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Empirical Study on IT Productivity in eGovernment in Korea

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Abstract: Korean government ministries are asked to carry out their works and to operate internal organization along the principle of economic efficiency. We develop and apply IT systems in order to make work processes more efficient and more effective. Certainly they have done their jobs, but still must be subjected to an economic efficiency assessment. But it is not easy to assess IT systems in non-profit organizations with economic measurement for the reason why they have various and different stakeholders and their services are frequently intangible. Many scholars and researchers take interests in assessing IT systems in non-profit organizations as well. The purpose of this paper is to offer the real calculation which provides an overall statement concerning the economic efficiency of the IT system in public sector in Korea. It also provides some factors to be considered when not only assessing IT systems in non-profit organizations but also presenting a methodological frame for IT evaluation and the government ministries.

Keywords: ICT, productivity, intellectual property, non-profit organization, assessment

1. Introduction

Korean Intellectual Property Office (KIPO) is the major governmental authority in charge of intellectual property matters in Korea. KIPO offers information on patent applications and provides an accurate examination/trial service to satisfy global standards. The mission of KIPO is to help Korea become an advanced country, by providing legal and institutional administration with regard to the creation and utilization of highly creative, value-added intellectual property and by promoting technological innovation and industrial development(see <http://www.kipo.go.kr/>).

eGovernment refers to the delivery of government services and production improvement through IT applications ([Chen], [Sprecher]). eGovernment services include eGovernment initiatives to create efficiencies at both inter- and intra- governmental agency levels ([Lee]). As one of eGovernment initiatives KIPO set out to automate its workforce several years ago, computerizing all administrative procedures for their knowledge workers. Now a days KIPO wanted to know whether if this strategy has resulted in increased employee productivity throughout the organization or not. And also it wanted to understand the business value of such strategy to itself.

Recently there have been many attempts to understand and measure the returns from information technology investment in public sector([Braaksma et al], [Danayan], [Castelnuovo et al]). The purpose of this paper is to offer the real calculation which provides an overall statement concerning the employee productivity of the KIPO IT system. It also provides some factors to be considered when not only assessing IT systems in non-profit organizations but also presenting a methodological frame for IT evaluation and the government ministries.

2. Study methodology

To understand and explore the impact of IT system on employee productivity during the two-month evaluation period, we used couple of data collection techniques:

- Surveys to collect satisfaction data
- Employees interviews
- System-generated data

Sample surveys and controlled experiment are the primary data collection techniques ([Guba], [Orlikowski]). Hence we surveyed some employees who had experienced old ways without IT systems to collect satisfaction data of IT systems. Due to KIPO's help, surveys were easy to administer and could be collected efficiently from sample employees. But since surveys can be impacted by a participant's willingness to respond and other user reporting biases, we also collected other information.

We interviewed some employees to gather open-ended responses, to allow for follow-up questions, and to uncover unanticipated information. We also asked them to keep activity logs capturing how often and for how long activities were performed, defining a core set of activities with clear start and stop points. Then we reviewed system-generated data to figure out the productivity of the employees who were performing certain activities with IT.

This paper was designed to quantitatively understand the impact to productivity and to develop a deeper understanding of the qualitative findings with knowledge workers in the office. We defined employee productivity as organization's average quantity of output produced by one employee ([Barton]). We consider a catalogue of criteria containing the quality criteria which are related to quality improvements within the public agency, and to the effect on the staff of the public administration:

- Improved job performance
- Acceleration of work procedures and processes
- Standardised and uniform administrative work
- Public image improvement
- Attractiveness of working conditions

3. Korea Intellectual Property Office and information system overview [\(<http://www.kipo.go.kr>\)](http://www.kipo.go.kr)

3.1 Korea Intellectual Property Office

After a patent application is filed with the KIPO, a patent right is granted through various steps. The Korean system is characterized by (i) First-to-File Rule; (ii) Publication of Unexamined Application; (iii) Request for Examination. Either the inventor of an invention or his assignee can file a patent application for the invention with KIPO. The applicant may be either a natural person or a juristic person.

When a patent application is submitted to KIPO, it is checked to ensure that all requirements necessary to accord the application a filing date have been satisfied. Applications that have not yet been published will be automatically laid-open in the official gazette called "Patent Laid-open Gazette" after 18 months from the filing date in the Republic of Korea or, if the right of priority is claimed from an earlier foreign filing, from the priority date.

