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# 정보시스템 아웃소싱의 결정 요인에 관한 실증적 연구

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# An Empirical Study on the Determinants of Information Systems Outsourcing

*Faced with the challenge of reducing costs and improving competitive position, firms have recognized outsourcing as an important information systems (IS) strategic option. It has not been understood clearly what determines IS outsourcing. Based on the IS literature and transaction cost economics, cost efficiency related factors were identified, and a questionnaire survey was conducted. The results based on 181 responses from the bank executives in U.S. revealed that vendor production cost advantage and transaction risk are significant predictors of degree of outsourcing and outsourcing preference for data processing services. Insufficiency of IS funds and information technology uncertainty were found to be not only positively associated with vendor production cost advantage, but also directly associated with outsourcing preference and degree of outsourcing. Firm size is, however, not significantly related to vendor production cost advantge and IS outsourcing.*

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# I. INTRODUCTION

Outsourcing is the process of turning over all or part of an organization's information systems (IS) activities to external vendors, whereas insourcing is managing internal IS units to provide information services to users in the organization. The scope of IS outsourcing has changed from partial outsourcing which comprises a small portion of IS budget to total outsourcing which transfers a significant piece of IS activities to external vendors such as EDS (Electronic Data Systems) and Systematics (Lacity and Hirschheim, 1993c). Earlier forms of partial outsourcing includes contract programming, time-sharing and purchase of packaged software, whereas more recent total outsourcing includes turning over the entire hardware and software support to an external vendor.

Outsourcing is an important issue in the field of information systems (IS). Clark (1992)'s analysis of interviews with senior IS executives from 30 companies reveals that "management of outside services" is one of six systems management issues. Cash, et al. (1992) include sourcing policy as an underlying theme of corporate IS management. This recognition reflects the current trend of IS outsourcing. After Eastman Kodak's turning over its data center, network, and microcomputer operations to external vendors in the late 1980s, outsourcing expenditures in companies have rapidly grown and will continue to increase in the 1990s(Loh and Venkatraman, 1992b). Grover and Teng (1993, p. 34) cites that "according to Input Corporation of Vienna, Virginia, the outsourcing market is expected to jump from $10 billion in 1991 to about $27 billion in 1997."

Growing outsourcing expenditures have attracted attention of IS researchers who are interested in various aspects of the trend. There are researchers addressing outsourcing contract issues (e.g., Richmond, et al., 1992). Some researchers discuss various reasons why firms outsource and why they do not outsource(e.g., Gupta and Gupta, 1992 ; Grover and Teng, 1993 ; McFarlan and Nolan, 1995 ; Ketler and Walstrom, 1993). Other researchers performed empirical studies to explain the recent phenomenon of outsourcing. Loh and Venkatraman (1992a), based on the data from 55 major U.S. corporations, showed that business cost structure (e.g., costs/total assets) and information technology (IT) cost structure (e.g., IT ex-

penditure/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.

Lacity and Hirschheim (1993b) conducted an in-depth, multiple case study of IS outsourcing from the perspectives of both Williamson's (1975) transaction cost economics 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.

Arnett and Jones (1994)'s survey examined structural and managerial characteristics of organizations that outsource IS activities. They reported that CEOs who are heavily involved in a steering committee are less likely to outsource, and further distance between the CEO and IS manager makes it more likely that IS functions are outsourced. Grover, et al. (1994) reported an exploratory survey which describes the relationship between outsourcing and size, industry and information intensity. Collins and Millen (1995)'s survey research described current practice about reasons for outsourcing, effects of outsourcing on the firm, and vendor selection.

Although an increasing number of studies describing the practice of IS outsourcing have recently appeared in the IS journals, there are still additional factors affecting outsourcing which require further attention of researchers. The purpose of this research is to examine such cost-efficiency related factors that are considered by bank executives when making sourcing arrangements for data processing services. Empirical tests about the relationships between those factors and sourcing arrangements would produce useful information that may help managers who are unfamiliar with outsourcing to make a more rational sourcing decision. An effective sourcing decision can result in increased IS productivity and stronger competitive position of a firm.

To understand IS sourcing arrangements of firms more clearly and completely, studies may focus on a different scope of industries and IS services. The scope of

IS services includes data processing operations and management, applications development and maintenance, telecommuni-cation management, end-user support, education and training, etc. This study focused on data processing services in the banking industry in the United States, because outsourcing of data processing in banks is a relatively common practice in the country.

In the next section, the paper provides a brief review of transaction cost economics on which major variables of the research model are based. The research hypotheses are then described, followed by details of research methods. Finally, the research results and conclusions are discussed.

## II. Theoretical Background

This research is primarily based on the transaction cost economics (TCE) which focuses on determining the appropriate governance structure for a transaction, "an exchange of goods or services between two entities" (Elam 1988, p. 85). The TCE explains why many firms produce some goods and services internally rather than purchase them from external, specialized organizations (Williamson, 1975, 1979). The governance choice for IS activities can also be explained by applying the concepts of the TCE (Lacity and Hirschheim, 1993b).

