there has been much interest in knowledge sharing between the service receiver and provider through an outsourcing partnership and its effect on Information Systems (IS) outsourcing success. Jae-Nam Lee's study examines the relationship between knowledge sharing and outsourcing success. The effect of the ability of the service receiver to absorb the needed knowledge and of companies to build a partnership on these relationships are modeled and hypotheses defined. These were tested using a sample of 195 public sector organizations in Korea. Findings

indicate that all hypothesized paths in the model are significant [16]. The following figure is the research model provided by Jae-Nam Lee.

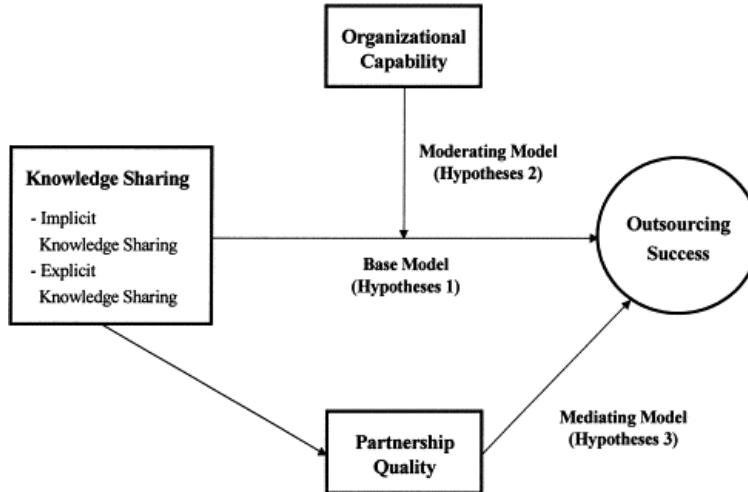


Figure 2. Research Model of IT Outsourcing

Zhang Pei (2008) separated IT outsourcing into four stages shown as the following figure.

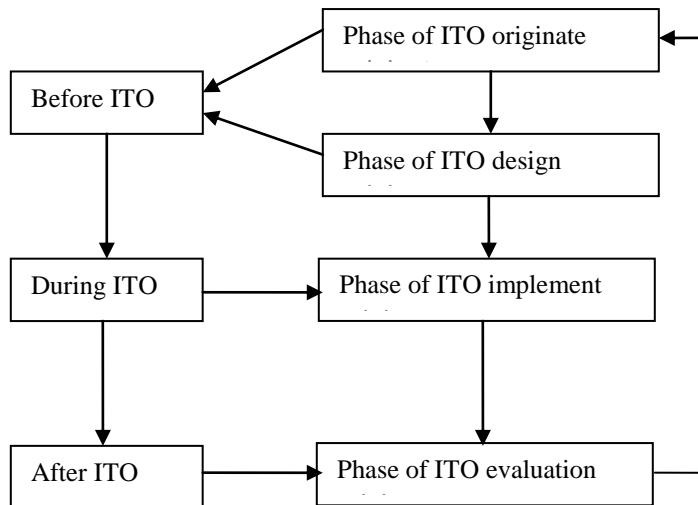


Figure 3. Multiple stages of IT outsourcing decision process [17]

Hafeez, *et al.*, (2007) analyzed how decisions are made based on the resource-based theory analysis of enterprise outsourcing of non-core assets and capabilities that enterprise resources include physical assets, intellectual assets and cultural assets as "unique" and "a collection of important resources and capabilities of an enterprise, property and constructing the four stages of the dual the AHP analysis decision-making type, that is planning to recognize corporate capacity → decisive factor in the application of AHP evaluation capacity of unique and collections → application AHP evaluation core assets [18].

Uma G. Gupta & Ashok Gupta (1992) answered such a question for CEOs and CIOs that is it necessary for the organization to outsource the IS function. Unfortunately,

however, they are realizing there is no simple answer. Uma G. Gupta & Ashok Gupta examined the critical issues that an organization must address before making the decision to outsource all or part of its IS function and identifies the pros and cons of outsourcing. Strategies for building successful relationships without sourcing vendors are also outlined [19].

T. Kern (2000) realized that a growing concern among the organisations who are actively involved in Information Technology outsourcing is post-contract management and the ensuing development of what many practitioners and scholars have coined the outsourcing partnership. This paper integrates theoretical concepts from organisation theory, social exchange theory, and relational contract theory with existing research on IT outsourcing, to develop a conceptual model for understanding the relationship. In particular, we conceptually elaborate and then address the relationship's properties — identified as interactions, contract, context, structure, and behavioural dimensions. Preliminary exploratory research into relationship practice in twelve organisations involved in outsourcing presents some interesting findings that advance the thinking about the outsourcing relationship. We found the conceptual model useful in elucidating important relationship management areas, highlighting not only the outsourcing relationship's contractual, social, and economic characteristics, but also many additional elements found to have relevance in practice [20].

