

정보시스템 아웃소싱의 상대적 이점과 위험: 경험적 연구

이민화

부산외국어대학교 상경대학 경영정보학과

요약

정보시스템 기능의 아웃소싱이 정보시스템 효율과 효과성을 개선하기 위한 하나의 전략으로 고려됨에 따라서 소싱설정의 결정요인을 식별하는 것은 중요하다. 본 연구는 금융산업에 있어서 자료처리 서비스에 대한 소싱결정에 영향을 주는 요인들을 조사하였다. 아웃소싱이 관리적 혁신으로 간주될 수 있기 때문에, 기존의 연구를 기초로하여 혁신특성으로서 상대적 이점과 위험을 소싱설정의 중요한 결정요인으로 제시한다. 미국의 1,000개의 은행을 대상으로 조사한 결과는 상대적 이점과 위험이 정보시스템 아웃소싱 및 아웃소싱 선호도와 유의적인 관계가 있음을 보여준다.

Relative Advantage and Risk of Information Systems Outsourcing: An Empirical Assessment

Lee, Min-Hwa

Department of Management Information Systems, Pusan University of Foreign Studies

Abstract

As outsourcing of information systems (IS) functions has been considered as a strategy for improving IS efficiency and effectiveness, it is important to identify the determinants of sourcing arrangements. This study examines the factors affecting sourcing decisions for data processing services in the banking industry. As outsourcing is considered as an administrative innovation, relative advantage and risk as innovation characteristics are suggested as significant determinants of sourcing arrangements. The results based on a survey of 1,000 banks in the U.S.A. show that relative advantage and outsourcing risk are significantly associated with IS outsourcing and outsourcing preference.

I. Introduction

Information systems (IS) outsourcing refers to "the practice of turning over part or all of an organization's IS functions to one or more external service providers" (Grover and Teng 1993, p. 34). In a typical outsourcing contract relationship, a client pays service fees to an external service provider who is specialized in IS areas, and the external service provider assumes a contractual obligation to provide information services to the client firm. The practice of

outsourcing has evolved from traditional timesharing and purchase of professional services in the 1970s to a broad range of information services acquired from vendors in all IS areas in the 1990s (Apte, 1990). Outsourcing includes complete outsourcing, facilities management and systems integration (Grover, et al., 1994; Gantz, 1990). Complete outsourcing refers to relying on external service providers for IT (Information Technology) facilities as well as operation and management of the facilities. Facilities management arrangement involves transferring the responsibilities for operation and management of IT facilities, often owned by the clients, to an external service provider. In a systems integration type of outsourcing, an external service provider develops an integrated system of hardware, software and networking, and the IS department of the client firm operates and maintains the system. In addition, outsourcing includes contract programming, rental of IT facilities and other professional services. Current outsourcing practice includes several IS activities, and three most used include application development and maintenance, data center operations, and telecommunications management (Gebelt, 1992; Loh, 1993).

The recent trend is toward increased use of IS outsourcing (Due, 1992; Huber,

1993; Huff, 1991; Kirkpatrick, 1991; Rochester and Douglas, 1990). Faced with tougher competition in national and international markets, business organizations are pressured to improve productivity in all functional areas, including IS activities. Outsourcing, as a component of information technology (IT) strategy, should be integrated with the overall business strategy of the firm (Henderson and Venkatraman, 1993). Outsourcing IS activities, as a strategic option, can impact IS productivity, market share, and profits significantly (Gupta and Gupta, 1992). Sourcing decisions are becoming increasingly common, especially as firms feel the pressure for productivity improvement, business process reengineering, downsizing and more efficient business performance.

However, outsourcing is not always an effective strategy (McKay and Connolly, 1991). Outsourcing is performed selectively for a certain category of information services which are considered to be good candidates. There are also situations in which insourcing is as effective as outsourcing. The decisions are often not simple and structured, but complex and ill-structured. Because of the complexity of the analysis and in order to evaluate the outsourcing option adequately, IS executives have spent approximately "80% of their time for three to six months" (Williamson 1991, p. 35). Hence, it is important to investigate factors which should be considered when making an IS service outsourcing decision.

Although there are many papers which explain the factors to be considered for IS outsourcing decisions (e.g., Grover and Teng, 1993; Gupta and Gupta, 1992), not much empirical evidence on such factors can be found in the IS literature. Unlike other descriptive studies on IS outsourcing (e.g., Arnett and Jones, 1994; Grover, Cheon, and Teng, 1994; Lacity and Hirschheim,

1993b), this paper reports a survey research on the relative advantages and risks which would be considered when making sourcing arrangements for data processing services. This research focuses on data processing, since data processing as a unit of sourcing decision can be outsourced, while other IS activities (e.g., application development, telecommunication, end-user support) can be insourced, or vice versa. Although outsourcing can be interpreted from various theoretical standpoints, this research emphasizes relative advantage and risk as innovation attributes.

II. Previous Studies of IS Outsourcing

As IS outsourcing becomes an increasingly important issue in industries, the number of articles explaining the phenomenon has also grown (e.g., Apte, 1990; Benko, 1993; Grover and Teng, 1993; Radding, 1990; Williamson, 1991). In an effort to understand outsourcing decisions more systematically, several empirical studies on factors influencing sourcing arrangements have been conducted recently.

In a field study, Cheon (1992) examined how information systems and organizational factors affect the degree of outsourcing IS functions and what factors are related to success of outsourcing. Questionnaires were mailed to IS executives of 1000 companies sampled from the Directory of Top Computer Executives published by Applied Computer Research, Inc. The study results, based on the data from 188 organizations, show that degree of IS outsourcing is determined by information quality, IS support quality, IS cost effectiveness, financial performance, and organizational role of IT, and that outsourcing success is related to quality of

service provider and nature of outsourcing partnership (Grover et al., 1996).

