

The Factors Affecting Outsourcing of Data Processing Services

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< Contents >

I. Introduction	V. Results
II. Previous Studies of IS Outsourcing	5.1 Characteristics of the Respondents
III. Research Model and Hypotheses	5.2 Means and Standard Deviations
IV. Methodology	5.3 Reliability and Validity of Measures
4.1 Operationalization	5.4 Hypothesis Testing
4.2 Pilot Study	VI. Conclusion
4.3 Sampling and Data Collection	References
	국문초록

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

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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 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.

The purpose of the study is, thus, to explain major factors affecting sourcing arrangements of 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 views outsourcing as an administrative innovation and emphasizes the perspective of strategic sourcing.

The paper first reviews major previous studies on the determinants of outsourcing, and provides a research model and hypotheses, followed by details of research methods. Finally, the research results and conclusions are discussed.

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 are 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

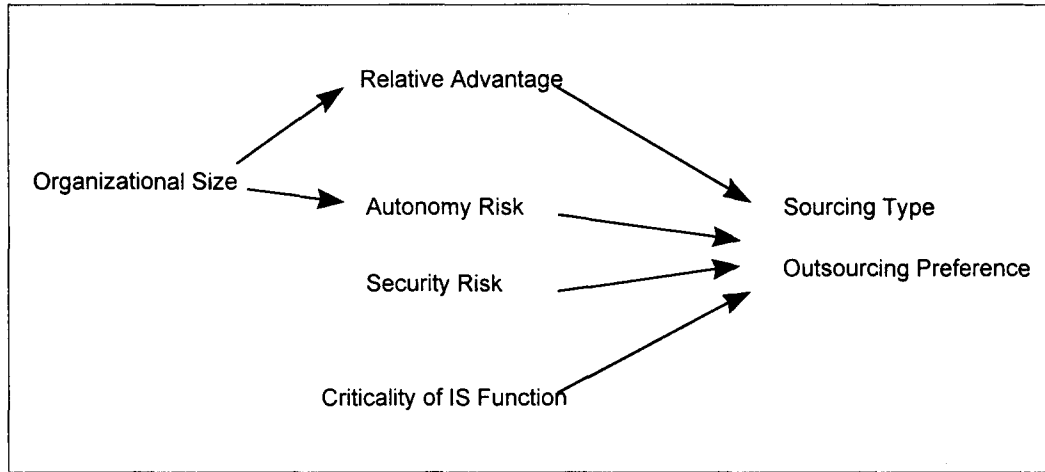
The studies focused on outsourcing decisions present that managers consider benefits and risks of outsourcing when they make a sourcing arrangement. Quinn and Hilmer (1994) conclude that outsourcing decisions involve the potential for obtaining competitive advantage and strategic vulnerability. Jurison (1995) discusses that expected benefits and risks of outsourcing are major factors affecting sourcing decisions. Based on these studies, the present study focuses on relative advantage and outsourcing risks 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 security and autonomy risks as innovation characteristics which would be important predictors of IS sourcing arrangements.

The principles of strategic sourcing decision-making concerning engineered products and process technology suggest that managers should consider not just cost factors but also the role of the transaction in attaining or sustaining a competitive advantage (Venkatesan 1992, Welch and Nayak, 1992). The strategic sourcing model implies that IS functions with strategic importance should be kept in-house. Insourcing enables organizations to invest in and learn the relevant latest technologies so that strategies can be changed in response to dynamic business environments. Hence, criticality of IS function is included in this study.

The research model shown in Figure 1 includes two dependent variables: sourcing type and outsourcing preference. Sourcing type 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

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



<Figure 1> Research Model

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.

Riskiness is another innovation characteristic affecting adoption of an outsourcing arrangement. Primary outsourcing risks addressed by the IS literature include security and autonomy 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.

Autonomy risk 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. 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 security risk, the lower the tendency for IS services to be outsourced.

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

Hypothesis 3a. The higher the autonomy risk, the lower the tendency for IS services to be outsourced.

Hypothesis 3b. The higher the autonomy risk, the lower the tendency of a firm to prefer outsourcing to insourcing.

IS researchers also recommend that critical IS functions, in general, should be retained and that other non-critical IS functions may be outsourced (Gupta and Gupta, 1992; James, 1993; McMullen, 1990; Kador, 1991). The criticality of an IS function refers to the importance of such IS function for making a significant contribution to the organization's "competitive position and profits" (Ang 1993, p. 79). Outsourcing IS services often leads to loss of control of IS resources (James, 1993). Organizations will avoid losing their autonomy, particularly when a stable supply of high quality IS services is vital for the organization's competitive strategy. As the strategic importance of the IS function for the organization increases, therefore, the organization will proactively avoid dependence on external organizations, i.e., outsourcing IS services. Thus, we can hypothesize that:

Hypothesis 4a. The higher the criticality of IS function, the lower the tendency for IS services to be outsourced.

