Evaluating the Effectiveness of Information Service for SMEs on Information Orientation and Firm Performance

Lee, C. S.,
College of Business Administration
Chonnam National University
cheol@chonnam.ac.kr

Ko, I. S.
College of Business Administration
Chonnam National University
isko@chonnam.ac.kr

Jeong, C.
College of Business Administration
Chonnam National University
chul7200@lycos.co.kr

Abstract
This study takes a long-term perspective on the relationship between firm performance and the usage of information service for promoting informatization programs and strengthening the competitiveness of small and medium-size enterprises (SMEs) in key industries.

We developed a research model and hypotheses using key variables drawn from previous research, such as Information System Success Model, Contingency Theory, Resource-based Theory and other research on the methodology to evaluate the performance of information service.

To empirically test the proposed model, we conducted both an internet-based survey and a paper-based survey on the Korean firms using government information service programs. Statistical methods, based on the structural equation modeling method using the LISREL software program, were used for analyzing 186 valid responses.

We found that the influence dimensions on service usage, such as ‘quality of information service for SMEs’ and ‘organizational specific factors’, are statistically significant in increasing the degree of usage and that the usage of information service is statistically significant in increasing firm performance, which includes information orientation and business performance. The results of our analysis also showed that information orientation is statistically significant in increasing business performance. In addition, information orientation mediates the link between information service usage and business performance. Based on the results of this empirical study, we suggest several important implications of government information service programs for researchers, firms and policy makers.

1. Introduction

Information and Communication Technology (ICT) has been recognized as a strategic factor in creating and sustaining competitive advantage for enterprises [29]. But many enterprises have hesitated to introduce ICT and informatization projects because of the obstacles, such as uncertain IT performance (IT Productivity Paradox) and limited resources for IT investment.

The South Korean Government has executed many information service programs to strengthen the e-competitiveness of SMEs in key industries. In spite of that, a 2006 Economist Intelligence Unit report showed that South Korea is in the 31st position in the e-business environments index. On the other hand, South Korea was top-ranked in the IT infrastructure index, which measures e-readiness. Beyond the rankings, these results require an evaluation method for assuring the achievements of government-supported information service programs for SMEs in terms of firm performance. We try to add a theoretical consideration for developing an evaluation method in the process of assessing these information service programs, especially in terms of their effectiveness on firm performance.

2. Information service program for SMEs in South Korea

The Framework Act on Informatization Promotion of Korea defines informatization as the process of making information available in every sector of society and enhancing efficiency by producing, circulating and using information. This law stipulates that policies should be established and carried out for informatization promotion and building a foundation for ICT. According to the policy developed from the law, informatization programs should cover various subjects and include diverse content. The policy divides government-led informatization projects into two major categories. First, the policy provides support for companies that meet National Informatization Project requirements and also aims at improving the performance of government agencies and public organizations. Second, the policy focuses on requiring non-government sector entities to carry out informatization projects at the same time and promoting informatization programs for companies. Sometimes, informatization programs, from a micro
perspective, are defined as government-funded projects for informatization of private sector companies and the enhancement of information service capability in their respective industries.

The recent government ICT policies for enterprises have tended to differ in scope of service from the semiconductor industry (SI) and provide comprehensive systems-based approaches on the level of support, target, time and requirements using specialized organizations [22][27]. Due to this current trend, government-supported information service has the following comprehensive characteristics:

1. Most of the informatization projects are intended for the private sector.
2. Information service outsourcing is aimed at firms’ strategic and operational benefits [30].
3. The public sector requires external information and knowledge to have a competitive edge [12][41].
4. Electronic channels facilitate interorganizational communication and collaboration [3][39].

In this study, we first try to evaluate the quality of information service for SMEs and their organization characteristics. Second, we measure their impact on the usage of information service. Third, we explain the effectiveness of the usage of information service on information orientation and firm performance. We define, in this study, information service for SMEs as information service provided as the result of informatization assistance programs aimed at improving the management performance of recipient companies and strengthening the competitiveness of key industries by providing necessary resources for the informatization of SMEs.

3. Theoretical Background

By considering comprehensive and multi-dimensional characteristics of information service for SMEs, we proposed a research model, variables and hypotheses based on their relationships. These have been developed using previous research, such as methodologies to evaluate the government-supported informatization programs, the Information System Success Model, the Contingency Theory, and Resource-based Theory, especially in developing informatization success factors.

