GIS Implementation at Korean Local Government: Analysis through Employees' Perception Survey*

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직원들의 인식조사를 통한 한국 지방정부에서의 GIS 도입 및 실행에 관한 연구*

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ABSTRACT

In the process of GIS implementation, various unexpected problems could be uncovered. If neglected, these problems would make GIS implementation much more difficult. In order to improve GIS implementation along with alleviating these problems, the following are recommended. First, in establishing GIS master plans the Korean government has to have a better understanding not only on financial and technological feasibilities, but also on organizational culture, employees' experience and perception on new technology, etc. Second, to avoid overlapping investments and technical problems such as discrepancies between digital maps drawn by different agencies and between traditional parcel maps and digital maps, a unified and/or coordinated GIS map-making system and departmental coordination are required.

KEYWORDS: GIS, Implementation, Organizational Culture, Experience, Perception, Technological Feasibility

요　약

GIS의 실행에 있어서는 예상치 못했던 여러 문제점들이 나타나기 마련이고, 이러한 문제점들이 계속 무시된다면 GIS의 도입 및 실행이 더욱 어려워질 것이다. 이러한 문제점들을 해결하고 GIS의 실행을 효율적으로 진행시키기 위해서 다음과 같은 사항들이 요구된다. 첫째, GIS 중장기계획을 세우는데 있어서 한국지방정부들은 재정, 기술부문 뿐만 아니라 조직문화, 도입될 새로운 기술에 대한 직원들의 경험과 인식에 대하여 좀더 깊은 이해가 있어야 할 것이다. 둘째, 중복된 투자나 기술적인 문제들, 예를 들어 수치지도와 기존의 지적도와의 불일치, 제작기관이 다른 수치지도들의 불일치를 해결하기 위해서는 수치지도 제작에 있어서 표준화가 요구되며 각 기관과 부서들의 협력이 절대적으로 필요하다.

주요어: GIS, 실행, 조직문화, 경험, 인식, 기술적인 실행가능성

INTRODUCTION

The Korean government is trying to introduce GIS since the early 1990's. While the digital map making was a major GIS related work of central and local governments at the beginning, recently the major focus seems to have shifted to establishing various urban information and management systems.

Many local governments including cities, counties, and provinces have established the GIS master plans and are trying to implement the plans. The master plans tend to include various advanced-techniques under so called technological optimism. However, various unexpected problems and/or frictions have been uncovered in the implementation process. These problems and/or frictions could not only be from traditional reasons such as lack of political will, lack of funding, and technological feasibility, but also from organizational culture, work tradition, and employees' experience and perception on new technology. If neglected continuously, these problems would make GIS implementation more difficult. GIS implementation could include construction, utilization, and maintenance of GIS.

Numerous studies of organizational and information management issue related to GIS in local government exist. Sieber(2000) argues, although implementation involves a considerable degree of technical issues, such as system design and installation, the technical issues may be equaled or surpassed by organizational issues. Obermeya and Pinto(1994) argue that technical validity, organizational validity, and organizational effectiveness are necessary conditions for successful implementation of GIS.

According to Pinto and Azad(1994), even in American local governments, such barriers as hesitation for new technology and lack of interdepartmental coordination exist in the process of GIS implementation. Similarly, Chan and Williamson(1999) argue that two of the major problems in GIS utilization are: an organizational culture that is as hesitant for departmental coordination, and employees' perception as a burden for new technology.

PURPOSE OF STUDY AND RESEARCH METHODS

The purpose of this study is to identify the problems, especially from organizational culture and employees' perception on new technology, which are occurred in the process of GIS implementation in local governments in Korea, and to suggest solutions to alleviate these problems.

Even though important as much as technological and financial feasibilities, organizational culture and employees' perception on new technology are frequently neglected in the GIS planning and implementation processes. These problems, if neglected continuously, would make GIS implementation much more difficult.

For the study, various related books, articles, and reports were reviewed. The survey data on local government employees' perceptions on GIS implementation were obtained from the Kyongsan City Geographic Information System Master Plan and the Gyeongsangbuk-Do Geographic Information System Master Plan performed in 2001 by the GIS Institute of Handong University.

INTRODUCTION AND IMPLEMENTATION OF GIS IN LOCAL GOVERNMENT

GIS was introduced in the early 1990's in Korea. By the year of 2000, digital maps of scale 1/5,000 and 1/25,000 for plains and mountains of whole Korea have been completed. Also, for 79 city areas 1/1,000 scale maps have been completed. These digital maps have been completed and revised by the Institute of National Geography in conjunction with local governments. Apart from digital map-making, major local governments have been trying to develop some engineering related GIS projects such as road information system and sewer information system.