Gebelt (1992) conducted a field study examining how project characteristics and contextual factors influence make-or-buy decisions for application software development. Of the 170 firms chosen from the Million Dollar directory and the Dun & Bradstreet directory that participated in the study, 128 (75%) reported that they have an IS department. The results of their study, largely based on transaction cost economics, indicate that, for firms with a flexible development strategy (i.e., those which have an IS department), application development tends to be outsourced when firms have greater frequency or experience with external providers, lower asset specificity of the project, and comparative production costs favoring external providers.

Loh and Venkatraman (1992a) empirically identified a set of determinants of IT outsourcing. The degree of IT outsourcing was measured by the ratio of IT outsourcing expenditure to total assets for each firm. Their data represent both primary and secondary sources including Standard and Poor's Compustat II and Lotus' CD/Corporate on CD-ROM. Based on the data from 55 major U.S. corporations, their study shows that business cost structure (e.g., costs/total assets) and IT cost structure (e.g., IT expenditure /Gross Plant, Property & Equipment) are positively associated with the degree of IT outsourcing, and IT performance (e.g., net income /IT expenditure) is negatively associated with the degree of IT outsourcing.

Ang (1993) conducted a field study to examine economic, behavioral, and institutional factors affecting IS outsourcing arrangement in banks. The sample was drawn from the list of member banks of the American Bankers Association. The

analysis of data collected from 226 shows that production costs, transaction costs, perceived IT criticality, technological uncertainty, supplier presence, peer bank influence, federal reserve bank influence, and unbundling support services policy were significantly correlated with outsourcing of data center operations. There were differences, however, in the factors influencing sourcing decisions between large and small banks.

Lacity and Hirschheim (1993b) conducted an in-depth, multiple case study of IS outsourcing from the perspectives of both Williamson's (1975) transaction cost theory and Pfeffer's (1981) political model. The analysis of case data from fourteen Fortune 500 service and manufacturing companies identified the following reasons for initiating outsourcing evaluations: (1) proving or improving IS efficiency; (2) acquiring resources such as hardware capacity, technical skills, and cash; (3) imitating outsourcing success; (4) reducing IS demand uncertainty; (5) eliminating a troublesome IS function; and (6) enhancing of personal or IS departmental credibility.

Loh (1993) conducted a field study to test an IT governance operational model consisting of factors contributing to firm costs and dyadic costs. A sample of 465 questionnaires were collected from directors of three specific IT areas of Fortune 500 companies: application development, data center management, and telecommunications/network management. The research model was generally supported, and a correlational analysis showed that IT outsourcing is related to core competence, technological imperative, fiscal impetus, and uncertainty.

Aubert et al. (1996) conducted a case study of outsourcing behavior of ten large organizations. The analysis used the transaction cost framework revealed that the

basic principles of transaction cost and incomplete contract theories are useful for explaining the choice of the outsourced activities.

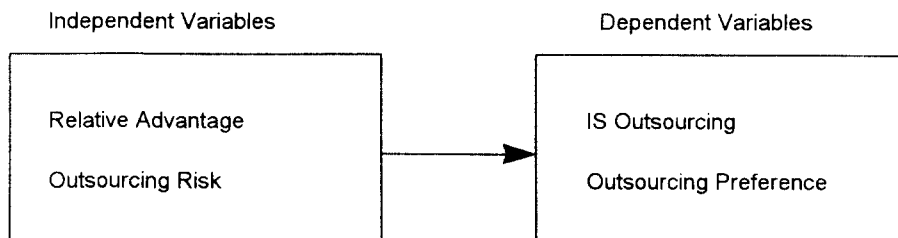
An increasing number of studies describing the practice of IS outsourcing have appeared in the IS literature (Cheon, 1995; Collins and Millen, 1995; Smith et al., 1996). As we can see from these prior studies, cost and efficiency are a major factor influencing sourcing arrangements. Not many organizational and industry characteristics found to be significant factors. Consistent with Gebelt (1992) and Ang (1993), the present research focuses on a specific IS function (i.e., data processing services) as a unit of sourcing arrangement, and reveals additional factors influencing sourcing decisions.

III. Research Model and Hypotheses

The studies focused on outsourcing decisions present that managers consider benefits and risks of outsourcing when they make a sourcing arrangement. Quinn and Hilmer (1994) conclude that outsourcing decisions involve the potential for obtaining competitive advantage and strategic vulnerability. Jurison (1995) discusses that expected benefits and risks of outsourcing are major factors affecting sourcing

decisions. Based on these studies, the present study focuses on the two factors, relative advantage and outsourcing risk, as the determinants of sourcing arrangements.

A new sourcing arrangement for information services in an organization is considered as an administrative innovation. Loh and Venkatraman (1992b) argue that IT outsourcing is an administrative innovation which refers to significant changes in managerial practice in organizations. According to the innovation diffusion literature, innovation characteristics such as relative advantage and riskiness are associated with innovation adoption (Tornatzky and Klein, 1982). This study, thus, examines relative advantage and outsourcing risk as innovation characteristics which would be important predictors of IS sourcing arrangements. The research model shown in Figure 1 includes two dependent variables: IS outsourcing and outsourcing preference. IS outsourcing refers to whether a firm's current primary sourcing arrangement is outsourcing or insourcing, and outsourcing preference refers to the degree to which a firm prefers outsourcing to insourcing as their primary sourcing arrangement. The two dependent variables are included in the model, because there are situations in which a firm currently has insourcing as its



<Figure 1> Research Model

primary sourcing arrangement, but prefers to make an outsourcing arrangement as its primary arrangement, and vice versa.