According to Williamson's (1975) TCE, transactions are governed by either by a market or a hierarchy. Market governance refers to purchasing goods or services from other economic entities, whereas hierarchical governance refers to producing goods and services "through some type of predefined management structure for a single administrative entity" (Elam 1988, p. 85). Outsourcing data center operations, for example, to an external vendor involves a market governance structure, since the contract terms such as price and quality of services are generally determined by the forces of supply and demand for the services. The operation of an internal data center reflects a hierarchical governance structure, i.e., insourcing.

The TCE implies that managers should consider transaction costs, as well as production costs when choosing a governance structure for IS services (Lacity and Hirschheim, 1993b). Production costs of IS services are the costs to produce the information services, such as the costs of hardware, software, and personnel. Transaction costs, according to Clemons and Row (1992), are decomposed into coordination

costs and transaction risk. Similarly, Gurbaxani and Whang (1991) divided transaction costs into contractual costs and operational costs. Coordination costs are operational costs such as exchanging information between the two economic entities. The costs, in hierarchical governance, which correspond to external coordination costs are internal coordination costs, taking the form of administration costs of supervising employees. Transaction risk is the possibility of opportunistic behavior or underperformance of an external vendor due to conflicting interests between the two entities, leading to higher contractual costs of writing and enforcing outsourcing agreements. Transaction risk or contracting costs are major transaction costs to be considered when making an IS sourcing decision, because coordination costs are "largely independent of whether the interaction occurs within a single firm or crosses firm boundaries" (Clemons and Row, 1992, p.15).

A market governance structure tends to have lower production costs than a hierarchical structure, because market competition allows consumers to purchase products and services at efficient prices (Malone, Yates, and Benjamin, 1987). In fact, a major driving force for IS outsourcing is that external vendors can provide information services to clients at a lower cost, due to external vendors' production economies of scale achieved in terms of physical, human, and technological resources (Martinsons, 1993). An external vendor can purchase computing facilities at volume discounts and share them with many customers. External vendors also can more easily hire high quality IS professionals and invest, with less risk, in learning advanced technologies, such as object-orientated software engineering techniques, because these external vendors can spread their new technology investments and learning costs over a large volume of tasks from multiple clients. The economies of scale for systems development are generally smaller than those for data center and communications operations, due to the fact that applications development involves more unique, firm-specific requirements (Apte, 1990).

The transaction cost for a market governance structure, however, tends to be higher than the internal coordination cost for a hierarchical governance structure, because of relatively significant transaction risk or the costs of selecting external vendors, negotiating and writing contracts, and handling any disputes. Hence, it is im-

portant to take into account the total cost, consisting of production cost and transaction cost, to determine an appropriate governance structure for a given transaction. From the economic point of view, the growth of IS outsourcing would be attributed to relatively low perceived outsourcing transaction risk and cost savings which can be expected to be achieved by outsourcing.

## III. Research Hypotheses

Based on the TCE and other existing literature concerning outsourcing, major variables and their expected relationships were identified and shown in Figure 1. The dependent variables of outsourcing preference and degree of outsourcing will be predicted by vendor production cost advantage and transaction risk. Vendor production cost advantage will, in turn, be predicted by insufficiency of IS funds, IT uncertainty, and firm size.

Degree of outsourcing refers to the extent to which a firm is currently outsourcing its data processing function. The current arrangement, however, may not fully represent the firm's preferred type of sourcing, if a long period of time has passed since the last sourcing decision. Hence, outsourcing preference was included in the model to address the degree to which a firm prefers outsourcing as a primary arrangement to insourcing.

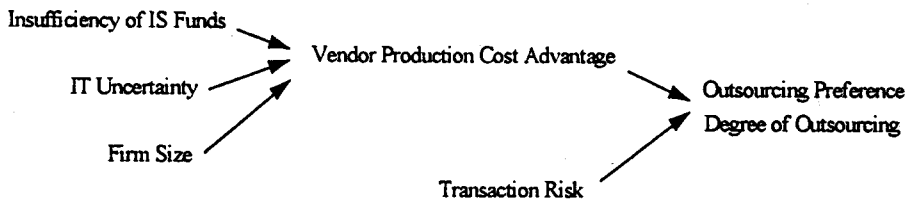


Figure 1. Research Model

### 3.1. Vendor Production Cost Advantage

As the TCE implies, production cost is a major factor influencing a make-or-buy decision of IS services. Production cost advantages of utilizing external vendors have been regarded as a major incentive for outsourcing of IS activities (Gupta and Gupta, 1992 ; Lowell, 1992 ; Rochester and Douglass, 1990). Since it is difficult to

estimate production costs of complex IS services, relative costs of external versus internal production are considered, rather than actual production costs. Outsourcing would be a preferred choice when the service fees charged by external vendors are lower than the internal production costs of the firm.