Now, most of the local governments have installed GIS for their computer systems and many of them established the GIS master plans. Even though detailed GIS applied projects have not been actively performed yet, except some facility management projects, GIS is known as a major tool for local governments for a better administration and public services. Central government and most of the local governments are investing a large sum of money for establishing urban information system using GIS. The urban information system could include land use information system, urban planning information system, facility management system, road management system, and administration information system.

The land use information system has been studied and developed since 1992. The National GIS Information System(NGIS) started in 1995 includes the land use information system, which has pursued the parcel-based land information system. The project would invest $85 million from 1998~2002 and plans to complete the parcel-based GIS maps for the whole country(Park et al., 2001). The land use information system will also include zoning and land use planning maps. One of the major problems of the project is in the discrepancies between newly drawn GIS parcel-based maps and traditionally drawn parcel maps. For more intensive utilization of the newly drawn GIS parcel-based maps, certain methods and/or techniques have to be developed to resolve these kinds of discrepancies. Also, according to Koo(2000), one of the major problems in GIS map making and/or GIS implementation in Korea is on the too-much-comprehensiveness of digital maps. Digital maps in Korea not only include comprehensive geographic data, but also comprehensive attribute style data. These attribute style data could be established in different system and could be integrated into GIS according to need. But digital maps in Korea including a lot of attribute style data require frequent, expensive modification, since for example requests for of parcel and land use information could be hundred cases at a city in a day.

The facility management has been tentatively developed on a small scale in local governments. The Korean government is establishing comprehensive plans to make underground facility maps such as water and sewer lines and their utilization systems. The Korean government plans to complete the underground facility maps of all cities during 2001~2005. However, various problems are identified and forecasted because of a variety of known and unknown underground facilities and too many controling bodies and/or jurisdictions(Park et al., 2001).

The road management system has been

developed by the central government and local governments almost independently. The central government focuses on developing digital road maps, traffic volume survey system, bridge management system, and road pavement management system. Local governments focus to develop road and related land and facility management system, and road signage management system. Major problems with the road management system are from the non-unified system of map-making and administration systems(Park et al., 2001).

Administration information systems could be either a part of urban information system, or administrative computerization system. The central government and local governments currently have developed or are developing master plans of administrative computerization for better and faster public services. However, detailed projects are not developed yet except for some web-site connections of city or departmental home-pages.

Urban planning information systems could be a part of urban information systems. It is focusing on digitalization and/or computerization of urban planning related maps and information for better and faster planning related administration work and public services. Local governments started to do digitalization of planning related maps and figures along with urban information system development, but still there exist hesitations for inter-departmental information sharing and for intensive use on administration and/or decision-making(Park et al., 2001).

Kim(2000) argues that if urban information system only focus on technical factors and not integrate administrative realities to the system, utilization of urban information system would be

very limited. According to Kim(1999), major problems for GIS implementation and utilization in local governments in Korea are:

- Lack of GIS techniques
- Lack of financial resources
- Difficult cost-benefit analysis for GIS implementation
- Low recognition of decision-makers on GIS
- Lack of GIS specialists and education
- Resistance of workers
- Lack of departmental coordination
- Backwardness of administrative data-bases
- Lack of collaboration between GIS maps and socio-demographic data

A SURVEY OF LOCAL GOVERNMENT EMPLOYEES' PERCEPTION ON GIS IMPLEMENTATION

Three sets of survey data were used for this study. The first one is the survey from employees of GIS departments or sections of thirty two local governments in Korea(Kyongsan City, 2001). Second survey is from employees of GIS related departments of Kyongsan City(Kyongsan City, 2001). The third one is the survey from employees of GIS related department of Gyeongsangbuk-Do province office and twenty three local governments in Korea(Gyeonsangbuk-Do, 2001) .

1. Survey from Thirty Two Local Governments

The survey was done in June 2000 by the Kyongsan City GIS team and the GIS Institute of Handong University. The survey sheets were sent to the 32 local governments which adopted GIS. More specifically, 105 survey sheets were

sent to the two groups of the 32 local governments, one is the GIS related planning and management group, the other is the line department group who directly use GIS for their work, and 36 sheets were returned from 15 local governments.

The survey questionnaires included questions on the reasons for GIS adoption, the employee's perceptions on GIS technology, and the degree of utilization of GIS. These two groups have some different perspectives and feedbacks on GIS implementation.

1) Answers from the planning and management group

Regarding immediate reasons for adopting GIS, 40% of those surveyed said it was for preparation of incoming telecommunication era without pin-pointing any specific reasons, 27% for following guidance and/or order of central government, and only 16% for some practical reasons at the department.