3.1. Previous research on evaluating the quality of information service

Ko et al. [27] suggested accessibility, efficiency, reliability and security as the four elements for assessing the quality of service by the Photonics Industry Information Service Centers in Korea and conducted a comprehensive analysis of these factors for user satisfaction.

Kim et al. [26] carried out an outcome analysis of government-supported informatization programs for SMEs by using the Return on Investment (ROI) index for information resource investment employing the Balanced Scorecard (BSC) technique in 2001.

Choi[5] analyzed the detailed evaluation time and detailed sectors and content in accordance with the life cycle of informatization projects by suggesting outcomes of added values for each content and linkage of variables through the Analytical Hierarchy Process (AHP) technique. The study shows what factors should be considered before information service for private sector is established.

Choi et al. [7] proved the effects of information service on enhancing competitiveness of SMEs by comparing major government-supported projects based on the outcome evaluation system of the Technology and Information Promotion Agency (TIPA) for SMEs in Korea.

3.2. Information Systems Success Model

Hamilton & Chervany emphasized that in considering multi-dimensional characteristics of information systems, evaluations should be carried out from an efficiency-based and effectiveness-oriented point of view simultaneously [17]. DeLone & McLean insisted that the outcome performances of information systems should be divided into levels and conducted in accordance with the flow of the information. They defined the evaluation subject dimension such as system quality, information quality, use, user satisfaction, individual impact, and organizational impact, and examined the relationships between each factor[10]. Later, based on research such as Pitt et al.[42], they adapted the IS Success Model that added the service quality dimension to these factors and unified the outcome dimension into the net-benefits dimension[11].

3.3. Informatization Success Factors: organization factors

3.3.1. Approaches based on the Contingency Theory

Seven contingent factors frequently have been used in Management Information Systems (MIS) studies: strategy, organizational structure, size, environment, technology, and task and individual characteristics [54]. Many studies have used contingent variables related to technology, organization, and environment. Tornatzky & Fleisher used these factors in explaining the adoption and performance of information systems [53].
Their analysis framework is based on the Contingency Theory by Lawrence & Lorsch [28], which postulates that a general management method does not exist and management decisions are based on circumstances. This theory is expanded by Kast & Rosenzweig [23] and is the theoretical base for the appropriateness of organizational factors reflecting various circumstances of organizations [52].

Contingency factor analysis, which uses this theory, has provided the basis for the adoption of various ICT applications and the analysis of the practical use of information systems. Various research suggests that organizational characteristics and appropriateness of information systems have an influence on system performance. A good example of the organizational characteristics factor examined in previous studies is organization culture, which includes internal factors influencing management innovation such as management strategy and the introduction of new technologies combined with organizational structure and size [29][35].

3.3.2. Approaches based on the Resource-based Theory

According to the Resource-based Theory, a firm is composed of mutually related tangible and intangible corporate resources that create capacity. In many studies about information technology-related resources, the analysis of competitiveness has come from this theory. Currently, information resources have become diversified and the penetration rate of information systems is high. In these circumstances, the concept of IT resources should be expanded to include all resources and staff related to information systems understood in the broadest sense [54].

4. Research model and hypotheses

4.1. Research model

We developed a research model aimed at analyzing the use of public information service for SMEs and its effectiveness on firm outcomes based on the previous research on methodologies to evaluate the performance of information service. More specifically, we defined three dimensions – influence dimension, the degree of usage, and the performance.

First, the influence dimension was broken down into two sub-dimensions: the quality factors of information service (information, service, system) and organization factors (maturity of information technology resources, flexible organization culture).

Second, this study measured the degree of usage of government-supported information services. Previous studies suggested using models of the effects of user satisfaction on outcomes. This study defines the usage of information service as the state of consistently using information service with satisfaction. In this study, we concentrate on the companies that continuously use information service with expectations built through prior experience and satisfaction [1][40]. Third, the firm performance dimension consists of two factors: information orientation and management performance. Information orientation includes three sub-factors (information technology practice, information management practice, information behavior and values) proposed by Marchand et al. [32][33][34] for measuring the achievement of information systems using information-oriented views. Management performance is defined as operational performance and strategic performance as suggested by Subramani [49].