Lower production costs of external vendors stem from their economies of scale. An industry rule of thumb suggests that if a data center supports less than 50 MIPS (million instructions per second), then the outsourcing option should be evaluated (Huff, 1991 ; Kelly, 1990). An analysis based on many customers revealed that "costs per central processing unit (CPU) minute are lowest for data centers in the 135 to 200 MIPS range" (Lacity and Hirschheim 1993a, p. 77). Savings gained primarily from external vendors' economies of scale can range from 10% to 50% (Benko, 1992). Spreading the fixed costs over a larger volume provides the basis for cost advantages of external vendors (Martinsons, 1993). Thus, we hypothesize that :

*Hypothesis 1a : The greater the production cost advantage of external IT vendors, the greater the tendency of a firm to prefer outsourcing to insourcing.*

*Hypothesis 1b : The greater the production cost advantage of external IT vendors, the greater the degree of outsourcing an IS function.*

### 3.2. Transaction Risk

The TCE suggests that firms considering outsourcing should be aware of various transaction costs of dealing with external IT vendors. There are two categories of transaction costs : costs of coordination and costs of transaction risk (Clemons and Row, 1992). Transaction risk is regarded as a more important element, because the costs of coordination between a firm and an IT vendor are almost equivalent to the internal coordination costs of insourcing, such as supervision and communication among organizational members. Transaction risk is the possibility of opportunistic behavior by the external vendor to the outsourcing relationship. Since both IT vendors and their clients basically seek their own profits, external vendors, who have much experiences with outsourcing contracts, might behave opportunistically unless a strategic partnership between the two parties are established.

Major sources of transaction risk in the context of IS outsourcing include irreversibility, performance shirking, and security. Irreversibility means that a firm which outsources IS functions loses opportunities for accumulating technical expertise about the area that has been outsourced. As a result, the firm, which has only invested in building a cooperative relationship with the external vendor, would find it difficult to rebuild the outsourced function internally when the contract period ends (Martinsons, 1993). On the other hand, the external vendor who has been familiar with the operation of the firm may be at a considerable advantage in the future contract renegotiations.

Another source of transaction risk is the possibility of performance shirking by the external vendor, who is not willing to provide its best services to meet the needs of an individual client firm (Lowell, 1992). Because of conflicting self−interests, for example, an external vendor may reduce quality of IS services to improve its profitability. It is necessary, thus, to monitor the performance of an external vendor to check if the services are delivered as specified in the contract.

Finally, IS outsourcing might involve a higher risk of security, since corporate data are handled by the people in an external organization, who may benefit from using the data. Proper measures should be taken, thus, in the contract to keep strategic information confidential. Even if an external vendor has economies of scale that allows lower production costs, significant transaction risk in executing an outsourcing contract would make outsourcing less attractive. Hence, we hypothesize that :

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

*Hypothesis 2b : The higher the outsourcing transaction risk, the lower the degree of outsourcing an IS function.*

### 3.3. Insufficiency of Information Systems Funds

Lack of financial resources, in general, makes outsourcing more attractive. Firms under poor financial performance often downsize, as a cost cutting strategy, by using layoffs and other forms of work force reduction (Sutton and D'aunno, 1989). Outsourcing can be a way of downsizing that can help to alleviate finan-

cial difficulties (Williamson, 1991). Financial difficulties can be reduced, because firms often have a chance to receive cash infusions from the sale of hardware, investment in stocks, and favorable payment schedules (Lacity and Hirschheim 1993b).

Firms with insufficient funds to invest in IT resources will have difficulty in managing and operating in-house data processing efficiently and effectively. Faced with the challenge of lowering IS costs, firms often need significant IT investments such as hardware and software upgrades and personnel training. Without a large capital expenditure, it is often not possible to improve IS efficiency (Huff, 1991). The funds for computer-aided software engineering tool may lead to improved software productivity (Bordoloi and Lee, 1994). Similarly, adequate investments in internal data center facilities may have the effect of lowering variable costs of processing corporate data, which would result in improved IS productivity. Automating a data center and improved application programs, for instance, may improve the efficiency of computer data processing of a firm. Sufficient IS funds in a firm, therefore, would increase comparative cost advantage of using an internal data center. Conversely, lack of funds would result in inefficient internal IS operations. Thus, we hypothesize that :

*Hypothesis 3. Insufficiency of information systems funds of a firm is positively related to vendor production cost advantage.*

### 3.4. Information Technology Uncertainty

IT uncertainty refers to a firm's inability to predict and keep up with changing IT. Technological changes in IS areas are so rapid that the internal IS group in an organization is often in a weaker position to invest in new technologies than external vendors. It would be easier for external vendors to predict future IT changes and invest in new IT, because they often have greater economies of scale and competent IT staff. The firms, who are less developed in IT and have difficulty in keeping up with technological changes, may find that they have not sufficient economies of scale necessary to justify learning new IT and to make operation of an internal data center efficient. Thus, those firms are likely to have lower production cost efficiency than external vendors whose core business is to provide information services.