Relative advantage is a broader concept encompassing strategic aspects as well as cost efficiency than production cost, which is a major construct of the transaction cost theory to explain sourcing decision. Relative advantages of outsourcing for a firm could be lower costs or financial advantages, higher quality of information services, strategic focus and access to advanced technological resources possessed by external service providers (Ketler and Walstrom, 1993; Lacity and Hirschheim, 1993a; Martinsons, 1993). Cost savings can be obtained, when external service providers supply information services at lower costs because of their economies of scale (Wagner, 1994). Firms can reduce financial difficulties through outsourcing by avoiding a large capital expenditure that is necessary to improve IS efficiency (Huff, 1991). Firms with the problem of poor internal information services can improve the quality by outsourcing, when external service providers provide the required services by using advanced IT (Benko, 1993; Gupta and Gupta, 1992; Lacity and Hirschheim, 1993b). Outsourcing can be a means of solving internal lack of technical expertise for operating and managing IT facilities, because external service providers are specialized in IT (Apte, 1990; Benko, 1993; Buck-Lew, 1992; James, 1993; Kador, 1991). Finally, firms can reallocate their resources to more important tasks or core business by outsourcing less important IS functions (Grover, et al., 1994; Rochester and Douglass, 1990; Sinensky and Wasch, 1992; Williamson, 1991).

Relative advantage is an innovation characteristic which is generally positively associated with innovation adoption (Kwon and Zmud, 1987). Firms with a higher

degree of relative advantages of outsourcing would prefer outsourcing to insourcing. Perceived economic and strategic relative advantages of using external service providers for a firm would result in outsourcing as a primary sourcing arrangement, whereas the absence of such advantages would result in the choice of insourcing as a primary arrangement. Thus we hypothesize that:

Hypothesis 1a. The higher the relative advantage of using external service providers, the higher the tendency for IS services to be outsourced.

Hypothesis 1b. The higher the relative advantage of using external service providers, the higher the tendency of a firm to prefer outsourcing to insourcing.

Outsourcing risk is another innovation characteristic affecting adoption of an outsourcing arrangement. Primary outsourcing risks addressed by the IS literature include security, irreversibility and contractual risks (Ketler and Walstrom, 1993; Martinsons, 1993). IS security risk need to be assessed when outsourcing of IS services is considered (Grover and Teng, 1993). Security risk refers to the possibility of leakage of confidential information and unauthorized access to important data. Outsourcing might cause such a risk, because an IT vendor provides information services to multiple clients who might compete with each other (Grover, Cheon and Teng, 1994; Lowell, 1992). Although service providers take measures to protect clients' data, potential clients would perceive different degrees of security risk which could be posed by outsourcing.

Irreversibility refers to perceived

difficulty of changing an outsourcing arrangement to an insourcing arrangement for information services. Once information services are outsourced, it might be difficult to rebuild internal capability for producing the services in the future, because service receivers do not usually keep internal staff who can accumulate IT expertise (Martisons, 1993). Sourcing decision makers who perceive higher degree of flexibility to accommodate changes in sourcing arrangements are more likely to prefer outsourcing to insourcing, and their choice would be an outsourcing arrangement. On the other hand, insourcing could be a preferred choice to those who think that outsourcing would result in permanent dependence on external service providers for the information services. In addition, the firms considering an outsourcing arrangement might have the risk of spending considerable time and resources for solving problems associated with negotiating a contract or an agreement on their terms and conditions with an external service provider and the difficulty of modifying contracts or agreements with external service providers. Sourcing decision makers who perceive high risk of outsourcing would choose insourcing as their primary sourcing arrangement. Thus, it is hypothesized that:

Hypothesis 2a. The higher the outsourcing risk, the lower the tendency for IS services to be outsourced.

Hypothesis 2b. The higher the outsourcing risk, the lower the tendency of a firm to prefer outsourcing to insourcing.

IV. Methodology

To test the research hypotheses, this questionnaire survey study focused on sourcing arrangements for data processing services in the banking industry in the United States. The banking industry was chosen, because outsourcing practice is common in banks, computer data processing is major IS services in banks, and industry differences in the factors may exist.

4.1 Operationalization

IS outsourcing, a dependent variable in the research model, is a dichotomous measure which refers to a firm's primary sourcing arrangement for data processing. This study used the measure developed by Ang (1993). According to her operational definition of IS outsourcing, a bank chooses one of six major sources of IS services: (1) in-house computer operations where the bank purchases and operates hardware and software with its own personnel; (2) an IS subsidiary or division at the parent firm; (3) other financial institutions, such as correspondent banks that provide the required IS services; (4) service bureaus that provide off-site IS services; (5) facilities management where a bank has in-house computing facilities but control and management over daily computer operations are assigned to external service providers; (6) joint venture, cooperative computer service arrangement where a group of firms shares the costs of operating an IS facility. To capture any additional IS source that does not fit appropriately into any of the above six categories, an "other" category was provided to the respondents.

Whereas IS insourcing refers to in-house IS services, IS outsourcing refers to services from external service providers

including correspondent banks, service bureaus, facilities managers, and joint ventures. Affiliated banks which rely on centralized IS services from the parent bank may not have authority with regard to IS sourcing decisions. Thus, the responses from the banks that relied on their parent banks or bank holding companies for IS services were eliminated from the analysis.

Outsourcing preference, another dependent variable in this study, measures the degree to which a firm prefers outsourcing to insourcing for data processing services. The construct is operationalized by the degree to which a firm prefers outsourcing to insourcing as the ideal primary sourcing arrangement and the degree to which outsourcing is preferred, if a firm were to make a sourcing decision today. A seven point Likert scale was used to measure it (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree). The independent variables also were measured by a seven point Likert scale.