3. Influence Factors of Choosing IT Outsourcing Providers

3.1. Cost contribution

Cost contribution refers to cost advantages by outsourcing non-core business, it is a comparative advantage but not a simple outsourcing cost calculation [2].

Formula of cost contribution:

$$\text{Cost contribution} = (\text{self made cost} - \text{outsourcing cost}) / \text{self made cost} * 100\%$$

By the formula, it is easy to find out that cost contribution is the percentage of outsourcing cost saving. Generally speaking, self-made costs include cost of production and management costs. Outsourcing cost includes transaction cost, out-of-pocket cost, transition cost and supervisory cost, etc. The formula is as follow:

Self-made costs=production costs (raw material costs, procurement costs, manufacturing costs, equipment investment, etc)+management costs(personnel management, equipment management, production management, etc.)

Outsourcing costs= transaction cost + out-of-pocket cost + transition cost + management and supervision cost + to sign the contract costs + conversion cost

3.2. Internal factors of Outsourcing Service Providers

The reason of outsourcing non-core business for most enterprises are to reduce costs, thus, outsourcing service price is one of the key factors that requires the consideration, service price also reflects the competitive ability of the outsourcing service providers [3]. Today, the shadow of the financial crisis has not completely abreaction, effective cost control is an effective way to enhance the competitiveness of shipbuilding enterprises. If one IT project are subcontracted with multiple software companies, the software testing costs, integration costs and management costs would be increased, therefore the shipbuilding enterprises would like to choose some scaled service

providers, the purpose of this demands is to insure that the projects are subcontracted as few as possible [4].

At present, software company in China can not get proper offshore outsourcing project due to the limited scale, instead, the projects they often get are from some other outsourcing service providers, which we call it second-handed outsourcing. The cost of future door-to-door services is up to Offshore distance. It is import to shipbuilding enterprises to choose IT outsourcing provider that on-site service can reduce the transaction costs [5]. Management ability is about the project management ability of outsourcing service provider, because the standardization of the development process can reduce the uncertainty of software development, thus, consideration of service management ability is usually based on whether this enterprise passed the corresponding authentication. At present, capability maturity model authentication (CMM) developed by Carnegie Mellon university has become the general standard in IT outsourcing industry [6]. Due to the large shipbuilding enterprise IT projects need treatment of large quantities of data, data updated quickly and especially needs of concurrent characteristics, good project management ability and coordination ability is needed, CMM certification is undoubtedly effective reference standard in this situation [7]. In addition, passing the certification such as ISO9001, 6SIGMA can also effectively prove enterprise management level, and provide a reference for the shipbuilding enterprises to choose outsourcing service provider. Service quality refers to satisfy level how does the outsourcing service provider meets the demand of shipbuilding enterprise [8]. The quality of IT outsourcing includes: software error probability, error arecovery time, system maintenance and upgrade frequency, *etc.* Because IT outsourcing often involved in business secrets, if unable to provide effective protection of commercial secrets, the business secrets may got by the competitors, information security is one of the core ability that attractive shipbuilding enterprises [9]. The business secrets of shipbuilding enterprises include: the new ship design, strategic planning, equipment selection, *etc.* Technical ability refers to unique way of knowledge production ability which includes: theory and practice knowledge, unique methods, procedures, experience and lessons, *etc.* The enterprise culture is the enterprise knowledge and values accumulation similar enterprise culture can reduce possibility of conflict, and reduce the cost for resolving conflicts.

3.3. The external environment factors of outsourcing service providers

Traffic facilities are not that important in choosing outsourcing service provider, because IT outsourcing does not need a lot of goods transport. Communication facilities are important especially in offshore outsourcing because shipbuilding enterprises are normally far away from the outsourcing service provicers. In recent years, success of Indian software outsourcing industry is benefited from giving full play to the talent advantage, so human resource is an important factor in IT outsourcing providers choosing. China is still short for software talent, this directly lead our software enterprises to small scale, and then limit the ability to get large project from big shipbuilding enterprise. Policy environment is also an important factor for outsourcing

service providers choosing, stable policy can supply a safe environment for the investors, also, the development of outsourcing service providers need the supplyment of goverenment. At the mean time, developed outsourcing service provider is more likely to attract shipbuilding enterprises. Because large project of IT outsourcing always take ages, a stable policy environment is demanded by most of the decision makers [10]. At last, law environment is also a factor considered by the shipbuilding enterprises, which always includes: Intellectual property law, contract law, trade law, etc. [11-13].