Outsourcing allows the firms with high IT uncertainty to transfer the risks of technological obsolescence to external vendors (Wagner, 1994). External IT vendors are expected to continue to invest in more advanced technologies and provide their client firms with IS services based on those new technologies. The firms which lack technical expertise may choose using advanced technologies possessed by vendors rather than assuming the risk of keeping up with new IT.

Balakrishnan and Wernerfelt (1986, p. 348) explain how uncertainty associated with technological changes influences the governance structure of a transaction :

> According to the standard analysis of Williamson (1975), uncertainty will, in general, lead to more vertical integration... As the number of contingencies in the contract goes up, it becomes more expensive to write, monitor and enforce so that vertical integration becomes more attractive... For a particular type of uncertainty, the possibility of technological obsolescence, the relationship does, however, reverse... as the likelihood of obsolescence goes up, the expected profitability of the investment goes down...

Consistent with Balakrishnan and Wernerfelt's (1986) position, it is proposed that IT uncertainty tends to make the outsourcing of IS services more attractive. Thus, we hypothesize that :

> *Hypothesis 4 : Perceived IT uncertainty of a firm is positively related to vendor production cost advantage.*

### 3.5. Firm Size

Firm size has been an important variable influencing organizational structure and behavior in organizational and information systems studies (Grover, et al., 1994 ; Robbins, 1983 ; Saunders and Jones, 1992). Since larger firms purchase greater hardware and software to deal with larger information processing requirements, they are more likely to have volume discounts and accumulate technical skills necessary to operate the facilities (Lacity and Hirschheim, 1993b). The larger the organization, the greater the functional differentiation of the organization (Miletic, et al., 1977). The larger firms with a mature IS department and information centers, thus, may have more functionally specialized IS activities. The economies of scale and functional specialization

which can be obtained in a larger firm would make its internal data center to compete with external vendors. Conversely, small firms with less specialized IS function would be less efficient in operating an internal data center. Perhaps, small firms prefer transferring data processing function to external vendors, because of their smaller economies of scale in information systems area. Thus, it is hypothesized that :

*Hypothesis 5 : Firm size is negatively related to vendor production cost advantage.*

# Ⅳ. Research Methodology

## 4.1. Operationalization of Research Variables

The type of current sourcing arrangement can be either insourcing or outsourcing. Insourcing is operating and managing in-house data processing facilities, whereas outsourcing of data processing services includes using other banks, service bureaus, facilities management, and joint venture. The banks that relied on their parent banks or bank holding companies for data processing services were not included in this study, because it was not clear whether or not they have the authority with regard to sourcing decisions.

The two dependent variables are degree of outsourcing and outsourcing preference. Degree of outsourcing is the degree to which a firm is currently outsourcing its data processing function. It is measured by the percentage of the current data processing budget allocated for outsourcing. Outsourcing preference 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, and 7 = strongly agree).

The independent variables, except for firm size, and the mediating variable also were measured by a seven point Likert scale. Vendor production cost advantage refers to the degree to which an external IT vendor is perceived to have production cost advantages for data processing ser-

vices over an internal IS unit. This study operationalizes it as : the degree to which an external vendor could provide a firm with the same data processing services at lower costs than an in-house data center ; the degree to which an external vendor is able to reduce hardware costs, software costs, and IS personnel costs.

Transaction risk refers to the possibility of opportunistic behavior by an external IT vendor at the expense of its client firm. The construct is operationalized by three items : the degree to which an external vendor may not do its best to satisfy a firm's data processing needs ; the degree to which using an external vendor would cause leakage of confidential information ; the degree to which using an external vendor makes it difficult to rebuild a firm's in-house data processing capabilities in the future. These items were identified by examining the current IS literature (Grover, et al., 1994; Ketler and Walstrom, 1993 ; Lowell, 1992).

Insufficiency of IS funds refers to the degree to which a firm lacks the funds for managing in-house data processing facilities. It is operationalized by : the degree to which a firm lacks the funds that could be invested in data processing facilities ; the degree to which a firm has limited funds for managing an in-house data center efficiently ; and the degree to which a firm has inadequate budget for managing an in-house data center effectively.

IT uncertainty refers to the degree to which a firm is not able to predict and keep up with developmental changes in IT. Based on Ang (1993)'s work, it is operationalized by : the degree to which a firm cannot forecast accurately changes in IT for the firm's needs ; the degree to which a firm cannot predict IT obsolescence; and the degree to which a firm cannot keep up with the developmental changes in IT. Finally, firm size is measured by total asset.