The measures for independent variables were developed by examining the existing IS outsourcing literature and previous empirical studies. Relative advantage is defined as the degree to which using external service providers is more beneficial for the firm than operating and managing an internal data center. The construct was operationalized by: (1) comparative in-house cost advantages(reverse scale); (2) external production cost advantage for the same level of services; (3) focus on core business activities; (4) focus on strategic tasks; (5) better DP support for business; (6) more timely, accurate and reliable services; (7) utilizing external technical expertise; (8) utilizing more competent staff; (9) reducing financial difficulties; and (10) adequate

budget for operating and managing an in-house data center(reverse scale). Sources of these items include numerous discussions on IS sourcing decisions (Ang, 1993; Apte, 1990; Clark and Wolfarth, 1989; Huff, 1991; Lacity and Hirschheim, 1993b; Lowell, 1992; Mitchell, 1993).

Outsourcing risk refers to the chance of loss associated with an outsourcing decision (Huff, 1991; Ketler and Walstrom, 1993; Lacity and Hirschheim, 1993b; Lowell, 1992; Martinsons, 1993). It is operationalized by: (1) the possibility of making it difficult to rebuild in-house data processing capabilities; (2) the possibility of making it difficult to accumulate expertise for data processing; (3) the possibility of unauthorized access to important data; (4) the possibility of leakage of confidential information; (5) the possibility of having problems with negotiating a contract or an agreement on terms and conditions; (6) the possibility of having difficulty in modifying contracts or agreements with external service providers.

4.2 Pilot Study

The questionnaire designed to measure variables was first examined by two IS researchers who were familiar with IS-sourcing issues to see if each item represents the construct which it is supposed to measure. As a result of the discussion with the two researchers, a few items were modified to improve the validity of each item. Three additional IS researchers, one MIS director and one bank systems consultant checked the wordings and understandability of the questionnaire. Then, the questionnaire was pretested with the executives in charge of data processing in two banks. Since they could understand clearly the questionnaire and suggested little changes, the questionnaire was mailed to 150 banks randomly selected from the list

directory used in the main study.

In the pilot study, two ways of gathering survey data were compared. One method is to mail the questionnaire to the CEO of each bank to solicit participation in the survey to ask him/her to direct the questionnaire to an executive who has the authority or is knowledgeable about sourcing arrangements for computer data processing services. One hundred questionnaires were mailed to CEOs of the banks. The other method was to mail the questionnaire directly to the executive who is responsible for computer data processing. Fifty banks were selected for this method. Since the response rates for the two methods were almost the same (20%), questionnaires were mailed to the CEOs of the banks. Mailing to CEOs can be justified in the sense that they know who are appropriate respondents in their banks for the survey. Minor changes in the items were made for the measures lacking reliability, and the data collected in the pilot study were not included in the main study.

4.3 Sampling and Data Collection

Questionnaires were mailed to a sample of the banks listed in the 1994 edition of the Polk Financial Institutions Directory published by R. L. Polk & Co. Publishers, because the directory contains a comprehensive list of banks in the United States. Since a simple random sampling may result in a list that includes only a

few large banks and many small banks, a stratified random sampling technique was employed. According to the American Bankers Association (ABA), the banks can be divided into two groups: one with total assets greater than \$1 billion (large banks) and the other with total assets less than \$1 billion (small banks). To decide an optimum number of sample size for each group, the study used the Neyman allocation formula described below (Mendenhall, et al., 1971):

$$n_h = n \left[\frac{N_h s_h}{\sum N_h s_h} \right]$$

where

n_h = sample size for each stratum,

n = total sample size,

N_h = population size for each stratum,

s_h = estimated standard deviation for each stratum.

Using the formula, which considers both population size and standard deviation, indicated that 30% of the sample banks should be large banks and 70% of the sample should be smaller banks to optimally

<Table 1> Sample Size Decision

	N_h	S_h	$N_h S_h$	n_h
Small Banks	10,430	268.64	2,801,915	700
Large Banks	425	2,826.41	1,201,224	300
Total			4,003,139	1,000

represent the population. The size of population and standard deviation of total assets for stratum were obtained from the bank directory. The standard deviations (in million) were calculated by a random sample of 80 banks for each type of banks.

To obtain adequate statistical power, a large sample (more than 100) was desirable. Thus, we mailed questionnaires to 300 large banks and 700 small banks in the United

States, assuming that response rate would be 20%, which was based on the results of the pilot study, for both large and small banks. Three weeks later, follow-up questionnaires were mailed to the banks which had not responded to the first mailing. Seven questionnaires were not deliverable. Of 246 banks that responded to the survey, 31 banks declined participation in the survey. The remaining 215 banks completed and returned the questionnaires (response rate of 21.5%), but 181 usable responses were included in the data analysis. The responses not included in the data analysis consist of 28 questionnaires from the banks whose parent or holding companies provide them with data processing services and 6 incomplete or unusable responses. For most of the banks for which their parent or holding companies provide data processing services, it was not clear that the respondents are knowledgeable about sourcing decisions. One of the reasons for the limited participation in this survey was that parent companies of the banks have the authority for making sourcing decisions. Thus, we decided to exclude those responses from the data analysis.

Non-response bias was assessed by comparing the respondents with non-respondents in terms of total assets. Responding banks refer to ones which completed and returned the questionnaires. Non-respondents were randomly selected from the list of banks which were included in the mailing list but did not respond to the survey. The result of t-test shows that there is no significant statistical difference between the means of total assets between the two sample groups ($t = 0.29$; $p = 0.77$). And the banks which responded immediately were compared with those which responded after follow-up steps were taken in terms of a few characteristics of the sample. The

results of t-tests comparing the two groups showed that there were not significant differences between the two groups in terms of total assets, number of employees and number of data processing employees at the significance level of 0.05. Thus, lack of non-response bias improves confidence that the respondents were representative of the original sample.

