

The Trend of Internet Use in Korean Health Care Sector

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Abstract

This paper explores the trend of diffusion on internet use for health care in Korea, and tracing the development of internet applications. In 2001, the OECD ranked Korea #1 in the world for broadband Internet penetration. The internet diffusion experience in Korea can thus provide information about potential effects of the internet on the health care delivery elsewhere. Major Internet related innovations include the development of medical contents provider, hospital information systems, telemedicine, electronic commerce and total medical solution portals.

Forty three respondents, 31.4% of the sample, use B2C EC. Among the types of health care organizations, hospitals show the lowest utilization and internet companies show the highest. 13.1% of the respondents operate B2B EC. Only one hospital out of 65 operates EC while 21% of medical equipment company and 58% of internet company operate B2B EC.

Among the internet related industry-wide innovations, we focused on electronic commerce.

In the EC development stage, 74.5% of sample hospitals belong to the first stage and about 10% are to the second stage. It might be worth noting that 15.7% of the sample hospitals have been leading organizational innovations including the transformation of organizations and the integration of activities.

Key word: *Electronic Commerce, Internet Use, B2B, B2C, Diffusion, Trend*

I. Introduction

1. Background

Digitalization significantly improves the connectivity among various entities and standardization of communication. It also relieve the tradeoff between the richness of and reach to the information. Through internet, one can simultaneously reach a plenty of information and its rich contents without incurring a significant additional cost.

To reduce the transaction costs, firms in the 20th century internalized the customer relationship management, product innovation and commercialization, and infrastructure management inside the firm. Since these three processes are significantly different in nature, the firm spent most resource to coordinate the processes so that each process might be sub-optimized. The competitiveness of the firm is, therefore, measured by the average competitive

advantage of these three processes rather than by the total competitive advantage of a firm. Digitalization enhances the possibility of optimizing each process by deconstructing the value chain of a firm. Especially, internet has created various changes, in the patterns of transaction and organizational structure of a firm. Although a few studies dealt with the issue (Porter 2001, Rayport and Sviokla 1994), a very few investigated the case in the health care sector.

2. Objectives and Methods

In this study, we examine the internet related innovation in the health care industry of South Korea (hereafter Korea). Investigating the Korean experience will be valuable for the following three reasons. First of all, Korea has the highest broadband internet penetration in the world. Secondly, the government requires medical institutions to file medical claims through EDI (OECD 2001). The hospitals and clinics have, therefore, incentives to adopt the broadband internet and utilize it to pursue internet based innovations such as e-procurement. In the last, Korea has a unique health care system in that 90% of medical institutions are privately owned, but the financing for health care depends on the national health insurance. Hence, the internet-related innovations are more likely to be pursued by the self-motivated decision of the medical institutions.

Korea also leads the world in the establishment of internet infrastructure. In January 2003, more than 10 million Koreans – one out of four Koreans – have access to the broadband internet, which is more than two times over the penetration rate in Canada (8.4 per 100 population). Sweden ranks the third with the penetration rate of 4.96 per 100 population (OECD 2002). About 26 million Koreans are accessing some types of internet by using 30 million personal computers that are currently available nationwide. Korea ranks third in the world in the number of internet utilization rate. It ranks first in the internet using time, 8th in the number of domains owned and 4th in the number of Ipv6 (Korean Ministry of Telecommunication 2003, MaeKyung Daily 2002, Korean Internet Information Center 2002).

The focus of this study is placed on examining how the well established internet infrastructure. In order to understand the industry-wide changes after the internet boom, we compiled the survey results on the electronic commerce of the health care sector in Korea.

To analyze the industry-wide trends, we used the survey data collected by the Science & Technology Policy Institute and the Korean Institute of Health & Social Affairs. To collect information on e-health innovations, we selected

1005 medical websites by using five search engines including yahoo, hanmir, lycos, naver and empass. We investigated the categories of services offered by each site.

II. Health Care Industry-Wide Trends in Internet Using

1. Proportion of IT Input in Input-Output Table for Major Industries

How much does the health care sector in Korea invest in IT? The answer will be found in the proportion of the IT input among the total input and its comparison across the industries. With this information, we can conjecture the degree of establishment of IT infrastructure across industries.