4. Dicision-making model of outsourcing service provider selection based on AHP

4.1. Basic calculation steps of AHP

(i) Constitute comparative matrix:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} = \begin{bmatrix} w_1 / w_1 & w_1 / w_2 & \dots & w_1 / w_n \\ w_2 / w_1 & w_2 / w_2 & \dots & w_2 / w_n \\ \dots & \dots & \dots & \dots \\ w_n / w_1 & w_n / w_2 & \dots & w_n / w_n \end{bmatrix} \quad (1)$$

$$a_{ij} = w_i / w_j, w_i, w_j$$

(ii) Calculate the eigenvalues, eigenvectors:

Set \bar{w} as the vector composed of criteria weights, that is,

$$\bar{w} = [w_1, w_2, \dots, w_n], \quad A\bar{w} = \begin{bmatrix} w_1 / w_1 & w_1 / w_2 & \dots & w_1 / w_n \\ w_2 / w_1 & w_2 / w_2 & \dots & w_2 / w_n \\ \dots & \dots & \dots & \dots \\ w_n / w_1 & w_n / w_2 & \dots & w_n / w_n \end{bmatrix} * \begin{bmatrix} w_1 \\ w_2 \\ \dots \\ w_n \end{bmatrix} = n * \begin{bmatrix} w_1 \\ w_2 \\ \dots \\ w_n \end{bmatrix} \quad (2)$$

(iii) Objective criteria weighting

$$\bar{w} = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} i, \quad j = 1, 2, \dots, n \quad (3)$$

(iv) Consistency test

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} \quad (4)$$

(v) It represents exactly the same if $C.I. = 0$, we regard $C.I. \leq 0.1$ as the extent permissible deviation

4.2. Empirical Study of the Outsourcing service provider selection Decision-Making Mode

(i) Hierarchical structure

Table 1. Influence Factors of Choosing IT Outsourcing Providers

factors of decision making	Cost contribution	
	Internal factors	scale (SC)
		offshore distance (OD)
		management ability (MA)
		information security (IS)
		service quality (SQ)
		technology ability (TA)
		Corporate Culture (CC)
	External factors	Response speed (RS)
		traffic facilities (TF)
		communication facilities (CF)
		human resources environment (HR)
		policy environment (PE)
		law environment (LE)
		language environment (LA)

(ii) Comparison Matrix

There is an IT project, it costs the shipbuilding enterprise \$200,000 to devekop it alone. If outsource the project to A, B, C, D company, the cost is \$140,000, \$150,000, \$120,000, \$180,000.

Table 2. The calculation of the cost contribution

	cost of outsourcing	cost contribution
A service provider	14.00	0.30
B service provider	15.00	0.25
C service provider	12.00	0.40
D service provider	18.00	0.10

(iii) Consistency test

The calculation steps are as follow:

$$0.50 * \begin{pmatrix} 1 \\ 0.7 \\ 0.3 \end{pmatrix} + 0.35 * \begin{pmatrix} 1.43 \\ 1 \\ 0.43 \end{pmatrix} + 0.15 * \begin{pmatrix} 3.33 \\ 2.33 \\ 1 \end{pmatrix} = \begin{pmatrix} 1.5 \\ 1.05 \\ 0.45 \end{pmatrix} \quad 0$$

Cost contribution: $1.5/0.5=3$

Internal contribution: $1.05/0.35=3$

External contribution: $0.45/0.35=3$

$$\frac{3+3+3}{3} = 3 \quad 0$$

$$CI = \frac{3-3}{3-1} = 0 \quad 0$$

Table 3. Average random consistency index

Exponent number	1	2	3	4	5
RI	0	0	0.52	0.89	1.12
Exponent number	6	7	8	9	
RI	1.26	1.36	1.41	1.46	

$$CR = \frac{CI}{RI} = \frac{0}{0.52} = 0 < 0.1 \quad 0$$

So, the consistency is acceptable.

(iv) Rating of outsourcing service providers,

A service provider

$$0.5*0.29+0.35*(0.06*0.21+0.15*0.42+0.13*0.21+0.19*0.29+0.17*0.1+0.15*0.35+0.06*0.11+0.1*0.4 \\ 2)+0.15*(0.11*0.40+0.26*0.1+0.14*0.42+0.2*0.21+0.17*0.31+0.11*0.09) = 0.276645$$

B service provider

$$0.5*0.24+0.35*(0.06*0.25+0.15*0.11+0.13*0.25+0.19*0.26+0.17*0.44+0.15*0.09+0.06*0.34+0.1*0.11)+0.15*(0.11*0.1+0.26*0.44+0.14*0.11+0.2*0.38+0.17*0.19+0.11*0.39) = 0.245385$$

C service provider :

$$0.5*0.37+0.35*(0.06*0.21+0.15*0.32+0.13*0.21+0.19*0.26+0.17*0.29+0.15*0.3+0.06*0.34+0.1*0.2)+0.15*(0.11*0.35+0.26*0.29+0.14*0.32+0.2*0.25+0.17*0.27+0.11*0.3) = 0.32754$$