### 4.2. Pilot Study

The questionnaire designed to measure the research variables was examined by three IS researchers who were familiar with IS sourcing issues, one MIS director and one bank systems consultant to check the wording and understandability. Then, the questionnaire was pretested in consultation with the executives in charge of data processing in two banks. They suggested only minor changes, and the questionnaire was then mailed to 150 banks randomly selected from the bank directory.

As a result of the pilot study, a few items lacking reliability were slightly modified, and the data collected at this stage were not included in the main study.

### 4.3. Sampling and Data Collection

Questionnaires were mailed to a sample of 1,000 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 should be large banks and 70% of the sample should be smaller banks to optimally 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 bank.

Table 1. Sample size decision

| | $N_h$ | $s_h$ | $N_h s_h$ | $n_h$ |
|---|---|---|---|---|
| Small Banks | 10,430 | 268.64 | 2,801,915 | 70 |
| Large Banks | 425 | 2,826.41 | 1,201,224 | 30 |
| Total | | | 4,003,139 | 100 |

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 6 incomplete or unusable responses and 28 questionnaires from the banks whose parent or holding companies may have the authority for making sourcing decisions and provide them with data processing services.

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 a 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 no 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 improved confidence that the respondents were representative of the original sample.

## V. Results

### 5.1. Characteristics of the Respondents

A questionnaire was mailed to the CEO (Chief Executive Officer) of each bank, and the CEO was asked to direct the questionnaire to an executive who is responsible for sourcing arrangement of data processing services. The respondents were the

CEOs, the presidents, executive vice presidents (VPs), senior VPs, VP for operations, VP for data processing, chief information officers, etc.

Thirty-one percents of the 181 sample banks were large and 69% were small. This proportion of small banks to large banks is very close to the previous Neyman allocation for sampling, which suggests that 30% of the sample should be large banks and 70% should be small banks. Eighty-four banks (46%) of the sample have primarily outsourced data processing services and 97 banks (54%) have mainly insourced the services (Table 2).

Table 2. Profile of the Responding Banks

| | Frequency | | Total | Percent |
|---|---|---|---|---|
| (a) Total Assets | IN | OUT | | |
| Less than $300 million | 41 | 32 | 73 | 40.3 |
| $300 million to below $1 billion | 23 | 28 | 51 | 28.2 |
| $1 billion to below $5 billion | 26 | 20 | 46 | 25.4 |
| $5 billion and above | 7 | 4 | 11 | 6.1 |
| Total | 97 | 84 | 181 | 100.0 |
| | | | | |
| (b) Number of Employees | IN | OUT | | |
| Less than 100 | 24 | 24 | 48 | 26.5 |
| 100 to below 200 | 26 | 21 | 47 | 25.9 |
| 200 to below 500 | 20 | 20 | 40 | 22.1 |
| 500 and above | 27 | 19 | 46 | 25.5 |
| Total | 97 | 84 | 181 | 100.0 |

Note-IN : Insourcing
OUT : Outsourcing

Table 3 shows the last time that the responding banks evaluated their sourcing arrangements for data processing. A total of 68.9% of banks have evaluated sourcing alternatives within the past two years, implying that the survey responses reflect their recent experiences.

Table 3. Evaluation of Sourcing Arrangements

| Sourcing Evaluation | Frequency | % |
|---|---|---|
| 0－1 year ago | 86 | 48.6 |
| 1－2 years ago | 36 | 20.3 |
| 2－3 years ago | 24 | 13.6 |
| 3－4 years ago | 14 | 7.9 |
| 4－5 years ago | 9 | 5.1 |
| Over 5 years ago | 8 | 4.7 |
| Total | 177 | 100 |

### 5.2. 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 in Table 4 are greater than 0.55.

Table 4. Cronbach's Alpha

| Constructs | Items | Item-to-total correlation | Alpha Coefficient |
|---|---|---|---|
| Vendor Production Cost Advantage | CA1 | 0.6228 | 0.7965 |
| | CA2 | 0.7150 | |
| | CA3 | 0.5806 | |
| | CA4 | 0.5187 | |
| Transaction Risk | TR1 | 0.5139 | 0.6801 |
| | TR2 | 0.4634 | |
| | TR3 | 0.5042 | |
| Insufficiency of IS Funds | IF1 | 0.5331 | 0.7619 |
| | IF2 | 0.6840 | |
| | IF3 | 0.5678 | |
| IT Uncertainty | IU1 | 0.6130 | 0.7304 |
| | IU2 | 0.4906 | |
| | IU3 | 0.5623 | |
| 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 5). 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 65.48% of the total variance. For a factor loading to be significant, it should exceed 0.5 (Hair, et al., 1992). Each item in Table 6 loaded very significantly on only a single factor it is supposed to measure.