The Korea Central Bank estimates the input-output table for every five year. Based on the table, we calculated the proportion of IT among the total input. In 1995, the high rankings are observed in the computer & office equipment (66.1%), picture and telecommunication (61.3%), electronic parts (45.9%) and medical equipment (22.9%). Interestingly, the IT input in the medical equipment parts rose from 4.58% in 1985, to 12.81% in 1990, and then to 22.98% in 1995. Except the medical equipment parts, IT utilization by hospitals and pharmaceutical companies are in the lowest quartile compared with other industries (See Table 1).

We also collected data on e-readiness of the health care industry compared with other industries. In terms of the personal computer availability in 1999 fiscal year (FY), the health care industry was also in the lowest group among other industries. It had 102,471 personal computers, financial industry 232,081, public sector 748,491, and other service industries 137,475 (Ministry of Information and Telecommunication 2000). However, the group of medical, precision equipment industries was ranked among the top quartile in terms of digitalization score of small companies as shown in Table 2. We can interpret this gap as the proportion of small size hospitals is high in the health care industry and their e-readiness is lower than the average of all size firms in other industries. But the e-readiness of the health care industry is high when the comparison is limited to the small to medium size organizations of other industries.

Table 1. Proportion of IT out of Total Input in Input-Output Table across Industries

	1985	1990	1995
	IT Input Proportion	IT Input Proportion	IT Input Proportion
Agriculture & Forestry, Marine Product	0.294	0.317	0.730
Mine	0.864	0.584	0.993
Foodstuffs	0.141	0.208	0.244
Textiles & Leather	0.320	0.252	0.351
Lumber & Wood, Paper	0.242	0.239	0.547

Publication, Printing	0.879	1.233	1.883
Oil & Coal	0.110	0.168	0.347
Chemistry	0.278	0.291	0.352
Medicine	1.048	0.611	0.881
Cosmetics	0.559	0.329	0.704
Base metal	0.424	0.396	0.803
First metal	0.124	0.147	0.412
Metal	0.557	0.589	0.373
Machinery	1.260	1.818	1.524
Electricity, Applicants	4.598	5.982	7.030
Electronic parts	38.137	40.857	45.964
Film, Music, Communication	53.269	53.902	61.294
Computer, Office automation	54.097	51.289	66.109
Home electric applicants	13.902	15.372	14.440
Medical applicants	4.585	12.810	22.986
Precision Machinery	6.399	10.105	17.412
Transportation equipment	1.141	1.894	2.364
Furniture	2.838	1.661	1.789
Electricity, Gas, Water supply	0.304	0.236	0.601
Construction	1.414	1.032	0.697
Wholesale, Retail	9.083	10.646	15.429
Restaurant, Lodging	2.586	3.596	3.070
Traffic service, Storage	1.392	1.350	1.056
Broadcasting, Communication	43.484	30.382	21.243
Finance, Insurance	3.703	4.941	7.065
Property, Business Supporting	11.420	10.777	8.748
Public Service, Military	3.565	4.039	5.187
Education Institutes	4.757	2.386	4.699
Research Institutes	6.254	7.813	9.257
Public Medical Institutes	0.904	0.919	1.104
Private Medical Institutes	0.611	0.733	0.757
Health Industry	0.761	0.989	1.008
Social Welfare	4.460	6.605	8.357
Hygiene Service	0.520	0.617	1.790
Social & Etc services	2.222	3.426	3.104
Etc	0.159	0.308	2.050
Total	2.541	4.520	3.316

Source : Jung Y.H., Lee K.J., Jung Y.S., et al. 2002

Table 2. Digitalization Score in Small to Medium Scale Companies in Industries

(Unit : number of Business, (%))