A patent application will be taken up for examination only if a request for examination is made either by the applicant or by any interested party within 5 years from the filing date of the application. If the examiner finds a ground for rejection of a patent application, a notice of preliminary rejection will be issued; and the applicant will be given an opportunity to submit a response to the preliminary rejection within a time limit designated by the examiner. Such time limit is extendable upon the request for an extension by the applicant.

When a patent applicant receives a notice of decision to grant a patent he should pay, as a registration fee, the first 3 years' annuities within 3 months from the date of receipt of such notice. Where the examiners finds no grounds for refusal of a patent application, KIPO publishes the patent registration after the patent applicant pays the registration fee. Once a patent has been published in the Patent Registration Gazette, any person may file an opposition against the registration of a patent between the date on which the patent is registered and the date that marks a lapse of three months since the publication date.



Figure 1: Procedures for granting a patent

3.2 Information system overview

KIPOnet is an office automation system that enables complete electronic management of IPR affairs. It provides applicants with a breadth of electronic services such as on-line filing and patent information searches. All their administrative procedures are computerized. When an application is received via the Internet or on paper, KIPO handle everything electronically including filing, prior art searches, examination, registration, and publishing.

As of 2007, the KIPOnet system comprises 39 subsystems while integrating redundant legacy systems. For example, the Electronic Application Preparation System (KEAPS), the General Receiving System, the Formality Check System, the Search System, the Trial Administration System, and the Gazette Publication System. In February 2005, KIPO integrated networks, which were physically divided, into an internal network for IPR administration and an external network for public access, providing access to internal and external sites simultaneously. The introduction of the Enterprise Security Management System and the Security Patrol Center enabled KIPOnet to operate around the clock, even in an emergency.

The receipt, or if needed rejection, of an Internet-based application is immediately sent to the applicant or transmitted to a formality examiner of KIPO after it is received via the internal server in real time through the SSL channel. Applications passing a formality examination are loaded into an integrated database as an XML-based electronic dossier, which enable examiners to judge its patentability. After the examination, the application data is utilized for registration and publication. The Internet gazettes have been offered in PDF-format at the web site (<http://www.kipo.go.kr>) since July 2001.

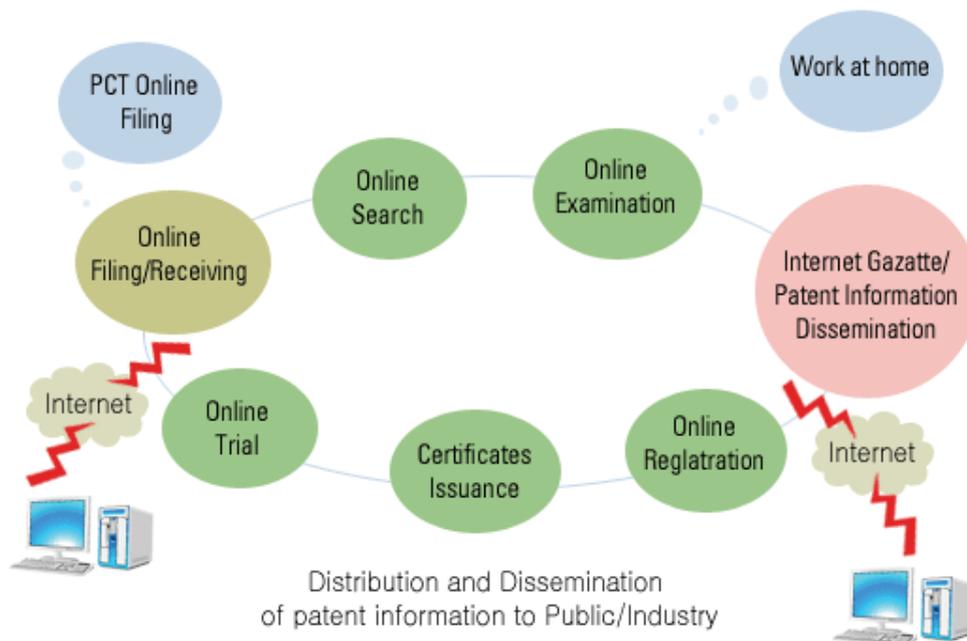


Figure 2: Concept of the KIPOnet system

4. Measuring IT productivity in KIPO

In 2001, the McKinsey Global Institute found that IT had diverse and complex impact depending on when, where, and how it was deployed [Kellison]. Therefore we seek to answer the question, "how did IT drive productivity growth in the KIPO in the 2000s?" This report focuses on the relationship between IT and productivity in two parts: a process management part for the administration and a data management part for the effective data search and examination. We conducted this study by first outlining the business process and evaluating the impact of IT applications. We define IT productivity of each business process as the ratio of the number of units produced and the number of employees when they do their works with IT.