Table 5. Factor Loadings for Items

| | Items / Factors | PC | IF | IU | TR |
|---|---|---|---|---|---|
| CA1 : | Overall cost savings | **0.61** | 0.27 | 0.22 | −0.36 |
| CA2 : | Hardware cost savings | **0.80** | 0.19 | 0.19 | −0.20 |
| CA3 : | Software cost savings | **0.68** | 0.10 | 0.21 | −0.21 |
| CA4 : | Personnel cost savings | **0.75** | 0.19 | 0.08 | −0.03 |
| IF1 : | Funds for IT investment | 0.27 | **0.73** | 0.07 | −0.16 |
| IF2 : | Funds for efficient operation | 0.15 | **0.85** | 0.17 | −0.10 |
| IF3 : | Funds for effective operation | 0.17 | **0.69** | 0.29 | −0.20 |
| IU1 : | Predict IT development | 0.27 | 0.26 | **0.69** | −0.32 |
| IU2 : | Predict IT obsolescence risk | 0.27 | 0.14 | **0.71** | 0.10 |
| IU3 : | Keep up with IT changes | 0.06 | 0.13 | **0.83** | −0.15 |
| TR1 : | Security risk | −0.19 | −0.24 | 0.02 | **0.70** |
| TR2 : | Irreversibility risk | −0.08 | 0.00 | −0.14 | **0.84** |
| TR3 : | Performance risk | −0.34 | −0.28 | −0.14 | **0.59** |
| Eigenvalues | | 5.16 | 1.25 | 1.06 | 1.02 |
| Cumulative % of explained variance | | 39.76 | 49.41 | 57.59 | 65.48 |

Note : CA = Vendor Production Cost Advantage
IF = Insufficiency of IS Funds
IU = IT Uncertainty
TR = Transaction Risk

### 5.3. Comparison Between Small Banks and Large Banks

There are no statistically significant differences between small and large banks in terms of vendor production cost advantage, transaction risk, and insufficiency of IS funds (Table 6). Small banks, however, have higher IT uncertainty than large banks ($t = 2.08$, $p = 0.03$). Small banks tend to have more difficulty in predicting and keeping up with changing IT than large banks. Table 6 presents that there is no significant differences in outsourcing preference and degree of outsourcing between small and large banks. Accordingly, bank size is not considered as a direct predictor of sourcing arrangements in this study.

Table 6. Comparison Between Small Banks and Large Banks

| Variables | Types of Banks | Means | t | $p$-value |
|---|---|---|---|---|
| Vendor Production Cost Advantage | Small<br>Large | 17.38<br>16.33 | 1.20 | 0.229 |
| Transaction Risk | Small<br>Large | 11.93<br>12.87 | −1.57 | 0.117 |
| Insufficiency of IS Funds | Small<br>Large | 9.95<br>9.56 | 0.60 | 0.543 |
| IT Uncertainty | Small<br>Large | 12.08<br>10.82 | 2.08 | 0.038 |
| Outsourcing Preference | Small<br>Large | 7.41<br>6.50 | 1.30 | 0.193 |
| Degree of Outsourcing | Small<br>Large | 39.88<br>35.30 | 0.67 | 0.499 |

### 5.4. Hypothesis Testing

Multiple regression models were formulated to test the research hypotheses. Table 7 presents the estimated coefficients and related statistics for the multiple regression model for predicting outsourcing

preference and degree of outsourcing. The data analysis supports Hypothesis 1a which proposes a positive relationship between vendor production cost advantage and outsourcing preference ($t = 9.50$, $p < 0.001$). The results also support Hypothesis 1b which requires to examine the effect of vendor production cost advantage on degree of outsourcing ($t = 5.39$, $p < 0.001$). There is a statistical basis for concluding that vendor production cost advantage significantly helps to estimate the means of outsourcing preference and degree of outsourcing.

Table 7. Multiple Regression Model for Predicting Outsourcing Preference and Degree of Outsourcing

(a) Outsourcing Preference

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 5.111 | 1.349 | | | |
| Cost Advantage | 0.416 | 0.043 | 0.525 | 9.50 | 0.000 |
| Transaction Risk | −0.415 | 0.063 | −0.360 | −6.50 | 0.000 |
| R-square=0.6042 | | | | | |

(b) Degree of Outsourcing

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 41.707 | 16.002 | | | |
| Cost Advantage | 2.778 | 0.515 | 0.379 | 5.39 | 0.000 |
| Transaction Risk | −4.072 | 0.753 | −0.379 | −5.40 | 0.000 |
| R-square=0.4435 | | | | | |

Hypothesis 2a, which posited a negative relationship between transaction risk and outsourcing preference, was supported by this study ($t = -6.50$, $p < 0.001$). We can say that transaction risk does significantly help to estimate the mean of outsourcing preference when vendor production cost advantage is held constant. The higher the transaction risk of IS outsourcing, the lower the tendency of a

bank to prefer outsourcing to insourcing. Similarly, the results support hypothesis 2b, which posits the effect of transaction risk on the degree of outsourcing($t=-5.4$, $p<0.001$). The higher the outsourcing transaction risk, the lower the degree of outsourcing data processing function.