Hypothesis 4b. The higher the criticality of IS function, the lower the tendency of a firm to prefer outsourcing to insourcing.

Organizational size would explain variations of IS sourcing arrangements, since it has been an important variable affecting organizational behavior. Large organizations may have greater internal IS departments with latest information technologies. Large organizations may be more functionally differentiated and may have more specialized and competent IS staff (Mileti, et al., 1977). Small organizations, however, may not

allocate sufficient funds for building and maintaining mature IS departments which can operate efficiently. Thus, small organizations would have greater relative advantages of outsourcing than large organizations.

Since outsourcing arrangements involves transferring IS functions to external organizations, the organizations which outsource IS activities may not accumulate internal IT expertise and lose their autonomy for managing internal IS functions. Large organizations may have greater difficulties in returning to insourcing when the outsourcing period ends, because they have to rebuild greater IS functions than small organizations. Small organizations, with the assistance of external consultants, would not have much problems with rebuilding their internal IS capabilities and perceive less autonomy risk.

Hypothesis 5. The firm size is negatively related to relative advantage of outsourcing an IS function.

Hypothesis 6. The firm size is positively related to autonomy risk of outsourcing an IS function.

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

Sourcing type, 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 sourcing type, 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).

Security risk refers to the possibility of a leakage of critical information, which

might occur from processing data by external service providers. It is operationalized by: (1) the possibility of unauthorized access to important data; (2) the possibility of leakage of confidential information; and (3) the possibility of leakage of strategic information.

Autonomy risk is the possibility of losing control over IS activities, which might be caused by outsourcing. It is operationalized by: (1) the possibility of making it difficult to rebuild in-house data processing capabilities and (2) the possibility of making it difficult to accumulate expertise for data processing.

Criticality of IS function refers to the extent to which an IS function contributes to the firm's competitive position and profits. It is operationalized by the impact of computer data processing on (1) profits, (2) revenue growth rate and (3) competitive position.

Finally, organizational size is measured by total assets of banks. Large banks refers to the ones with total assets greater than \$1 billion and small banks refers to the ones with total assets less than \$1 billion.

4.2 Pilot Study

The questionnaire designed to measure variables was first examined by two IS researchers who were familiar with IS sourcing issues. 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 bank 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 (Mendenhall, et al., 1971). 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 represent the population.

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.

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 1). Interestingly, about 65% of the respondents had non-IS titles such as VP-Operations and VP-Cashier, executive VP and senior VP.

<Table 1> 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

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 2 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.

<Table 2> 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 2 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 ($\chi^2 = .62$, $df = 1$, $p = .43$). In other words, the result does not support that bank size is significantly associated with sourcing type.

Table 3 presents a further breakdown of sourcing arrangements for data processing services. Major types of outsourcing arrangements for data processing services include using other banks, service bureaus, facilities management and/or joint ventures.

<Table 3> 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

Using a service bureau refers to arranging with an external IT vendor with 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 4> 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

Table 4 presents the comparison of large banks with small banks in terms of 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.

5.2 Means and Standard Deviations

Table 5 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.

<Table 5> Means and Standard Deviations (n=181)

Variable	Possible Range	Mean	Standard Deviation
Relative Advantage	(10, 70)	36.14	15.34
Security Risk	(3, 21)	9.82	4.04
Autonomy Risk	(2, 14)	8.79	2.67
Criticality of IS Function	(3, 21)	14.05	3.26
Outsourcing Preference	(2, 14)	7.12	4.33

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), 0.82 (Security Risk), 0.71 (Autonomy Risk), 0.66 (Criticality of IS Function) and 0.95 (Outsourcing Preference) (Table 6).

<Table 6> 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	
Security Risk	SR1	0.7105	0.8246
	SR2	0.7547	
	SR3	0.5844	
Autonomy Risk	AR1	0.5598	0.7135
	AR2	0.5598	
Criticality of IS Function	CI1	0.4187	0.6623
	CI2	0.4293	
	CI3	0.5800	
Outsourcing Preference	Pre1	0.9147	0.9553
	Pre2	0.9147	

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 7). To decide the number of factors to extract, the Kaiser criterion, which suggests the retention of factors with eigenvalues greater than one, was used. Four factors, emerged from the varimax rotation, explained 69.10% 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 7 loaded very significantly on only a single factor it is supposed to measure.