As a result, by digitizing the entire patent administration process, including the application, examination, registration, and trial of patents, KIPOnet has faithfully supported the renovation of patent administration and its internal work process. In fact, since IT was deployed in the business processes, IT has increased the average productivity by 5.6% in e-filing process and 16.5% in registration process.

This is because that IT system enables filing online applications, automatic retrieval of a variety of notifications and filing records, and providing convenient services involving notifications and issuance of certificates. KIPO also introduced the work-at-home system for examiners. While examination circumstances vary, some examiners only have to commute to work one day a week.

Table 1: IT productivity in e-filing process

	before IT(avg)	'99	'00	'01	'02	'03	'04	'05	'06
number of applications (thousand)	185	231	283	289	290	306	327	359	367
number of employees	34	47	42	42	42	42	42	42	42
rate of IT productivity compared with before IT	1.00	0.90	1.24	1.2	1.27	1.34	1.43	1.5	1.61

Table 2: IT productivity in registration process

	before IT(avg)	'99	'00	'01	'02	'03	'04	'05	'06
number of registrations (thousand)	73	148	126	130	153	155	165	198	250
number of employees	26	26	26	26	26	26	26	26	26
rate of IT productivity compared with before IT	1.00	2.00	1.71	1.77	2.07	2.11	2.24	2.68	3.39

The number of applications increased rapidly every year so that examiners have had burdensome duties to examine. To disburden workload, KIPO increased the workforce and boosted the outsourcing of prior art searches. The number of examiners expanded from 400 in 1999 to 728 in 2005, while the portion of outsourced prior art searches rose from 13% in 2000 to 50% in 2005.

Despite the skyrocketing of patent applications, KIPO reduced the average examination period, which is the time for a first action on patent applications from over 28.1 months in 1998 to 9.8 months in 2006. As a result, KIPOnet has doubled the employee productivity in examination process. IT system improved productivity by speeding up examination processes. More up-to-date and more precise forms of communication reduced transport time, dead time, and preparation time. But the productivity remained almost same through recent years except 2006, in which KIPO encouraged examiners to do their jobs and to reduce the examination period.

Table 3: IT productivity in examination process

	'99	'00	'01	'02	'03	'04	'05	'06
number of units examined (thousand)	796	711	610	828	991	1,140	1,518	2,244
number of examiners	402	380	382	453	513	558	728	727
rate of IT productivity compared with before IT	2.0	1.9	1.6	1.8	1.9	2.1	2.1	3.1

To have a high quality result concerning productivity, other criteria and multi-dimensional approach should be required. That is, we have to consider some parameters beyond parameters can be quantified because IT systems can have different effects in different circumstances. In the case of

KIPO, qualitative and strategic parameters would be more important than parameter in monetary terms since KIPO is a non-profit organization. We surveyed and evaluated KIPOnet in 4 qualitative terms: the quality of work process, acceleration of work processes, standard and uniform work flow, satisfaction.