4.2. Hypotheses

4.2.1. Influence dimension on service usage

DeLone & McLean [10] suggested that information quality and system quality are the precedent factors, which influence performance through the use of information systems based on the Information System Success Model. The studies by Saunders & Jones [45] and Pitt et al. [42] agreed that these factors influence the use of systems and user satisfaction.

Pitt et al. verified the appropriateness and reliability of the five dimensions of SERVQUAL by applying them to information system quality. They suggested that service quality is also an important factor influencing the use of information systems and user
satisfaction [11]. Based on the previous studies, we proposed the following hypotheses:

H1. Information quality of information services positively influences the use of information service.

H2. Service quality of information services positively influences the use of information service.

H3. System quality of information services positively influences the use of information service.

From the Resource-based Theory, Feeny, Willcocks[16] and Bharadwaj[2] suggested that companies can obtain an advantage from information technology resources. Information technology resource is defined as an important factor for management in being able to acquire the competitiveness of informatization, the performance of e-business and the successful use of IT applications [13][52][55]. Researchers have various opinions about the relation between the maturity of information technology resources and the use of external information technology resources.

On the assumption that the maturity of information technology resources will have a positive influence on the use of information technology and its performance, we proposed the following hypothesis:

H4. The maturity of information technology resource positively influences the use of information service.

Organization culture is defined as shared values, trust and common norms. The previous studies argued that organization culture is an important value which can affect the activities and the thoughts of members and emphasized that it is an internal factor influencing the achievement of information systems [4][8][15][50]. This study sets the flexible organizational culture in the context of Quinn’s CVM, which showed that positively influencing, accepting and achieving information systems will have a positive effect on the degree of the use of information service.

H5. Flexible organizational culture positively influences the use of information service.

4.2.2. The use of information service and its impacts on firm performance

One of the most frequently used variables in studies is the use of information service. This variable is used to measure how much the members of organizations use information service with respect to behavioral and cognitive perspectives. Through previous studies, this variable shows that the use of information service is closely related to its usefulness and effectiveness for decision-making [9][18][43][44][48].

For the variables of the performance dimension, we examine how SMEs effectively use information service to increase firm performance using perspectives from the information orientation model suggested by Marchand et al. [32]. The information orientation model defines the information capability related to information use in three areas: information technology practice, information management practice, information behavior and values. This model suggested that if the capability of using information service is well managed, this contributes to the enhancement of firm performance [32][33][34].

The variable for measuring management performance was developed in a way similar to the measurement variable that Subramani used in measuring the use of inter-organizational information system (SCM) performance [49]. Based on the above considerations, we suggested the following hypotheses:

H6. The use of information service positively influences information orientation.


H9. Information orientation mediates management performance through the use of information service.