V. Results

5.1 Characteristics of the Respondents

One individual from each bank completed the questionnaire, and these included either the CEO (Chief Executive Officer), the president of the bank, EVP (Executive Vice President), SVP (Senior Vice President), CFO (Chief Financial Officer), VP for operations, VP for Cashier, other non-IS VP, CIO (Chief Information Officer), VP for data processing, or other non specified VP. The VPs who completed the questionnaires can be regarded as appropriate executives who represent the views of their banks with respect to sourcing arrangements for computer data processing, because the CEOs of most banks in the survey sample selected the officers to complete the questionnaires. For 15.1% of the sample, CEOs or presidents themselves answered the questionnaires (Table 2). Interestingly, about 65% of the respondents had non-IS titles such as VP-Operations and VP-Cashier, executive VP and senior VP.

The sample of banks included in the data analysis and hypothesis testing constituted a near optimal allocation for different sizes of banks. According to the Neyman allocation discussed previously, 30% of the sample should be large banks and the remaining should be small banks.

Table 3 shows that 31% of the sample banks were large and 69% were small. With this difference of only one percent, we can say that the sample adequately represents the population.

processing services include using other banks, service bureaus, facilities management and/or joint ventures.

Using a service bureau refers to arranging with an external IT vendor with

<Table 2> Titles of Respondents

Title	Frequency	%
CEO/President	27	15.1
Executive VP	17	9.5
Senior VP	23	12.8
CFO	6	3.4
VP-Operations	24	13.4
VP-Cashier	12	6.7
Other Non-IS VP	7	3.9
VP - IS/DP	31	17.3
Non-specified VP	32	17.8
Total	179	100.0

<Table 3> Characteristics of Participating Banks

Size	Currently Insourcing	Currently Outsourcing	Total
Small Banks	64	60	124(69%)
Large Banks	33	24	57(31%)
Total	97(54%)	84(46%)	100(100%)

Table 3 also shows that 46% of the banks primarily outsourced their computer data processing services, and 54% mainly insourced the services. Thus, sufficient evidence of insourcing and outsourcing practices were included in the sample. A chi-square analysis was performed to assess if the proportion of insourcing to outsourcing arrangements of large banks significantly differed from that of small banks. The analysis showed that the proportions were not significantly different statistically ($\chi^2 = .62$, $df = 1$, $p = .43$).

Table 4 presents a further breakdown of sourcing arrangements for data processing services. Major types of outsourcing arrangements for data

data processing facilities to provide data processing services. Alternatively, facilities management involves an arrangement in which banks have their own in-house data processing facilities, but control and management of data processing operations are contracted to external service providers such as Electronic Data Services and Systematics. Joint-venture refers to sharing data processing services and the costs with other firms with similar information service requirements. In-house data processing operations was the most frequently reported type of data processing arrangement, with service bureau usage being the next.

Table 5 presents the comparison of large banks with small banks in terms of

<Table 4> Type of Sourcing Arrangements by Banks

Arrangement Type	Small Banks	Large Banks	Total
In-house	64	33	97
Service Bureau	46	13	59
Parent Bank	14	14	28
Facilities Management	7	8	15
Other Banks	5	0	5
Joint Venture	1	0	1
Other	1	3	4
Total	138	71	209

<Table 5> Small Banks and Large Banks

Variable	Bank Size	Mean
Sourcing Evaluation Recency	Small	2.40 years
	Large	1.64 years
Percent of Total DP Budget for Outsourcing	Small	40.45%
	Large	35.30%
Number of Employees	Small	149
	Large	2,341
Total Assets	Small	\$297 million
	Large	\$3,510 million
Number of DP Employees	Small	5
	Large	71
DP Capacity in MIPS	Small	15 MIPS
	Large	123 MIPS

several characteristics. Large banks evaluated their sourcing arrangements more recently than small banks. On the average, large banks evaluated sourcing arrangements 1.6 years ago, whereas small banks did so an average of 2.4 years ago. The average reported percentage of the total data processing budget allocated for outsourcing is slightly smaller (35.3%) for large banks than for small banks (40.4%). The average reported number of employees

of large banks exceeds 2,000, whereas the average for small banks was 149. The average total assets was \$3,150 million for large banks and was \$297 million for small banks. The average number of data processing employees was 71 for large banks and 5 for small banks. The reported average number of MIPS (Millions Instruction Per Second) for data processing operations in Large banks was 123 and 15 for small banks.

<Table 6> Means and Standard Deviations (n=181)

Variable	Possible Range	Mean	Standard Deviation
Relative Advantage	(10, 70)	36.14	15.34
Outsourcing Risk	(5, 35)	19.28	5.71
Outsourcing Preference	(2, 14)	7.12	4.33

<Table 7> Cronbach's Alpha

Constructs	Items	Item-to-total correlation	Alpha coefficient
Relative Advantage	RA1	0.7551	0.9420
	RA2	0.7323	
	RA3	0.8363	
	RA4	0.8560	
	RA5	0.8531	
	RA6	0.8526	
	RA7	0.7279	
	RA8	0.7959	
	RA9	0.6363	
	Ra10	0.5845	
Outsourcing Risk	OR1	0.5562	0.7838
	OR2	0.5529	
	OR3	0.5165	
	OR4	0.5565	
	OR5	0.3994	
	OR6	0.6423	
Outsourcing Preference	Pre1	0.9147	0.9553
	Pre2	0.9147	

5.2 Means and Standard Deviations

Table 6 presents the means and standard deviations of the variables in this study. Mean value of 36.14 and standard deviation of 15.34 for relative advantage indicate that some respondents seem to perceive high relative advantage of outsourcing, while others feel relatively low relative advantage. It seems that the other variables also have considerable variations in the values of the variables.