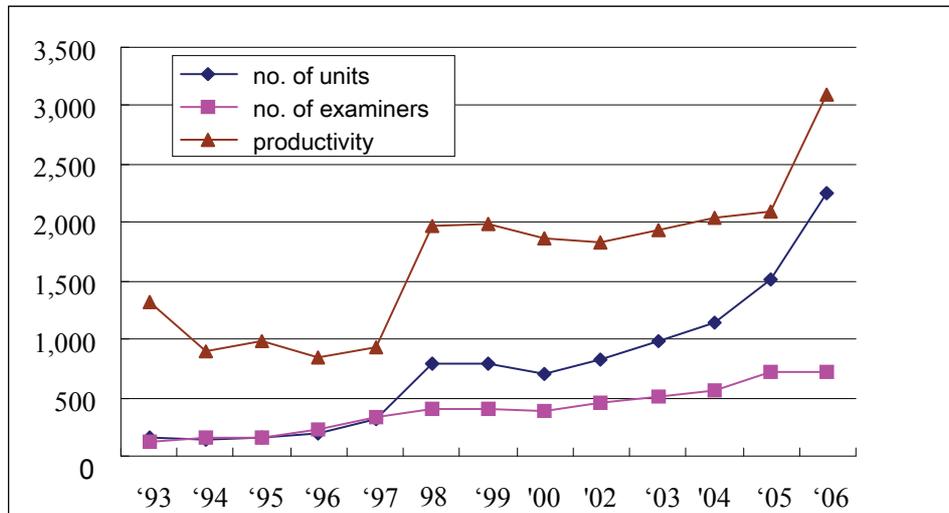


Figure 3: IT productivity in examination process

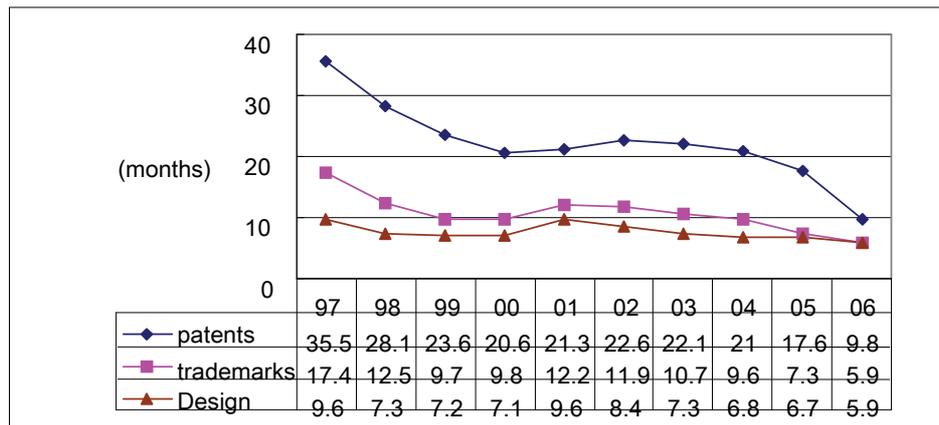


Figure 4: The examination period (unit : months)

We evaluated the qualitative effects related to work, i.e. whether the quality of the work process as such and hence also of the product is improved. We assessed the qualitative improvements of transparency of administrative work, simplified internal workflows, as well as elimination of redundant and routine operations. When evaluating this criterion, the effects should be differentiated in terms of formal improvement (the workflow improves itself) and material improvement (the result of the workflow is improved) As a result, KIPO showed significant improvement of the formal work process(7.1 point out of 10) and some improvement of the result of the workflow. KIPO established the intelligent search and examination system, KIPO published examination guidelines and began evaluating examinations. It introduced an examination quality index to help manage examinations. From a score of 100 points in 1999, the index rose to 125 points in 2005. Furthermore, to increase the fairness of examinations, KIPO started using examination notes in 2005 as a means of recording and publishing the major decisions of examiners.

Table 4: Examination quality index

Year	2000	2001	2002	2003	2004	2005	2006
Quality index	100	106.4	112.3	116.2	122.1	125.3	128.7

We measured the improvement by speeding up work procedures and processes. Acceleration of work procedures and processes enables faster performance (reducing cycle time). The effects are due to electronic communications, elimination of media inconsistency, access to up-to-date databases by all authorised users, and even by elimination of individual working positions. The assessment of the qualitative criterion is the result of a critical evaluation of the improvements which the IT measure will offer to users in the organization unit concerned.- Acceleration: whether cycle time is reduced by reducing traveling time and preparation. As a result, KIPO showed significant improvement of the acceleration of work processes as present cycle time had been reduced by up to 30%.

We evaluated standard and uniform work flow: the extent to which IT system would replace old work flow with standardized and uniform one. This can be due to up-to-date access to data with uniform structures and due the harmonisation of administrative procedures on both organizational and IT level. There was significant improvement thanks to standardization of data structures and process routines within KIPO(6.9 point out of 10).

5. Conclusion

The most remarkable benefit of KIPOnet has been the shift in their work process; namely, from a paper-based paradigm to an electronic paradigm. With a state-of-the-art IT infrastructure, KIPO has become more IT-oriented. Indeed, IT accelerated the KIPO productivity revolution, pushing annual labor productivity growth higher. For internal efficiency, KIPO enhanced efficiency and transparency of the intellectual property administration with computerized searches and renovated business processes. e-Filing and registration processes of patents are administrative processes which are good collaborated with IT. Both processes deal with a set of meta information like patent's applicant's information and thus IT systems can easily check whether if the applicants fill basic information in the application or registration forms. In fact, employee productivity in both processes increases even though the number of applications are increased high and the number of staffs has been never increased.

On the other hands, employee productivity in substantial examination was doubled when the IT system introduced first but it has not been increased any more and stayed even. Substantial examination is complicated and nuanced jobs requiring experience, expertise, judgement, interaction and collaboration. Increasing productivity for these employees, whose jobs can't be automated, has thus far proven to be a major challenge for software developers around world.

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