Table 8 expresses the results of testing Hypothesis 3 concerning the relationship between insufficiency of IS funds and vendor production cost advantage($t=5.87$, $p<0.001$). It can be concluded that IT uncertainty significantly helps to predict the mean of vendor production cost advantage (Hypothesis 3 supported). The higher the insufficiency of IS funds, the higher the tendency for a firm to have relatively high vendor production cost advantage.

Table 8. Multiple Regression Model for Predicting Vendor Production Cost Advantage

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 6.988 | 1.124 | | | |
| IS Funds | 0.529 | 0.090 | 0.395 | 5.87 | 0.000 |
| IT Uncertainty | 0.444 | 0.096 | 0.310 | 4.58 | 0.000 |
| Firm Size | −0.0002 | 0.0001 | −0.107 | −1.81 | 0.071 |
| R-square=0.3877 | | | | | |

The results of the multiple regression in Table 8 also support hypothesis 4, which posits the positive relationship between IT uncertainty and vendor production cost advantage ($t = -1.81$, $p < 0.001$). We can say that the higher the IT uncertainty, the higher the tendency for a firm to have relatively low internal production cost efficiency.

Finally, Hypothesis 5 is not supported by the p−value of 0.07 ($t = 4.73$). Hence, we can conclude that firm size does not help to estimate the mean of vendor production cost advantage. Although the sign of the coefficient is negative which is correct direction, there is insufficient evidence to say that firm size is related to vendor production cost advantage of computer data processing. This indicates that smaller banks may have their own way of operating data centers with low costs.

### 5.5. Testing the Mediation of Vendor Production Cost Advantage

The research model in Figure 1 posits that the effects of insufficiency of IS funds, IT uncertainty, and firm size on outsourcing preference and degree of outsourcing were mediated by vendor production cost advantage. According to Baron and Kenny (1986), the following conditions must hold to establish mediation : (1) the independent variable must affect the mediator in the equation of regressing the mediator on the independent variable ; (2) the independent variable must be shown to affect the dependent variable in the equation of regressing the dependent variable on the independent variable ; (3) the mediator must affect the dependent variable in the equation of regressing the dependent variable on both the independent variable and the mediator ; (4) if the first three conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second.

The first condition holds except for firm size, because insufficiency of IS funds and IT uncertainty have significant effects on vendor production cost advantage(Table 8). The failure to meet the first condition for firm size suggests that the effects of firm size on outsourcing preference and degree of outsourcing were not mediated by vendor production cost advantage.

Table 9 presents that the independent variables of insufficiency of IS funds and IT uncertainty have significant effects on outsourcing preference and degree of outsourcing (the second condition), but firm size has no direct effect on the dependent variables. The third condition also holds in Table 10. The results of regressing the dependent variables on both independent variables and the mediator, the mediator of vendor production cost advantage has significant effects on outsourcing preference ($t = 5.97$, $p < 0.001$) and degree of outsourcing ($t = 2.92$, $p = 0.004$).

The effects of insufficiency of IS funds and IT uncertainty on outsourcing preference are less in Table 10 than in Table 9 (the fourth condition). The regression parameter estimate for insufficiency of IS funds reduced from 0.399 in Table 9 to 0.294 in Table 10, and the one for IT uncertainty reduced from 0.282 in Table 9 to 0.185 in Table 10. Accordingly, we can say that the effects of insufficiency of IS funds

and IT uncertainty on outsourcing preference were mediated by vendor production cost advantage.

The effects of insufficiency of IS funds and IT uncertainty on degree of outsourcing are also less in Table 10 than in Table 9 (the fourth condition). The regression parameter estimate for insufficiency of IS funds reduced from 2.742 in Table 9 to 2.209 in Table 10, and the one for IT uncertainty reduced from 2.269 in Table 9 to 1.561 in Table 10. Hence, we can say that the effects of insufficiency of IS funds and IT uncertainty on degree of outsourcing were mediated by vendor production cost advantage.

Thus far, the research hypotheses and the mediating role of vendor production cost advantage were tested. These results and the logical grounds in the research hypothesis section support the hypothesized directions between variables, except for the relationship involving firm size, in the research model.

Table 9. Multiple Regression Model Without the Mediator

(a) Outsourcing Preference

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 5.197 | 1.274 | | | |
| IS Funds | 0.399 | 0.059 | 0.376 | 6.75 | 0.000 |
| IT Uncertainty | 0.282 | 0.061 | 0.249 | 4.62 | 0.000 |
| Firm Size | −0.000 | 0.000 | −0.018 | −0.40 | 0.688 |
| Transaction Risk | −0.429 | 0.060 | −0.371 | −7.07 | 0.000 |
| R-square=0.6288 | | | | | |