<Table 7> Factor Loadings for Items (n = 181)

Items\Factors	RA	SR	CI	AR
RA1: External cost advantage	0.75	-0.22	-0.03	-0.15
RA2: Less costs for the same services	0.74	-0.16	-0.03	-0.15
RA3: Focus on core business activities	0.83	-0.20	0.00	-0.14
RA4: Focus on strategic tasks	0.84	-0.22	-0.03	-0.16
RA5: Better DP support	0.85	-0.22	-0.05	-0.10
RA6: Timely, accurate, reliable services	0.86	-0.19	-0.04	-0.10
RA7: Utilize technical expertise	0.74	-0.17	0.00	-0.17
RA8: Utilize competent staff	0.83	-0.09	-0.04	-0.12
RA9: Reduce financial difficulties	0.69	-0.19	0.08	0.02
RA10: Reduce budget problems	0.63	-0.05	0.05	-0.19
SR1: Leakage of strategic info.	-0.30	0.83	-0.05	0.08
SR2: Leakage of confidential info.	-0.37	0.81	-0.02	0.11
SR3: Unauthorized access to data	-0.19	0.69	-0.06	0.33
CI1: Impact on competitive position	-0.15	-0.10	0.68	0.32
CI2: Impact on profits	0.05	-0.11	0.75	-0.28
CI3: Impact on revenue growth	0.03	0.07	0.86	0.32
AR1: Difficult to rebuild in-house DP	-0.23	0.25	-0.04	0.77
Eigenvalues	8.00	1.90	1.52	1.01
Cumulative % of explained variance	44.45	55.02	63.48	69.10

Note: RA = Relative Advantage
 SR = Security Risk
 CI = Criticality of IS Function
 AR = Autonomy Risk

5.4 Hypothesis Testing

To test the research hypotheses, a logistic regression model and a multiple regression model were formulated, and t-tests were performed to examine the effects of organizational size. The logistic model that regresses sourcing type with relative advantage (RA), security risk (SR), autonomy risk (AR) and criticality of IS function (CI) 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),
 $Z = \beta_0 + \beta_1 (RA) + \beta_2 (SR) + \beta_3 (AR) + \beta_4 (CI)$,
 β_j = coefficient terms ($j = 1,2,3,4$).

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 8 shows that the logistic model predictions correctly classified 154 (85.1%) of the 181 survey sample observations.

<Table 8> Classification Table for Sourcing Type

		Predicted		% of Correct Predictions
		Outsource	Insource	
Observed	Outsource	71	13	84.5
	Insource	14	83	85.6
Overall Correct Prediction: 85.1%				

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 113.16 ($df = 4, p = 0.0001$)(Table 9). 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, security risk, autonomy risk, and criticality of IS function is useful for predicting the probability of outsourcing.

<Table 9> Logistic Regression Model for Predicting Sourcing Type

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	p-value
Intercept	2.922	1.852	2.488	0.1147
Relative Advantage	0.140	0.022	39.132	0.0001
Security Risk	-0.164	0.072	5.171	0.0230
Autonomy Risk	-0.207	0.102	4.148	0.0417
Criticality of IS	0.066	0.078	0.713	0.3982
-2 Log L = 113.169 ($df = 4, p = 0.0001$)				

Table 9 presents the estimated coefficients and related statistics for the logistic regression model which predicts sourcing type from the independent variables: relative advantage, security risk, autonomy risk and criticality of IS function. Hypothesis 1a is supported by this study, since the Wald chi-square = 39.13 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 security risk and sourcing type, given the Wald statistic = 5.17 and $p = 0.02$. We infer that perceived security risk significantly helps to predict sourcing arrangements for data processing services, when other variables are already included in the model. The higher the perceived security risk, the lower the tendency for IS services to be outsourced. Hypothesis 3a, which hypothesized that autonomy risk is negatively related to sourcing type, is supported by the Wald statistic = 4.14 and $p = 0.04$. The higher the perceived autonomy risk, the lower the tendency for IS services to be outsourced.

This study fails to support Hypothesis 4a that there is a negative relationship between criticality of IS function and sourcing type (the Wald statistic = 0.71 and $p = 0.39$). There is no statistically significant information to infer that the criticality of computer data processing assists in estimating the probability of outsourcing.

The multiple regression analysis, which regresses outsourcing preference with relative advantage, security risk, autonomy risk and criticality of IS function, resulted in Table 10. Hypothesis 1b, which posited a positive relationship between relative advantage and outsourcing preference, was supported by this study ($t = 23.38$, $p < 0.01$). 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 security risk and outsourcing preference ($t = -2.27$, $p = 0.02$). There is statistically significant information to infer that security risk assists in estimating outsourcing preference. The higher the perceived security risk, the lower the tendency of a firm to prefer outsourcing to insourcing. This study, however, does not support Hypothesis 3b ($t = -1.40$, $p = 0.16$) and Hypothesis 4b ($t = -0.48$, $p = 0.62$). There is insufficient information to say that autonomy risk and criticality of IS function are negatively related to outsourcing preference.