Score Type	Score Level of Computerization								
	Average	~20	20~40	40~50	50~60	60~70	70~80	80~	Sub-Total
Total	47.48	70 (5.6)	332 (26.7)	295 (23.7)	239 (19.2)	171 (13.8)	96 (7.7)	40 (3.2)	1243 (100.0)
Machinery	50.35	5 (2.2)	56 (24.8)	58 (25.7)	33 (14.6)	42 (18.6)	25 (11.1)	7 (3.1)	226 (100.0)
Metallwork	46.80	9 (5.8)	46 (29.7)	36 (23.2)	29 (18.7)	19 (12.3)	10 (6.5)	6 (3.9)	155 (100.0)
Textiles, Leather	39.93	14 (14.6)	35 (36.5)	16 (16.7)	18 (18.8)	6 (6.3)	6 (6.3)	1 (1.0)	96 (100.0)
Chemistry, Fuel	47.99	6 (4.2)	36 (25.2)	38 (26.6)	33 (23.1)	11 (7.7)	13 (9.1)	6 (4.2)	143 (100.0)
Electricity, Electronic	50.83	6 (3.1)	46 (23.7)	42 (21.6)	39 (20.1)	40 (20.6)	14 (7.2)	7 (3.6)	194 (100.0)
Information, Film, Music	59.76	1 (1.8)	3 (5.3)	12 (21.1)	15 (26.3)	10 (17.5)	9 (15.8)	7 (12.3)	57 (100.0)
Medical, Precision Equipment	53.29	1 (2.9)	4 (11.8)	9 (26.5)	11 (32.4)	5 (14.7)	2 (5.9)	2 (5.9)	34 (100.0)
Beverage, Foodstuff	45.76	4 (6.1)	19 (28.8)	17 (25.8)	14 (21.2)	6 (9.1)	4 (6.1)	2 (3.0)	66 (100.0)
Lumber, Wood	44.60	2 (7.1)	12 (42.9)	5 (17.9)	4 (14.3)	4 (14.3)	1 (3.6)	-	28 (100.0)
Publication, Printing	43.74	2 (8.3)	10 (41.7)	4 (16.7)	7 (29.2)	-	1 (4.2)	-	24 (100.0)
Etc, Manufacture	44.10	20 (9.1)	65 (29.5)	58 (26.4)	36 (16.4)	28 (12.7)	11 (5.0)	2 (0.9)	220 (100.0)

Source : Jung Y.H., Lee K.J., Jung Y.S., et al. 2002

Care Industry

According to the Korea Institute of Information Technology Assessment, South Korea had 747 health care related portal sites in 1999 fiscal year (FY) and about 1900 sites in 2000 FY. During the internet boom, 3 major business groups (Samsung, SK, CJ) launched virtual health care markets. Also, the 41 university hospitals set up alliance to start the medical portals and about 100 large pharmacies established pharmaceutical malls. After the bubble burst at the end of 2000 FY, more than a half of the portal sites including the ones owned by business groups were either closed or merged with other sites. The most noteworthy change after 2001 FY is that the proportion of e-health that were not affiliated with major hospitals – either owned by business group or by venture capital – significantly dropped. Among the major business groups, only Samsung group still operates the medical portals.

This trend of e-health during the internet boom was regarded as a potential substitute to hospitals and clinics but the role was changed to complement the off-line medical service after the internet boom. Most major hospitals utilized internet for public relations, managing patient complaints, appointment system and electronic commerce. Among the internet related innovations, electronic commerce had most extensive industry-wide impacts. To understand how the internet commerce affected the health care organizations, we used survey data collected by the Korea Institute of Health & Social Affairs (KIHASA) and the Science & Technology Policy Institute (STEPI). The sample is summarized in the following table.

Table 3. Composition of Sample

	H	P	E	I Co	
# Sent	438	238	144	50	870
%Response	14.8	17.2	13.2	24.0	15.8
#Response	65	41	19	12	137
Proportion	47.4	29.9	13.9	8.8	100.0

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

1) Utilization of B2C Electronic Commerce (EC) in the Health Care Sector

Forty three respondents, 31.4% of the sample, use B2C EC. Among the types of health care organizations, hospitals show the lowest utilization and internet companies show the highest.

Table 4. Utilization of B2C EC by Types of Health Care Organizations

Yes/No	(unit : #, (%))				Total
	H	P	E	I Co	
Yes	14 (21.5)	11 (26.8)	8 (42.1)	10 (83.3)	43(31.4)
No	51 (78.5)	30 (73.2)	11 (57.9)	2(16.7)	94(68.6)
Total	65(100.0)	41(100.0)	19(100.0)	2(100.0)	137(100)

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

2. Trends in the Electronic Commerce in the Korean Health

In the health care sector, the B2C EC is operated through homepage, shopping mall or both. 76.3% of the respondents utilize the homepage only while the rest operate the both. None of the respondents operate shopping mall alone.