(b) Degree of Outsourcing

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 34.923 | 14.883 | | | |
| IS Funds | 2.742 | 0.704 | 0.275 | 3.89 | 0.000 |
| IT Uncertainty | 2.269 | 0.713 | 0.217 | 3.18 | 0.001 |
| Firm Size | 0.0002 | 0.0009 | 0.017 | 0.29 | 0.771 |
| Transaction Risk | −4.041 | 0.707 | −0.377 | −5.71 | 0.000 |
| R-square=0.4810 | | | | | |

Table 10. Multiple Regression Model With the Mediator

(a) Outsourcing Preference

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 5.197 | 1.334 | | | |
| IS Funds | 0.294 | 0.056 | 0.277 | 5.18 | 0.000 |
| IT Uncertainty | 0.185 | 0.58 | 0.163 | 3.19 | 0.001 |
| Firm Size | 0.000 | 0.000 | 0.013 | 0.30 | 0.761 |
| Transaction Risk | −0.315 | 0.058 | −0.272 | −5.37 | 0.000 |
| Cost Advantage | 0.268 | 0.044 | 0.339 | 5.97 | 0.000 |
| R-square=0.6918 | | | | | |

(b) Degree of Outsourcing

| Variable | Parameter Estimate | Standard Error | Standardized Estimate | t | $p$-value |
|---|---|---|---|---|---|
| Intercept | 10.529 | 16.765 | | | |
| IS Funds | 2.209 | 0.712 | 0.221 | 3.10 | 0.002 |
| IT Uncertainty | 1.561 | 0.737 | 0.149 | 2.11 | 0.035 |
| Firm Size | 0.0006 | 0.0009 | 0.038 | 0.67 | 0.499 |
| Transaction Risk | −3.286 | 0.737 | −0.306 | −4.45 | 0.000 |
| Cost Advantage | 1.653 | 0.566 | 0.225 | 2.92 | 0.004 |
| R-square=0.5079 | | | | | |

## VI. Discussion and Conclusion

This study supports that the preference and degree of outsourcing of data processing services in banks are associated with vendor production cost advantage and transaction risk, as suggested by the TCE. Cost savings is a primary motivator affecting IS outsourcing. Outsourcing is preferred and more budget is allocated for outsourcing when an external vendor can provide the same quality of data processing services at lower hardware, software, and personnel costs than an in-house data center. The banks tend to avoid

outsourcing, if perceived transaction risk of outsourcing is high. The risks of using external IT vendors include the leakage of confidential information, performance shirking, and irreversibility of the IS function. These risks, which are related to opportunistic behavior of an external vendor motivated by its own profits, may be reduced by writing and enforcing contracts more carefully.

Insufficiency of IS funds and IT uncertainty are not only positively associated with vendor production cost advantage, but also directly related to outsourcing preference and degree of outsourcing. Internal production cost efficiency of data processing services is relatively weak and outsourcing becomes a preferred choice, when banks lack the funds for investing in in-house data processing facilities to operate efficiently and effectively and when banks have difficulty in predicting and keeping up with changing IT.

Bank size measured by total asset is not significantly associated with vendor production cost advantage, outsourcing preference, and degree of outsourcing. This result, consistent with Grover, et al. (1994), implies that larger firms do not necessarily have more efficient operation of data centers. Perhaps, small banks are also able to operate their data centers economically while meeting the business requirements of data processing services. Given a low volume of data processing, a smaller system can be an efficient solution, because of a constant average cost per MIPS (Mendelson, 1987). For even large banks, there are often situations in which outsourcing offers financial benefits that can exceed costs of transaction risk.

This study employed outsourcing preference as well as degree of outsourcing as a dependent variable. Use of the two variables led to the same results of hypothesis testing, as can be expected by a high correlation of outsourcing preference with degree of outsourcing ($r = 0.79$, $p < 0.001$). Use of the two types of variables inform us of how consistent current sourcing is with the ideal sourcing. A high percentage of budget allocated for outsourcing data processing services reflects a high degree of outsourcing preference of the bank executives. Outsourcing preference may be a more proper measure in the sense that it is based on current sourcing evaluation which affects future sourcing, whereas degree of outsourcing expresses sourcing evaluation made in the past.

The results of this study focused on data processing services in the banking industry

are limited in their generalizability to other industries and IS functions. The research models presented in this study can be applied to sourcing decisions for other IS services such as application development, telecommunication services, and disaster recovery. As the same factors are identified in other research contexts, the findings become more generalizable to over a broader scope of the IS sourcing. Future research may explore other aspects of the phenomenon of outsourcing, such as social and political aspects. Interdepartmental power structure and political tactics may be another aspect of sourcing decisions.

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## ◇ 저자소개 ◇

저자 **이민화**는 계명대학교 경영학과를 졸업하고 서울대학교 대학원에서 경영학석사, University of Texas at Arlington에서 MIS 전공으로 경영학박사 학위를 취득하였다. 현재 부산외국어대학교 상경대학 경영정보학과 전임강사로 재직하고 있다. 주요 연구관심분야는 정보기술의 수용과 확산, CASE, 아웃소싱, Internet 등이다.