D service provider :

$$0.5*0.09+0.35*(0.06*0.32+0.15*0.16+0.13*0.32+0.19*0.19+0.17*0.17+0.15*0.26+0.06*0.2+0.1*0.6)+0.15*(0.11*0.15+0.26*0.17+0.14*0.16+0.2*0.15+0.17*0.23+0.11*0.22) = 0.14734$$

5. Conclusion

In this paper, outsourcing service provider selection decision making model is studied through some key factors, such as: cost contribution, internal factors and external factors. The analysis is made based AHP, empirical Study of the decision making model is provided. This model is useful to make better decision for the shipbuilding enterprise when they choose IT outsourcing service provider.

References

- [1] J. J. Wang and D. Yang, "Decision Making Method of Information System Outsourcing based on AHP / PROMETHEE", Chinese Journal of Management, vol. 3, (2006), pp. 288-291.
- [2] X. Wang and Z. Fan, "Fuzzy Decision-Making Method of Information System Outsourcing", Journal of NorthEasteren University, vol. 8, (2002), pp. 750-753.
- [3] S. Chen, "Analysis of Decision Making Factors for Information System Outsourcing", Science and Technology Management Research, vol. 9, (2005), pp. 172-174.
- [4] C. A. Weber and J. R. Current, "A Multi-Objective Approach to Vendor Selection", European Journal of Operational Research, vol. 68, (1993), pp. 173-184.

- [5] F. P. Buffa and W. M. Jackson, "A Goal Programming Model for Purchase Planning", *Journal of Purchasing and Materials Management*, vol. 3, (1983), pp. P27-34.
- [6] S. H. Ghodsypour and C. O. Brien, "A Decision Support System for Supplier Selection using an Integrated Analytic Hierarchy Process and Linear Programming", *International Journal of Production Economics*, (1998), pp. 56-57.
- [7] D. Sharma, W. C. Benton and R. Srivastava, "Competitive Strategy and Purchasing Decision", *Proceeding of the 1989 Annual Conference of the Decision Science Institute*, (1989), pp. 1088-1090.
- [8] M. Beenstock and A. Vergottis, "An econometric model of the world market for dry cargo and shipping", *Applied Econometrics*, vol. 21, (1986), pp. 339-356.
- [9] C. Versehoor, "Performance Auditing: A Measurement Approach", *Internal Auditing*, vol. 2, (2003).
- [10] I. Mahdavi and N. Mahdavi-Amiri, "Designing a model of fuzzy Topsis in multiple criteria decision making", *Applied Mathematics and Computation*, (2008), pp. 607-617.
- [11] Y. E. Gelogo and B. J. Park, "Next Generation Cloud Computing Issues and Solutions", *IJCA*, vol. 5, no. 1, (2012) March, pp. 63-70.
- [12] S. H. Jang, T. Y. Kim, J. K. Kim and J. S. Lee, "The Study of Genetic Algorithm-based Task Scheduling for Cloud Computing", *IJCA*, vol. 5, no. 4, (2012) December, pp. 157-162.
- [13] H. Li and R. Suomi, "A Proposed Scale for Measuring E-service Quality", *IJUNESST*, vol. 2, no. 1, (2009) March, pp. 1-10.
- [14] J. Barthélémy, "MIT Sloan management review", ISSN 1532-9194, vol. 42, no. 3, (2001), pp. 60-69.
- [15] C. Yang and J. -B. Huang, "A decision model for IS outsourcing", *International Journal of Information Management*, vol. 20, no. 3, (2000) June, pp. 225-239.
- [16] J. -N. Lee, "The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success", *Information & Management*, vol. 38, no. 5, (2001) April, pp. 323-335.
- [17] Z. Pei, "Research on decision models and simulation for IT outsourcing in enterprise", (2008), pp. 8-9.
- [18] K. Hafeez, N. Malak and Y. B. Zhang, "Outsourcing non-core assets and competences of a firm using analytic hierarchy process", *Computers & Operations Research*, vol. 34, no. 12, (2007), pp. 3592-3608.
- [19] U. G. Gupta and A. Gupta, "Outsourcing the IS function", *Information Systems Management*, vol. 9, no. 3, (1992), pp. 44-47.
- [20] T. Kern and L. Willcocks, "Exploring information technology outsourcing relationships: theory and practice", *The Journal of Strategic Information Systems*, vol. 9, no. 4, (2000) December, pp. 321-50.

Financial Assistance under Heilongjiang Postdoctoral Fund No. LBH-Z12146

Authors



En-lin Li, Associate professor, Main research fields: Information Service; E-commerce and E-government. This paper is subsidized by Financial Assistance under Heilongjiang Postdoctoral Fund No. LBH-Z12146.