5.3 Reliability and Validity of Measures

Reliability refers to the internal consistency of the measures. Van de Ven and Ferry (1980) suggested Cronbach's alpha coefficient in a range of 0.55 to 0.90 for assessing reliabilities of narrow to moderately broad constructs. The measures in this research had acceptable reliabilities, since the Cronbach's alphas were 0.94 (Relative Advantage), 0.78 (Outsourcing Risk), and 0.95 (Outsourcing Preference) (Table 7). The deletion of the item of OR5, which has a lower item-to-total correlation, did not affect significantly the alpha coefficient of 0.78 for outsourcing risk.

<Table 8> Factor Loadings for Items (n = 181)

Items\Factors	RA	OR
RA1: External cost advantage	0.73	-0.31
RA2: Less costs for the same services	0.73	-0.25
RA3: Focus on core business activities	0.81	-0.32
RA4: Focus on strategic tasks	0.82	-0.32
RA5: Better DP support	0.84	-0.29
RA6: Timely, accurate, reliable services	0.85	-0.26
RA7: Utilize technical expertise	0.71	-0.30
RA8: Utilize competent staff	0.81	-0.21
RA9: Reduce financial difficulties	0.71	-0.10
RA10: Reduce budget problems	0.60	-0.23
OR1: Difficult to rebuild in-house DP	-0.15	0.74
OR2: Difficult to accumulate expertise	-0.14	0.72
OR3: Unauthorized access to data	-0.32	0.57
OR4: Leakage of confidential information	-0.17	0.71
OR5: Difficult to write a contract	-0.28	0.45
OR6: Difficult to modify contracts	-0.33	0.69
Eigenvalues	8.10	1.53
Cumulative % of explained variance	50.67	60.24
Note:	RA = Relative Advantage OR = Outsourcing Risk	

Construct validity asks if the items are measuring the construct which they are supposed to measure. A factor analysis for all the items was conducted to examine the construct validity of the variables in the research model (Table 8). To decide the number of factors to extract, the Kaiser criterion, which suggests the retention of factors with eigenvalues greater than one, was used. Two factors, emerged from the varimax rotation, explained 60.24% of the total variance. For a factor loading to be very significant, it should exceed 0.5 (Hair, et al., 1992). Each item in Table 8 loaded very significantly on only a single factor it is supposed to measure, except for the item of OR5, which is supposed to measure outsourcing risk. Because of a low factor loading, the item of OR5 was not included in the measure for data analysis.

5.4 Comparison Between Small Banks and Large Banks

There are no statistically significant differences between small and large banks in terms of relative advantage and outsourcing preference (Table 9). Large banks, however, perceive higher outsourcing risk than small banks ($t = 2.41, p = 0.016$). It is more likely for the executives of the large banks to think that it becomes difficult to rebuild in-house data center, there is a chance of leakage of important information, and it would be difficult to modify an agreement with external vendors when data processing services are outsourced.

<Table 9> Comparison Between Small Banks and Large Banks

Variables	Types of Banks	Means	t	p-value
Relative Advantage	Small	37.03	-1.14	0.254
	Large	34.22		
Outsourcing Risk	Small	18.59	2.41	0.016
	Large	20.77		
Outsourcing Preference	Small	7.41	-1.30	0.193
	Large	6.50		

5.5 Hypothesis Testing

To test the research hypotheses, a logistic regression model and a multiple regression model were formulated. The logistic model that regresses IS outsourcing with relative advantage (RA), outsourcing risk (OR) and size (SIZE) can be written as follows:

$$P = \frac{1}{1 + e^{-z}}$$

where

P = the probability that a firm's primary sourcing arrangement is outsourcing,

e = 2.718 (base of natural logarithms),

$Z = \beta_0 + \beta_1(RA) + \beta_2(OR) + \beta_3(SIZE)$,

SIZE = bank size coded by assigning "0" for small bank and "1" for large bank,

β_j = coefficient terms (j = 1,2,3).

One method for assessing the goodness of fit of the logistic regression model compares the model predictions with the respective observed outcomes. The classifications in Table 10 shows that the logistic model predictions correctly classified 159 (87.8%) of the 181 survey sample observations.

Another method for assessing the fit of

the model is to examine the -2 Log Likelihood statistic, which has a chi-square distribution. Under the null hypothesis, all the coefficients of independent variables in the model are zero. The statistic for the sample was 135.83 (df = 3, p = .0001)(Table 11). Thus, there is sufficient information to say that at least one of the model parameters is not zero. In other words, we can say that the logistic model containing relative advantage, outsourcing risk, and bank size is useful for predicting the probability of outsourcing.

Table 11 presents the estimated coefficients and related statistics for the logistic regression model which predicts IS outsourcing from the independent variables: relative advantage, outsourcing risk and bank size. Hypothesis 1a is supported by this study, since the Wald chi-square = 39.20 and p < 0.01. We infer that relative advantage does help significantly to estimate the probability of outsourcing for a firm when other variables in the model are held constant. This suggests that the higher the relative advantage of using external service providers, the higher the tendency for IS services to be outsourced.

This study also supports Hypothesis 2a concerning the relationship between outsourcing risk and IS outsourcing, given the Wald statistic = 11.19 and p < 0.01.

<Table 10> Classification Table for IS Outsourcing

		Predicted		% of Correct Predictions
		Outsource	Insource	
Observed	Outsource	74	10	88.1
	Insource	12	85	87.6
Overall Correct Prediction: 87.8%				

<Table 11> Logistic Regression Model for Predicting IS Outsourcing

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	p-value
Intercept	2.095	1.358	2.377	0.1231
Relative Advantage	0.140	0.022	39.207	0.0001
Outsourcing Risk	-0.182	0.054	11.197	0.0008
Size	0.508	0.518	0.963	0.3263
-2 Log L = 135.831 (df = 3, p = 0.0001)				

<Table 12> Multiple Regression Model for Predicting Outsourcing Preference

Variable	Parameter Estimate	Standard Error	t	p-value
Intercept	0.417	0.813	0.513	0.6086
Relative Advantage	0.237	0.010	23.309	0.0001
Outsourcing Risk	-0.096	0.027	-3.487	0.0006
Size	-0.026	0.272	-0.098	0.9219
R-square = 0.8529				

We infer that perceived outsourcing risk significantly helps to predict sourcing arrangements for data processing services, when other variables are already included in the model. The higher the perceived outsourcing risk, the lower the tendency for IS services to be outsourced.

