

2004

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Recommended Citation

Hsu, Jack Shih-Chieh and Chen, Edward T. (2004) "Managers' Perceived Benefits of Using Electronic Procurement in Taiwan," *Communications of the IIMA*: Vol. 4: Iss. 2, Article 3.

DOI: <https://doi.org/10.58729/1941-6687.1242>

Available at: <https://scholarworks.lib.csusb.edu/ciima/vol4/iss2/3>

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Managers' Perceived Benefits of Using Electronic Procurement in Taiwan

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ABSTRACT

Facing the competitive pressure from new hospitals and new regulations from the Bureau of National Health Insurance, hospital managers in Taiwan are concentrating on reducing the hospital operation costs and improving the healthcare quality. Practitioners and academic researchers agree that reducing the pharmacy cost is one of the best solutions to sustain competitive advantage. As electronic commerce becomes popular in many industry sectors, e-procurement is growing rapidly in the healthcare industry. The purpose of this paper is to investigate the managers' perceptions of benefits of using electronic procurement system. After surveying 152 hospitals in Taiwan, we find that hospital size and adoption status have significant influence on many perceived benefits. Managers in large hospitals show stronger confidence in the perceived benefits of using e-procurement than their counterparts of small hospitals.

INTRODUCTION

In October 2001, Taiwan's legislation institute passed the Electronic Signature Act, which provides actual regulation power for electronic signature on commercial activities over the Internet. Not only does this policy set up a new standard of online transaction but it also erects a new electronic commerce era in Taiwan. With tight norm and protection, the Act encourages companies to voluntarily join in EC and speed up online transactions.

With more and more successful examples of gaining some critical benefits by using IT from other industries, hospital managers are inquisitive about electronic commerce and related technologies. However, most of them have neither IT-related background nor IT implementation

experience. The successful cases in other industries might not be a suitable paradigm or might not be transferable to the healthcare industry. There is little research done at this critical issue of electronic procurement in healthcare. Hence, this study is to investigate the perceived benefits of hospital managers on the effects of electronic procurement, or called e-procurement. The purpose of this research is to draw inferences from research results and provide practical guidance to hospital managers who are facing the adoption of the e-procurement.

IT can help corporations improve operation efficiency and increase management performance (Ives and Learmonth, 1984; Porter and Millar, 1985). The competitive advantage model proposed by Bakos and Treacy (1986) indicates that IT can increase company's bargain power, bring more relative efficiency, and enhance the competitive ability. Besides adopting the new telecommunication technology, which can make organization efficient in communication, the adoption of inter-organization systems (IOS) produces common benefits between different companies and improves the whole group's competitive advantage (Johnston and Vitale, 1988). Other researchers point out that adoption of IOS (such as electronic data interchange, i.e., EDI) can improve the business operation efficiency and enhance competitive advantage (Emmelhainz, 1988; Mukhopadhyay et al., 1995).

Electronic procurement uses information and communication technology in the processes of purchasing. It includes technology, human, and process changes. Procurement involves many interactivities such as inquiry, ordering, shipping, delivery, payment processing, and warehousing, between supplier and buyer. The electronic procurement system is a typical IOS. Before e-procurement, EDI was the best way of exchanging data between companies using information technology. Many companies hold their steps of implementing EDI because the technology complexity and the high cost of EDI. The low cost of telecommunication and the standardization of data transmission make the Internet most popular for data communication in general industry. Many high-tech companies (IBM, Intel, etc.) and technology intensive industries (retailing, financial, etc.) adopt the Internet to facilitate collaborative operations among their business partners.

As Payton (2000) indicates that many information technology intensive and traditional industries have started using IOS to facilitate communication and data exchange between companies. Similar technology should apply to healthcare industry now. However, Taiwan's hospital managers cannot adequately evaluate the benefits of electronic commerce due to the immaturity of the e-procurement environment. There is also no consensus on the benefits of electronic commerce in healthcare industry. Inconsistence of benefits in information technology adoption is an important issue in MIS and has been coined as the "productivity paradox". In prior research, the adoption of information technology such as ERP has yielded different effects, some are good and some are bad, to different companies. One information system works fine in one company and generates lots of benefits, while it may have caused many difficulties to the other companies.