Health care organizations use B2C EC for different reasons: PR (60.5%), contents provider (23.3%), sales of products (11.6%) and customer relationship (4.6%). Details of the usage across the organization types are as follows.

Table 5. Usage of B2C EC in the Korean Health Care Sector

(unit : #, (%))					
Usage	H	P	E	I Co	Total
PR	10(71.4)	9(81.8)	6(75.0)	1(10.0)	26(60.5)
Contents	4(28.6)	1(9.1)	0(0.0)	5(50.0)	10(23.3)
Sales	0(0.0)	0(0.0)	2(25.0)	3(30.0)	5(11.6)
CRM	0(0.0)	1(9.1)	0(0.0)	1(10.0)	2(4.6)
Total	14(100.0)	11(100.0)	8(100.0)	10(100.0)	43(100.0)

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

The survey also investigated the reasons for not using B2C EC. They are uncertain profit model (24.1%), poor IT infrastructure (17.9%), budget constraint (16.7%), shortage of expert (12.3%), the lack of top management leadership (3.5%), and security problem (3.7%). In summary, the health care sector has not fully adopted the B2C EC due to the lack of infrastructure and resource. The Korean health care sector does not seem to approach the point of actively implementing B2C EC because it regards the leadership and security problems as less important, which are the key issues in implementation.

2) Utilization of B2B EC in the Health Care Sector

13.1% of the respondents operate B2B EC. Only one hospital out of 65 operates EC while 21% of medical equipment company and 58% of internet company operate B2B EC.

Table 6. Utilization of B2B EC by Types of Health Care Organizations

(unit : #, (%))					
Yes/No	H	P	E	I Co	Total
Yes	1(1.5)	6(14.6)	4(21.6)	7(58.3)	18(13.1)
No	64(98.5)	35(85.4)	15(78.9)	5(41.7)	119(86.9)
Total	65(100.0)	41(100.0)	19(100.0)	12(100.0)	137(100.0)

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

The reasons for not using B2B EC are similar to those for B2C. The B2B EC are operated through 3 types of data interchange: internet EDI (47.1%), traditional EDI (23.5%) and e-mail(17.6%). The usage of B2B EC are purchase order, information exchange, sales order, inventory control and financing.

Table 7. Usage of B2B EC in the Korean Health Care Sector

(unit : #, (%))					
Usage	H	P	E	I Co	Total
Internet EDI	0(0.0)	4(100.0)	2(50.0)	2(28.6)	8(47.1)
Traditional EDI	1(50.0)	0(0.0)	0(0.0)	3(42.9)	4(23.5)
Email	1(50.0)	0(0.0)	2(50.0)	0(0.0)	3(17.6)
Others	0(0.0)	0(0.0)	0(0.0)	2(28.6)	2(11.8)
Total	2(100.0)	4(100.0)	4(100.0)	7(100.0)	17(100.0)

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

The survey also compiled information on the obstacles to the B2C, B2B EC. While the incomplete Medical Act (20.3%), and poor logistic systems (10.2%) are considered as main obstacles to the development of B2C EC, the lack of standardization (16.9%), and poor IT infrastructure (11.9%) are the obstacles to B2B EC.

Table 8. Obstacles to the B2C EC and B2B EC

(unit : #, (%))		
Obstacles	B2C	B2B
Medical Act	12(20.3)	7(11.9)
Payment technology	7(11.9)	8(13.6)
Logistic system	6(10.2)	
Incomplete EC Act	5(8.5)	3(5.1)
Privacy/Security	5(8.5)	6(10.2)
Expert Shortage	5(8.5)	5(8.5)
Quality of Information	5(8.5)	7(11.9)
Standardization	3(5.1)	10(16.9)
Cooperation among HC org	3(5.1)	7(11.9)
IT infrastructure	3(5.1)	0(0.0)
Tax Burden	2(3.4)	1(1.7)
Fixed Cost	1(1.7)	
Lack of top management leadership		4(6.8)
Resistance to change		0(0.0)
	59(100.0)	59(100.0)

3) Development Stage of Electronic Commerce in Health Care

We classify the development of EC in health care into 5 stages. The first stage is web presence where the simple promotion is made through the homepage. In the second stage, the interaction between provider and consumer occurs in the manner of Q&A, online consultation through the homepage which was already established. The third stage is the adoption of intranet by the health care organization to utilize internet technologies. The fourth stage can be characterized as the transaction where various B2B, B2C transactions are made online. Finally, the fifth stage involves the transformation and integration of various activities and organizations.