5. Research Method

5.1. Data Collection

For this study, we collected data through face-to-face interviews and through an online survey using a list of companies provided by the Regional Information Service Center in Gwangju, Korea. About US$6.3 million was invested in informatization programs by the photonics industry from 2000 to 2005. We considered the comprehensiveness of the services and the operating period when we selected the programs as the proper subject of our study. We evaluated and verified the achievements of informatization, which mitigates the difficulties caused by time lag (IT Productivity Paradox) and generalization. A total of 196 responses to the questionnaire (1 response per a company) were returned. Of them, 186 responses were used in this analysis (10 responses were incomplete).
Table 1. Operational definitions and measures of the variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Operational Definition</th>
<th>Measurement (7 point Likert Scale)</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Quality</td>
<td>Degree of perceived information quality provided through information service.</td>
<td>①Timeliness ②Accuracy ③Sufficiency ④Usefulness ⑤ Appropriateness of forms</td>
<td>[5],[10],[36],[42]</td>
</tr>
<tr>
<td>System Quality</td>
<td>Degree of perceived system quality constructed for information service.</td>
<td>①Ease of use ②Navigation ③Response time ④ Stability ⑤ Security</td>
<td></td>
</tr>
<tr>
<td>Service Quality</td>
<td>Degree of perceived service quality provided by specialized information service agency</td>
<td>① Expertness ② Speed ③ Understanding the demands ④ Cooperative relations ⑤ Educational service</td>
<td>[5],[11],[20],[24],[47]</td>
</tr>
<tr>
<td>Information Technology Resource</td>
<td>Degree of internal preparation of information resource for achievement</td>
<td>① Understanding of IT staffs on purpose and task ② Ability of IT staffs ③ Interdepartmental e-collaboration ④ Network infrastructure for online operations ⑤ H/W &amp; S/W to make full use of IT</td>
<td>[2],[13],[16],[54]</td>
</tr>
<tr>
<td>Organization Culture</td>
<td>The organizational culture dimension.</td>
<td>① Atmosphere like a family ② Cooperative human relations and working together as a team ③ Commitment to innovation and development ④ Dynamic and entrepreneurial spirit ⑤ Emphasize growth through nurturing new ideas</td>
<td>[4],[53]</td>
</tr>
<tr>
<td>Usage</td>
<td>Degree of use of tangible &amp; intangible services provided through information service</td>
<td>① For decision support ② For task performance ③ For operational innovation</td>
<td>[5],[9],[10],[11],[44]</td>
</tr>
<tr>
<td>Information Technology Practice</td>
<td>A capability to manage IT application, infrastructure to support operations, process, innovation and decision making</td>
<td>① Degree of expertise on IT ② Degree of problem solving ability using IT ③ Degree of management supporting ability using IT ④ Degree of ability to manage IS effectively</td>
<td></td>
</tr>
<tr>
<td>Information Management Practice</td>
<td>A capability to manage information effectively over the life cycle of information use.</td>
<td>① A capability of collecting information ② A capability of organizing information ③ A capability of analyzing and refining information ④ A capability of maintaining information</td>
<td>[32],[33],[34]</td>
</tr>
<tr>
<td>Information Behavior and Values</td>
<td>A capability to instill and promote behaviors and values in its people for effective use of information</td>
<td>① An intention for information sharing among employees ② Feedback and sharing of individual achievement ③ Collaboration among department and employees to improve performance of information use ④ An activity control organization to improve performance of information use</td>
<td></td>
</tr>
<tr>
<td>Operational Performance</td>
<td>An effect of business process innovation through information service</td>
<td>① Improvement in effectiveness and flexibility ② Improvement in productivity ③ Reduction of cost ④ Improvement in decision capability such as quickness, rationality etc.</td>
<td>[6],[49]</td>
</tr>
<tr>
<td>Strategic Performance</td>
<td>An improvement of environmental Dimension and performance of new business process creation through information service</td>
<td>① An increase of market share ② A shortening period of releasing and developing products ③ An improvement of customer relationship, services ④ An improvement of recognition</td>
<td></td>
</tr>
</tbody>
</table>
5.2. Analysis

5.2.1. The validity, reliability and correlation coefficient analysis

We used the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) before testing our hypotheses in order to verify the validity of our measurement model. First of all, EFA was used in order to check whether the collected data reflected the potential factors that we desired: 10 out of 48 items were selected by excluding items with low measures. The management performance factors, which consist of the two sub-factors, operational performance and strategic performance, were combined into one composite factor. In this study, information orientation was measured by assessing information technology practice, information management practice, and information behavior and values. Second-order confirmatory factor analysis was conducted to examine unidimensionality. As Figure 2 shows, factor loadings were more than 0.64 (\( \lambda_{11}~\lambda_{13}=0.64~0.88; p<.01 \)), and second order factor loadings were more than 0.59 (\( \gamma_{11}=0.62, \gamma_{21}=0.70, \gamma_{31}=0.59; p<.01 \)). Therefore, we integrated the subordinate latent variables into the unidimensional factor.

Table 2 shows the results of the examination of the validity and reliability of the variables. Factor loadings were statistically significant and the unidimensionality and the convergent validity between each concept were obtained. Construct reliability and average variance extracted (AVE) were more than 0.7 and 0.5, respectively. Therefore, each measurement item was well representative for each research variable. After examining for internal consistency, the reliability of measurement variables was obtained.

Table 3 shows, the square root of AVE was more than correlation coefficient. Therefore, the discriminant validity of each concept was confirmed.
5.2.2. Fitness of the research model

The fitness indexes of the research model were χ²/d.f.=1.38, RMR=0.07, RMSEA=0.04, GFI=0.81, AGFI=0.79, NFI=0.88, NNFI=0.95, CFI=0.96. Considering this data, there should be no difficulty analyzing the relation between research variables. Figure 3 shows the results of the LISREL analysis of the research model.