EDI and IOS do not have integrated benefit evaluation model. The benefit evaluation of an information system is very important for firms who want to adopt it. The main idea of this study is to evaluate the benefits of electronic procurement in healthcare industry. We review prior research to identify possible benefits perceived by managers. Relationships between perceived benefits and hospital scale and adoption status are hypothesized after literature review. We then

investigate the perceived benefits by hospital managers on adopting electronic procurement through surveying the management of hospitals. Data results are presented following by conclusion at the end.

ELECTRONIC PROCUREMENT

IOS is an automation system shared by two or more organizations (Cash and Konsynski, 1985). It uses information technology to facilitate, create, store, transform, and deliver information among organizations. The difference between organizational information system and IOS is that IOS allows information transformation across the boundary of organization (Johnston and Vitale, 1988).

EDI is a common way to perform IOS particularly in supply chain management. Some researchers believe that EDI plays an important role in inter-organization business information transformation (Riggins and Mukhapadhyay, 1994; Crum et al., 1998). According to Hansen & Hill (1989), EDI uses standard format to transfer information between different applications in different companies to facilitate the business transaction processing.

E-procurement expedites the transaction, delivery, shipment, storage, and payment procedure. It transforms these processes into electronic forms. It reduces inventory and satisfies customer's need by using the procurement related data to forecast the future need of customer (Kalakota and Robinson, 1999). The major objectives of electronic procurement are to reduce the procurement cost and time, enhance budgetary control, curb the management errors, increase production capability, improve information management, reform payment procedure, strengthen the seller-buyer relationship, and lower price by standardizing the processes (Turban et al., 2000).

PERCEPTIONS OF BENEFITS

Companies hope that they can use electronic procurement to reduce costs and improve efficiency. When procurement equipment and ability are strengthened, adopters can get better contract, procurement efficiency, customer services, and total quality. In terms, they can get higher customer satisfaction, improve the relationship with supplier, lower cost, and improve quality. These perceived benefits push the procurement department to join the activities of production and gain more promotion time (Telgen and Sitar, 2001). With the adoption of e-procurement they can obtain timely information by reforming the inter-organization relationship and overcoming the low efficiency of communication channel and business process (Murray, 2001). To be exact, the adoption of electronic procurement makes it easier to compare price from different suppliers, to confirm the amount of inventory, to order nearly just-in-time replenishment. The above-mentioned benefits also include decreasing the contract-oriented procurement and increasing negotiation-oriented procurement. Finally, the goals of reducing the procurement time and improving the operation efficiency can be fulfilled.

Most benefits of electronic procurement can be obtained from past EDI research. Some benefits are derived from the special characteristics of the Internet. Electronic procurement executes

transaction by utilizing information technology and network. Hence, the transaction model is similar to, but broader than, EDI. The benefits of adopting electronic procurement is similar to those of adopting EDI such as large procurement quantity, stable suppliers, strong procurement alliance, improved business performance, precise contract content, close seller-buyer relationship, less paper cost, and minimum management cost (Turban et al., 2000). The benefits related to the Internet are reducing the market entrance barriers, increasing the transparency of price, limiting the black box of procurement, and balancing the supplier-buyer power (Ageshin, 2001).

RESEARCH METHOD

Perceived Benefits of Electronic Procurement

Based on the literature, we summarize the benefits of e-procurement in Table 1. These benefits are classified as two categories: the direct benefits and the indirect benefits.

Direct Benefits	
Reduced inventory	[1], [2], [5], [6], [7], [9], [10], [11], [12], [13], [14]
Improved information quality	[4], [6], [11]
Reduced human work	[1], [13]
Reduced data entry	[1], [9], [11], [13], [14]
Reduced data error	[2], [5], [8], [9], [11], [12], [13], [14]
Enhanced response rate	[6], [10], [12]
Improved cash flow	[1], [6], [13], [14]
Indirect Benefits	
Enhanced procurement process	[13], [14]
<i>Enhanced Information process</i>	[1], [2], [5], [6], [13], [14]
Improved customer satisfaction	[2], [4], [5], [8], [10], [12], [13], [14]
Improve relationship with supplier	[10], [11], [14]
Reengineered procurement process	[6], [11]
More competitive advantage	[2], [4], [10], [11], [12], [14]
Better managerial strategy	[3], [12]
Sources	
[1] . Arunachalam (1995)	[8] . O'Callaghan et al. (1992)
[2] . Banerjee and Golhar (1994)	[9] . Premkumar and Ramamurthy (1995)
[3] . Bergeron and Raymond (1997)	[10] . Reekers and Smithson (1994)
[4] . Crum et al. (1996)	[11] . Scala and McGrath (1993)
[5] . Hansen and Hill (1989)	[12] . Udo and Pickett (1994)
[6] . Iacovou et al. (1995)	[13] . Wigand (1997)
[7] . Mukhopadhyay (1995)	[14] . Jimenez-martinez & Polo Redondo (1998)