Among the survey respondents, 74.5% belong to the first stage and about 10% are in the second stage. These figures are similar to the development stages of the U.S. It might be worth noting that 15.7% of the respondents are classified into the third to fifth stages. Many types of innovations including the transformation of organizations and the integration of activities occurred in

Korea after 1997. We will discuss these cases in the next section.

Table 9. Proportion of HC Organization in each Development Stage of the EC

(unit : #, (%))					
Stages	H	P	E	I Co	Total
1	13(76.5)		14(87.5)	7(87.5)	38(74.5)
2	4(40.0)				5(9.8)
3	2(11.8)	2(12.5)	19(12.5)	0 (0.0)	4(7.8)
4	1(5.9)		0(0.0)	0(0.0)	3(5.9)
5	3(30.0)		0(0.0)	0(0.0)	1(2.0)
	0(0.0)		0(0.0)	0(0.0)	
	3(30.0)				
	1(5.9)	0(0.0)	0(0.0)	0 (0.0)	
Total	17(100.0)		16(100.0)	8(100.0)	51(100.0)
	10(100.0)				

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The survey also investigated the question of what aspects of EC will be the most promising business model in the near future? Health care contents provider is rated as the most promising business model (19.9% of the respondents), e-GPO as the second (16.4%) and e-CRM as the third (16.1%). Interestingly, the rankings are quite different across the types of health care organization. Hospitals rank medical contents providers and e-GPO as the first (20.4%), while pharmaceutical companies rank the virtual market as the first (21.6%). Also the proportion of health care organizations that regarded ASP as promising field is turn out to be 9%, which is higher than the case of manufacturing industry.

Table 10. Promising Health Care EC Business Model

(unit : #, (%))					
Biz Model	H	P	E	I Co	Total
Contents	34(20.4)	13(12.7)	16(31.4)	6(22.2)	69(19.9)
e-GPO	34(20.4)	12(11.8)	8(15.7)	3(11.1)	57(16.4)
e-CRM	25(15.0)	21(20.6)	6(11.8)	4(14.8)	56(16.1)
e-Market	15 (9.0)	22(21.6)	9(17.6)	3(11.1)	49(14.1)
Broadcast	24(14.4)	7(6.9)	9(17.6)	2(7.4)	42(12.1)
e-SCM	18(10.8)	17(16.7)	1(2.0)	2(7.4)	38(11.0)
ASP	15(9.0)	1(1.0)	0(0.0)	5(18.5)	21(6.1)
Broker	1(0.6)	9(8.8)	2(3.9)	2(7.4)	14(4.0)
Others	1(0.6)	0(0.0)	0(0.0)	0(0.0)	1(0.3)
Total	167(100)	102(100)	51(100)	27(100)	347(100)

H : Hospital, P: Pharmaceutical, E: Equipment, I Co: Internet Co

IV. Conclusion

Unlike the US, e-readiness of the Korean health care sector, except the medial equipment, was in the lowest quartile compared with other industries. Among the internet related industry-wide innovations, we focused on electronic commerce.

Forty three respondents, 31.4% of the sample, use B2C EC.

Among the types of health care organizations, hospitals show the lowest utilization and internet companies show the highest. 13.1% of the respondents operate B2B EC. Only one hospital out of 65 operates EC while 21% of medical equipment company and 58% of internet company operate B2B EC.

We classify the development of EC in health care into 5 stages. The first stage is web presence where the simple promotion is made through the homepage. In the second stage, the interaction between provider and consumer occurs in the manner of Q&A, online consultation through the homepage which was already established. The third stage is the adoption of intranet by the health care organization to utilize internet technologies. The fourth stage can be characterized as the transaction where various B2B, B2C transactions are made online. Finally, the fifth stage involves the transformation and integration of various activities and organizations.

In the EC development stage, 74.5% of sample hospitals belong to the first stage and about 10% are to the second stage. These figures are similar to the development stages of the U.S. It might be worth noting that 15.7% of the sample hospitals have been leading organizational innovations including the transformation of organizations and the integration of activities.

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