<Table 10> Multiple Regression Model for Predicting Outsourcing Preference

Variable	Parameter Estimate	Standard Error	t	p-value
Intercept	0.296	1.003	0.296	0.7677
Relative Advantage	0.239	0.010	23.382	0.0001
Security Risk	-0.089	0.039	-2.272	0.0243
Autonomy Risk	-0.077	0.055	-1.408	0.1610
Criticality of IS	-0.019	0.039	-0.488	0.6258
R-square = 0.8508				

In order to examine the effect of size on relative advantage and autonomy risk, the Pearson correlation coefficients (r) were calculated and t-tests were performed (Table 11). Hypothesis 5, which posited that organizational size is negatively related to relative advantage, was not supported ($r = -0.08$, $p = 0.25$). There was no significant difference between small banks and large banks in terms of relative advantage ($t = -1.14$, $p = 0.25$). Hypothesis 6 concerning the positive relationship between organizational size and autonomy risk was supported ($r = 0.18$, $p = 0.01$). The bank executives of large banks tend to perceive higher autonomy risk occurring from outsourcing data processing function. We can say that large banks have higher autonomy risk than small banks ($t = 2.97$, $p < 0.01$).

<Table 11> 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		
Security Risk	Small	9.47	1.71	0.088
	Large	10.57		
Autonomy Risk	Small	8.40	2.97	0.003
	Large	9.64		
Criticality of IS Function	Small	13.73	1.97	0.0502
	Large	14.75		

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 security 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 security risk was found to be an important factor 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. Whereas autonomy risk, which refers to the perceived difficulty of accumulating internal IS expertise and rebuilding in-house data processing capabilities in the future after outsourcing, was related to sourcing type, it was not significantly related to outsourcing preference. Sourcing type reflects the current sourcing arrangement, and outsourcing preference is concerned with the currently preferred sourcing arrangement which might influence a future sourcing decision. Thus, the mixed results for the two dependent variables imply that the bank executives who perceive low autonomy risk tend to outsource data processing services, but we do not have sufficient information to say that autonomy risk is a significant determinant of current sourcing preference. It would be necessary to perform further studies in order to resolve the inconsistent findings and reach a conclusion on the effects of autonomy risk.

This study did not show that criticality of IS function is related to sourcing arrangements. Perhaps, this result implies that the bank executives who think that their data processing function is critical also consider using external service providers. The study results also did not support that bank size is correlated with relative advantage and sourcing type. The reason would be that outsourcing can be an important strategy for small banks which lack data processing capabilities or smaller economies of scale, but a significant portion of large banks recognizes

relative advantage of outsourcing and are also conducting outsourcing practice. Although large banks may have greater economies of scale which would make insourcing more attractive, they could also find other factors which could make outsourcing more attractive. In other words, large banks as well as small banks can focus on core business, obtain higher quality of data processing services, and utilize advanced IT by using external service providers. Thus, large banks also might prefer outsourcing to insourcing and make an outsourcing arrangement. We need further studies, however, to clarify the effect of bank size or organizational size on IS sourcing decisions. On the other hand, bank size was positively related to autonomy risk in this study. Large banks seem to be more sensitive to the failure of accumulating internal IT expertise and the difficulty of rebuilding internal data center after outsourcing.

Although it is hard to make a causal inference with this cross-sectional study, this study provides empirical support for relative advantage and two types of outsourcing risks, 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

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< 국문초록 >

자료처리서비스의 아웃소싱에 영향을 미치는 요인

이 민 화

정보시스템 기능의 아웃소싱이 정보시스템 효율과 효과성을 향상시킬 수 있는 전략으로 고려됨에 따라 소싱유형의 결정요인을 식별하는 것은 중요하다고 할 수 있다. 본 연구는 은행 산업에 있어서 데이터 처리 서비스의 소싱결정에 영향을 주는 요인을 조사하였다. 아웃소싱을 관리적 혁신으로 볼 때, 혁신특성으로서 상대적 이점과 위험성이 소싱유형의 중요한 결정요인으로 제시된다. 미국의 1,000개 은행을 대상으로 한 현장연구(field survey)의 결과는 상대적 이점과 보안위험이 소싱유형 및 아웃소싱 선호도와 유의한 관계가 있다는 것을 보여주었다. 또한 대규모 은행이 소규모 은행 보다 아웃소싱에 대해 더 큰 자율성 위험을 가지고 있는 것으로 나타났다. 그러나 자율성 위험과 두 종속변수와의 관계에 대해서는 비일관적인 결과가 나타났고, 정보시스템 기능의 중요성과 소싱유형 및 선호도와의 관계, 조직규모와 상대적 이점과의 관계를 연구결과가 충분히 지지하지 못하고 있다.