Table 1. Perceived Benefits of E-Procurement

Direct Benefits refer to benefits of the adoption of Electronic procurement without changing the procurement procedures (Dearing, 1990). These benefits are results from the increased efficiency of procurement process such as reducing inventory, improving information quality, reducing human process, fewer data inputs, fewer data errors, shorter response time, better cash management, and ease of information process (Iacovou et al., 1995).

Indirect benefits are results from the procedure changes in the organization after IT adoption. Electronic procurement changes the procedures of procurement and strengthens the relationship between organizations. Hospitals can enhance the effectiveness of operation and increase the ability of strategic use of electronic procurement (Dearing, 1990).

Hospitals in Taiwan can be divided into three levels based on size and quality: medical center, regional hospital, and district hospital. From the perspective of size, governmental statute defines the minimum number of acute sickbeds for large hospitals as 500 for medical center and 250 for regional hospital. There is no mandatory requirement for the district hospitals because most of them are relatively small. Besides, a medical center should contain at least 22 different diagnostic departments, while a regional hospital should contain at least 14. Again, there is no minimum requirement of departments for district hospital.

Further, the hospital level can be viewed from the perspective of medical quality. Medical quality of each hospital is evaluated by a public organization in 8 different parts, which include both quality and quantity items. According to the hospital evaluation statute, a medical center should score at least 85 points, a regional hospital must earn 75 points, and a district hospital should receive a grade no less than 60 points.

The category and inventory of pharmacy used by hospitals varies at each level. The pharmacy consumption rate and the type of medicine also differ by the size of the hospitals. Hence, the frequency of pharmacy procurement changes from level to level. The perceived benefits of adopting electronic procurement should have different effects from the scale of the hospital. Therefore, we propose the first hypothesis as follows:

Hypothesis 1: Hospital size affects the hospital managers' perceived benefit of e-procurement.

Cost benefit analysis (CBA) is required when organizations plan to adopt innovative technology. CBA measures the costs and estimates the benefits with the consideration of present value. Some hospitals in Taiwan have adopted e-procurement in recent years to improve the procurement operation. They hope that the adoption of new procurement system can make the purchasing process more flexible and efficient. CBA is usually the major part of feasibility study before adopting e-procurement or other IT. The results from the feasibility study provide hospital managers either a green light to implement the e-procurement or terminate the project. Therefore, adopter, would-be adopter, and non-adopter should have different view on the perceived benefits of e-procurement. So, we propose the next hypothesis as stated below:

Hypothesis 2: The status of adoption affects the hospital managers' perceived benefit of e-procurement

DATA ANALYSIS AND DISCUSSION

Data Collection

Based on the previous research in EDI, IOS, and electronic procurement, we devise a survey questionnaire to collect the relevant data for this study. Research subjects of this study are hospital's presidents, vice presidents, managers of procurement department, and managers of inventory department, who have knowledge of their hospital size, status of e-procurement, and perceived benefits of e-procurement adoption. We have sent out the survey forms to 568 hospitals in Taiwan. 156 survey forms have been received. Four forms have incomplete answers. The total number of valid surveys is 152.

In the 152 returned responses, there are 6 medical centers, 35 regional hospitals and 111 district hospitals. According to the official list of hospitals in Taiwan from the Bureau of National Health Insurance, there are 23 medical centers, 75 regional hospitals, and 470 district hospitals. With 568 hospitals in total, the actual response rate is 26.09% in medical center level, 46.67% in regional hospital level, and 23.62% in district hospital level. The overall response rate is 26.76%. In our sample of 152 returned questionnaires, 22 hospitals have adopted electronic procurement and 58 hospitals will adopt it in a short term. More than half of the hospitals are considering in adopting the electronic procurement.