The multiple regression analysis, which regresses outsourcing preference with relative advantage, outsourcing risk and bank size, resulted in Table 12. Hypothesis 1b, which posited a positive relationship between relative advantage and outsourcing preference, was supported by this study ($t = 23.30, p < 0.01$). It is thus inferred that relative advantage assists in estimating outsourcing preference, when other independent variables in the model are held

constant. The higher the relative advantage of using external service provider, the higher the tendency of a firm to prefer outsourcing to insourcing. This study also supports Hypothesis 2b that there is a negative relationship between outsourcing risk and outsourcing preference ($t = -3.48, p < 0.01$). There is statistically significant information to infer that outsourcing risk assists in estimating outsourcing preference. The higher the perceived outsourcing risk, the lower the tendency of a firm to prefer outsourcing to insourcing.

As we can see in Table 11 and Table 12, bank size is not significantly associated with IS outsourcing (Wald chi-square = 0.96, $p = 0.32$) and outsourcing preference ($t = -0.09, p = 0.92$). This result is consistent

with the chi-square test to assess if the proportion of insourcing to outsourcing is the same between small banks and large banks.

VI. Conclusion

This study examined factors influencing sourcing arrangements for data processing services in the banking industry. The survey research results suggest that relative advantage and outsourcing risk are considered to be significant factors in the selection of IS sourcing arrangements. The banks with higher perceived relative advantage of using external service providers tend to outsource their data processing services, and also prefer outsourcing to insourcing. Relative advantage include higher information service quality, strategic focus, utilization of better IT facilities, cost savings and financial advantage. High correlations among these components of relative advantage indicate that banks make sourcing decisions by evaluating multiple related benefits. For example, outsourcing banks which reduce costs by outsourcing also tend to improve quality of data processing services by outsourcing.

In addition to lack of relative advantage, perceived outsourcing risk were found to be important factors explaining the reason why banks do not outsource their data processing services. Since transactions with customers in banks involve confidential information, any possibility of unauthorized access to data would make it more desirable to operate and manage in-house data center. In-house data center operations can be a preferred arrangement to the bank executives who are reluctant to lose control over data processing services, because of their perceived difficulty of rebuilding

in-house data processing capabilities in the future after outsourcing. Finally, the perceived difficulty to modify an outsourcing contract also make outsourcing less attractive.

This study also did not show that bank size is correlated with sourcing arrangements. This study reveals that outsourcing is an important strategy for smaller banks which lack data processing capabilities or smaller economies of scale, but a significant portion of large banks are also conducting outsourcing practice. This insignificant effect of size is consistent with the findings of Grover, et al. (1994).

Although it is hard to make a causal inference with this cross-sectional study, this study provides empirical support for relative advantage and outsourcing risk, which are major innovation characteristics affecting sourcing arrangements for data processing services. Further empirical evidence might be required to generalize the findings of this study to other industries and other IS functions such as telecommunication services and application development. This study supports that changing a primary sourcing arrangement can be an administrative innovation and the innovation diffusion theory is relevant to explain the outsourcing decision. Future studies may examine other innovation characteristics such as complexity and compatibility of outsourcing.

References

- _____, *Polk Financial Institutions Directory*, North American ed., Nashville, TN: R.L. Polk & Co. Publishers, 199th issue, Spring 1994.
- Ang, S., *The Etiology of Information Systems Outsourcing*, Doctoral Dissertation, University of Minnesota,

- 1993.
- Apte, U., "Global Outsourcing of Information Systems and Processing Services," *The Information Society*, Vol. 7, 1990, pp. 287-303.
- Arnett, K.P. and Jones, M.C., "Firms that Choose Outsourcing: A profile," *Information & Management*, Vol. 26, 1994, pp. 179-188.
- Aubert, B.A., Rivard S., and Patry, M., "A Transaction Cost Approach to Outsourcing Behavior: Some Empirical Evidence," *Information & Management*, Vol. 30, 1996, pp. 51-64.
- Benko, C., "Outsourcing Evaluation: A Profitable Process," *Information Systems Management*, Spring 1993, pp. 45-50.
- Buck-Lew, M., "To Outsource or Not?" *International Journal of Information Management*. Vol. 12, 1992, pp. 3-20.
- Cheon, M.J., *Outsourcing of Information Systems Functions: A Contingency Model*, Doctoral Dissertation, College of Business Administration, University of South Carolina, 1992.
- Cheon, M.J., Grover, V., and Teng J.T.C., "Theoretical Perspectives on the Outsourcing of Information Systems," *Journal of Information Technology*, Vol. 10, 1995, pp. 209-219.
- Clark, C. and Wolfarth, J.H., "A New Era in Bank Data Processing," *Bank Administration*, January 1989, pp.22-28.
- Collins, J.S. and Millen, R.A., "Information Systems Outsourcing by Large American Industrial Firms: Choices and Impacts," *Information Resources Management Journal*, Winter 1995, pp. 5-13.
- Due, R.T., "The Real Costs of Outsourcing," *Information Systems Management*, Winter 1992, pp. 78-81.
- Gantz, J., "Outsourcing: Threat or Salvation?" *Networking Management*, October 1990, pp. 25-40.
- Gebelt, M.K., *Make-Or-Buy Decisions For Application Software Development*, Doctoral Dissertation, University of California, Los Angeles, 1992.
- Grover, V., Cheon, M.J., and Teng, J.T.C., "A Descriptive Study on the Outsourcing of Information Systems Functions," *Information & Management*, Vol. 27, 1994, pp. 33-34.
- Grover, V. and Teng, J.T.C., "The Decision to Outsource Information Systems Functions," *Journal of Systems Management*, November 1993, pp. 34-38.
- Grover, V., Cheon, M.J., and Teng, J.T.C., "The Effect of Service Quality and Partnership on the Outsourcing of Information Systems Functions," *Journal of Management Information Systems*, Vol. 12, No. 4., Spring 1996, pp. 89-116.
- Gupta, U.G. and Gupta, A., "Outsourcing the IS Function; Is It Necessary for Your Organization?" *Information Systems Management*, Summer 1992, pp. 44-50.
- Hair, J.F., Anderson, R.E., Tatham, R.L., and Grabrowsky, B.J., *Multivariate Data Analysis with Readings*, Tulsa, OK: Petroleum Publishing Co., 1979.
- Henderson, J.C. and Venkatraman, N., "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," *IBM Systems Journal*, Vol. 32, No. 1, 1993, pp. 4-16.
- Huber, R. L., "How Continental Bank Outsourced Its Crown Jewels," *Harvard Business Review*, January-February 1993, pp. 121-129.
- Huff, S.L., "Outsourcing of Information Services," *Business Quarterly*, Spring 1991, pp. 62-65.
- James, P.N., "Wendell Jones: On Outsourcing," *Information Systems Management*, Fall 1993, pp. 72-77.
- Jurison, J., "The Role of Risk and Return in Information Technology Outsourcing Decisions," *Journal of Information*