5.2.3. Hypothesis testing

Table 4 shows the path coefficients and the results of our statistical test. All hypotheses were accepted as statistically significant.

The use of information service and the fitness index for testing the mediating effects of information orientation were accepted to the general standard and the indirect effect of information orientation (t=3.45) was significant (total effect: t=7.09). Therefore, information orientation partially mediates management performance through the use of information service.

Table 4. The results of hypothesis testing

<table>
<thead>
<tr>
<th>No.</th>
<th>Path</th>
<th>direction</th>
<th>path coefficients (Measurement errors)</th>
<th>r-Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Information Quality → Usage</td>
<td>+</td>
<td>0.25 (0.05)</td>
<td>4.18**</td>
<td>Accept</td>
</tr>
<tr>
<td>H2</td>
<td>Service Quality → Usage</td>
<td>+</td>
<td>0.25 (0.05)</td>
<td>4.34**</td>
<td>Accept</td>
</tr>
<tr>
<td>H3</td>
<td>System Quality → Usage</td>
<td>+</td>
<td>0.19 (0.05)</td>
<td>3.14**</td>
<td>Accept</td>
</tr>
<tr>
<td>H4</td>
<td>IT Resource → Usage</td>
<td>+</td>
<td>0.15 (0.05)</td>
<td>2.40*</td>
<td>Accept</td>
</tr>
<tr>
<td>H5</td>
<td>Organization Culture → Usage</td>
<td>+</td>
<td>0.21 (0.03)</td>
<td>3.59**</td>
<td>Accept</td>
</tr>
<tr>
<td>H6</td>
<td>Usage → Information Orientation</td>
<td>+</td>
<td>0.71 (0.10)</td>
<td>6.85**</td>
<td>Accept</td>
</tr>
<tr>
<td>H7</td>
<td>Usage → Business Performance</td>
<td>+</td>
<td>0.28 (0.13)</td>
<td>2.08*</td>
<td>Accept</td>
</tr>
<tr>
<td>H8</td>
<td>Information Orientation → Business Performance</td>
<td>+</td>
<td>0.59 (0.16)</td>
<td>3.75**</td>
<td>Accept</td>
</tr>
<tr>
<td>H9</td>
<td>Usage → Information Orientation → Business Performance</td>
<td>+</td>
<td>Direct Model: acceptable Total effect : 7.09 Indirect effect : 3.45</td>
<td>Accept</td>
<td></td>
</tr>
</tbody>
</table>

(* p<0.05, ** p<0.01)

6. Conclusions and implications

We examined the impacts of the quality of information service and organization characteristics on the use of information service for SMEs. We also examined the effectiveness of the use of information service on information orientation and management performance. Current informatization assistant programs aimed at improving the management performance and strengthening the competitiveness of recipient companies and key industries by providing necessary resources for the informatization in the private sector. Information service has various functional characteristics and its scope due to the development of information technology. The ranges of government-supported information service contain comprehensively the support for building infrastructure of individual companies, informatization consulting, outsourcing of information system, public sector for the acquirement of external information and knowledge, and the channels for inter-organizational communication and collaboration.

Information service for SMEs at the private sector is difficult to provide directly differentiated competitive advantage only by using the service itself. Therefore, not simple use of the service but the effort of analyzing its specific use and developing a capability toward information orientation by individual firm is required to enhance the competitiveness though the information service for SMEs.

This study also focused on organization characteristics and information capacity. Specifically, the study conceptualized the organization culture and information technology resources into the influencing factors of using information service for SMEs and enhancing their performance. We also conceptualized information orientation as the mediating factor for firm performance. Even if appropriate information and excellent systems are provided, differentiated results cannot be achieved without improving their internal capability. We are expecting to bring better outcomes of information service for SMEs if these factors are well recognized and used in the process of developing government-supported information service programs.

This study gives some theoretical suggestions by conceptualizing information service for SMEs and examining the influence of organization characteristics on it. Also, this study shows some implications on government policy making directions about information service for the private sector and the importance of individual companies' efforts to enhance the performance beyond their limited IT resources.
10. References


[26] Lawrence, P. R. and J. W. Lorsch (1967), Organization and Environment, Boston: Graduate School of Business Administration, Harvard University.