Though the BNHI classify the hospitals in Taiwan into three levels based on the size and quality provided, it is mainly for billing purpose. From the data collected, some regional hospitals have size equal to or greater than the size of some medical centers. It is inappropriate to measure the effects of hospital size on the managers' perceived benefits with these three pre-determined levels. To reflect the facts, we divide all hospitals into two levels: large and small. Large hospitals include medical centers and regional hospitals while small hospitals are mainly district hospitals. From this dichotomy, there are 43 large hospitals and 111 small hospitals.

Variables	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
Reduced inventory	0.185	0.000	0.909	0.000
Improved Information quality	0.229	0.000	0.895	0.000
Reduced human work	0.184	0.000	0.902	0.000
Reduced data entry	0.219	0.000	0.893	0.000
Reduced data error	0.238	0.000	0.875	0.000
Enhanced response rate	0.185	0.000	0.894	0.000
Improved cash flow	0.189	0.000	0.906	0.000
Enhanced information process	0.272	0.000	0.857	0.000
Improved customer satisfaction	0.208	0.000	0.908	0.000
Enhanced procurement processing	0.209	0.000	0.895	0.000
Improved relationship with supplier	0.215	0.000	0.898	0.000
Reengineered procurement process	0.218	0.000	0.899	0.000
More competitive advantage	0.245	0.000	0.892	0.000
Better managerial strategy	0.226	0.000	0.901	0.000

Table 2. Tests of Normality

Before conducting advanced statistical analysis, a test of basic assumptions is usually performed to determine which statistical methods are appropriate for analyzing the data collected. The results of normality test are listed in Table 2. The results indicate that all benefits items are not distributed normally. The value of significance in Kolmogorov-Smirnov test or Shapiro-Wilk test shall be .95 or higher to claim the normality. After possible transformation, the normality of all benefits items is still not reached. Therefore, the t-test cannot be applied for the hypothesis test without potential bias. Due to the existence of the violation of normality, non-parameter statistical tests are used to test the hypotheses.

Perceived Benefits	Mean (Large)	Mean (Small)	M-W test
Reduced inventory	5.70	5.21	0.010**
Improved information quality	5.53	5.21	0.070**
Reduced human work	6.03	5.38	0.001**
Reduced data entry	5.77	5.46	0.093*
Reduced data error	5.78	5.42	0.043**
Enhanced response rate	6.03	5.41	0.002**
Improved cash flow	5.12	4.91	0.244
Enhanced information process	5.83	5.34	0.002**

Improved customer satisfaction	5.46	4.98	0.004**
Enhanced procurement process	6.05	5.42	0.001**
Improved relationship with supplier	5.27	4.86	0.022**
Reengineered procurement process	5.83	5.33	0.005**
More competitive advantage	5.78	5.14	0.000**
Better managerial strategy	5.73	5.25	0.008**

** significant at $\alpha=.05$; * significant at $\alpha=.10$

Table 3. Mann-Whitney Test Results of Hospital Scale and Perceived Benefits

To test hypothesis 1, Mann-Whitney test is used for examining the difference of two groups. The results are presented in Table 3. Most perceived benefits are significant except for the reduced data entry and improved cash flow. The data results depict that there is no significant difference on perceived benefits of repeated input and cash flow between large hospital and small hospital.

Since the adoption status can be divided into three levels: adopter, will-be adopter, and non-adopter, we perform two sets of non-parameter tests to examine hypothesis 2. Kruskal-Wallis test is used to test the whole model and Mann-Whitney test is used to test the difference of the perceived benefits among three adoption statuses. Both test results are shown in Table 4.

Perceived benefits such as reduced inventory, improved response rate, improved information process, improved information quality, enhanced procurement process, improved relationship with supplier, reengineered procurement process, and more competitive advantage have shown significant difference among three adoption stages from Kruskal-Wallis test. Mann-Whitney pairwise comparison tests indicate that there are some significant differences of benefits perceived by hospital managers at different adoption stages. Most benefit items show significant difference between e-procurement adopters and non-adopters. This post-survey result shows that hospital managers who realize the benefits of e-procurement have adopted the technology while non-adopters remain skeptical about the potential benefits of e-procurement.