- Technology*, Vol. 10, 1995, pp. 239-247.
- Kador, J., "Outsourcing Application Development: Does it Pay?," *System Builder*, April/May 1991, pp. 26-30.
- Ketler, K. and Walstrom, J., "Outsourcing as a Managerial Decision," *Decision Line*, July 1992, pp. 6-7.
- Kirkpatrick, D., "Why Not Farm Out Your Computing," *Fortune*, September 23, 1991, pp.103-110.
- Kwon T.H. and Zmud, R.W., "Unifying the Fragmented Models of Information Systems Implementation," *Critical Issues in Information Systems Research*, ed. by Boland R. J. and Hirschheim, R.A., John Wiley & Sons Ltd., 1987.
- Lacity M.C. and Hirschheim, R., "The Information Systems Outsourcing Bandwagon," *Sloan Management Review*, Fall 1993a, pp. 73-86.
- Lacity M.C. and Hirschheim, R., *Information Systems Outsourcing: Myths, Metaphors, and Realities*, New York: John Wiley & Sons, 1993b.
- Loh, L., *The Economics and Organization of Information Technology Governance: Sourcing Strategies for Corporate Information Infrastructure*, Doctoral Dissertation, MIT, February 1993.
- Loh, L. and Venkatraman, N., "Determinants of Information Technology Outsourcing: A Cross-Sectional Analysis" *Journal of Management Information Systems*, Vol. 9, No. 1, Summer 1992a, pp. 7-24.
- Loh, L. and Venkatraman, N., "Diffusion of Information Technology Outsourcing: Influence Sources and the Kodak Effect," *Information Systems Research*, Vol. 3, No. 4, December 1992b, pp. 334-358.
- Lowell, M. "Managing Your Outsourcing Vendor in The Financial Services Industry," *Journal of Systems Management*, May 1992, pp. 23-36.
- Martinsons, M.G., "Outsourcing Information Systems: A Strategic Partnership with Risks," *Long Range Planning*, Vol. 26, No. 3, 1993, pp. 18-25.
- McKay, D.T. and Connolly, M.J., "It's not Business as Usual in the Data Center," *Journal of Information Systems Management*, Spring 1991, pp. 80-83.
- McMullen, J., "New Allies: IS and Services Suppliers," *Datamation*, March 1, 1990, pp. 42-51.
- Mendenhall, W., Ott. L., Scheaffer, R.L., *Elementary Survey Sampling*, Belmont, CA: Wadsworth Publishing Co., Inc., 1971.
- Mitchell, R., "Third-Party Processors Continue to Grow," *Bank Management*, June 1993, pp.61-60.
- Pfeffer, J., *Power in Organizations*, Cambridge, MA: Ballinger Publishing Co., 1981.
- Quinn, J.B. and Hilmer, F.G., "Strategic Sourcing," *Sloan Management Review*, Vol. 35, 1994, pp. 43-55.
- Radding, A., "Outsourcing," *Bank Management*, May 1990, pp. 56-61.
- Rochester, J. and Douglass, D. (eds), "Taking an Objective Look at Outsourcing," *I/S Analyzer*, Vol. 28, No. 9, September 1990, pp. 1-12.
- Sinensky, A., Wasch R.S., "Understanding Outsourcing: A Strategy For Insurance Companies," *Journal of Systems Management*, January 1992, pp. 32-36.
- Smith, M.A., Mitra, S., and Narasimhan, S., "Offshore Outsourcing of Software Development and Maintenance: A Framework for Issues," *Information & Management*, Vol. 31, 1996, pp. 165-175.
- Tornatzky, L.G. and Klein, K.J., "Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management*, February 1982, pp. 28-45.
- Van de Ven, A.H. and Diane L.F., *Measuring and Assessing*

Organizations, New York, NY: John Wiley, 1980.

Wagner, J.L., "Factors in the Outsourcing Decision," *Journal of End User Computing*, Vol. 6, No. 2, Spring 1994, pp. 27-31.

Williamson, O.E., *Markets and Hierarchies: Analysis and Antitrust Implications*, New York: the Free Press, 1975.

Williamson, M., "Outsourcing: The Decision," *CIO*, October 15, 1991, pp. 33-35.