Perceived Benefits	K-W test	M-W test A and B	M-W test A and C	M-W test B and C
Reduced inventory	0.007**	0.085*	0.002**	0.088
Improved information quality	0.338	0.726	0.182	0.267
Reduced human work	0.254	0.621	0.152	0.205
Reduced data entry	0.311	0.243	0.139	0.581
Reduced data error	0.259	0.296	0.118	0.398
Enhanced response rate	0.033**	0.165	0.019**	0.091*
Improved cash flow	0.069*	0.200	0.024**	0.206
Enhanced information process	0.011**	0.101	0.001**	0.179
Improved customer satisfaction	0.021**	0.056*	0.007**	0.222
Enhanced procurement process	0.005**	0.126	0.003**	0.037**
Improved relationship with supplier	0.008**	0.006**	0.003**	0.614
Reengineered procurement process	0.004**	0.120	0.002**	0.031**

More competitive advantage	0.003**	0.050**	0.001**	0.048**
Better managerial strategy	0.112	0.343	0.054*	0.168

A: hospitals that have adopted electronic procurement.

B: hospitals that will adopt electronic procurement in a short term.

C: hospitals that will not adopt electronic procurement in a short term.

** significant at $\alpha = .05$; * significant at $\alpha = .10$

Table 4. Mann-Whitney and Kruskal-Wallis Test Results

From the post comparison, we can understand that hospital managers who realize the benefits of e-procurement show strong interest in using it. Therefore, they have either adopted it or planed to adopt it in the near future. Besides, early adopters who have reaped the potential benefits of e-procurement want to sustain competitive advantage from using it. Hence, indirect benefits represented by seven items are significant. The results also show that larger hospitals have stronger interest in using e-procurement.

CONCLUSION

After surveying 152 hospitals in Taiwan, the perceived benefits of reduced inventory, improved information quality, reduced human work, reduced data error, improved response rate, enhanced information processing, improved customer satisfaction, enhanced procurement process, improved relationship with suppliers, reengineered procurement process, more competitive advantage, and better managerial strategy are significantly different between large and small hospitals. The results indicate that managers' perceived benefits in large hospitals are more positive than those of their counterparts in small hospitals. There are several possible reasons why hospital scale has significant influence on managers' perceived benefits.

First, the amount of pharmacy usage is quite different between large and small hospitals. Managers at larger hospitals are eager to adopt information technology to reduce the overhead of huge inventory and cash flow. The willingness of adopting new technology leads managers of larger hospitals to tap into innovative technology and conduct feasibility study. Not only does this phenomenon appear in the healthcare industry, but it also happens in other industries.

Second, information technology capability determines the willingness of adoption of e-procurement. Larger hospital has more capital spending on IT investment, more capable technology manpower, and the state-of-the-art IT infrastructure. They are more likely to adopt innovation in their IT strategic plan.

This study finds that reduced inventory, improved response rate, enhanced information process, improved information quality, enhanced procurement process, improved relationship with supplier, reengineered procurement process, and more competitive advantage are significantly different among the adopter, will-be adopter, and non-adopter. The managerial implications from these findings are discussed below.

First, cost and benefit analysis is a critical factor in the processes of adoption decision. Adopter and will-be adopter should have received positive outcomes from the economic feasibility study. They believe the adoption of e-procurement will reach break-even point at a foreseeable future. The return on IT investment is better than other alternatives.

Second, hospitals that have adopted e-procurement acknowledge these benefits more directly. They may even have reaped some potential benefits at the early stage of implementing e-procurement. Finally, the barrier for new entrant such as vertical alliance and time of implementation may have reached a point that non-adopter has less opportunity to gain the competitive edge.

To understand sustained benefits of innovative IT adoption, longitudinal data is required to reflect the real picture. However, this study only uses cross-sectional data. Further, this study does not include the cost benefit analysis, which is important in feasibility study. Future researchers can collect long-term data to identify how and when the benefits occur during different stage of adoption and implementation. Also, the maturity of e-procurement at some hospitals may have materialized some of the above-mentioned benefits.

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