Regarding the purpose of adopting GIS, 38% said it was for facility management, 28% for management of maps, drawings, and related data bases, 17% for spatial analyses, and 14% for public services.

For the degree of expectation for GIS utilization in their administration work, 76.5% of those surveyed said it was very high or high, 18% average, and 6% low.

For the degree of current utilization of GIS, 76% said it was very high or high, 18% average, and 6% low.

2) Answers from the line department group

Regarding the purpose of GIS adoption, 39% said it was for facility management, 25% for management of maps, drawings, and related data bases, 27% for spatial analyses, and 9% for public services.

Regarding trouble-some factors in GIS implementation process, 24% of those surveyed said it was because of a lack of experts, 22% a lack of fund, 19% a lack of interdepartmental coordination, 14% a lack of interest of probable users, 8% a lack of systematic data bases, and 7% employees' lack of knowledge on GIS.

Regarding the degree of expectation for GIS utilization on their administration work, 59% of
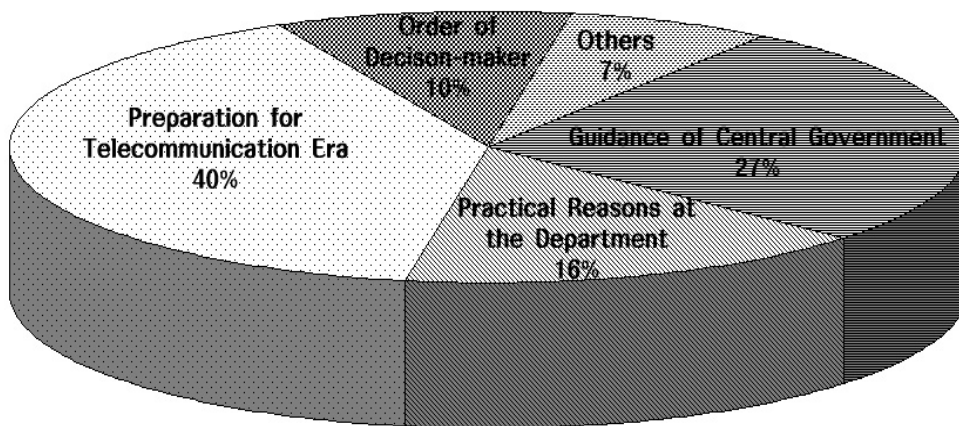

FIGURE 1. Reasons for adopting GIS of the planning and management group
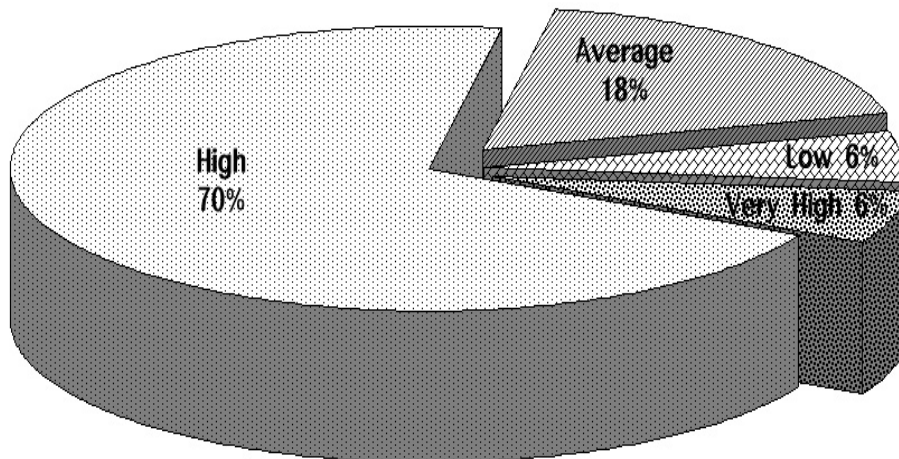
FIGURE 2. The degree of expectation for GIS utilization of planning and management group

those surveyed said it was very high or high, 31% average, and 10% low.

Regarding the degree of current utilization of GIS, 30% of those surveyed said it was very high or high, 55% average, and 15% low.

2. Survey Results from Kyongsan City

Kyongsan City established its GIS master plan in 2001. To obtain background information for the plan, a survey from probable GIS user department employees was done. 191 survey forms were sent to 16 departments and 121 of 63.4% answer sheets were returned.

Regarding the necessity of implementing and using GIS, 40% of managers thought that it was good decision, while 57% for line employees.
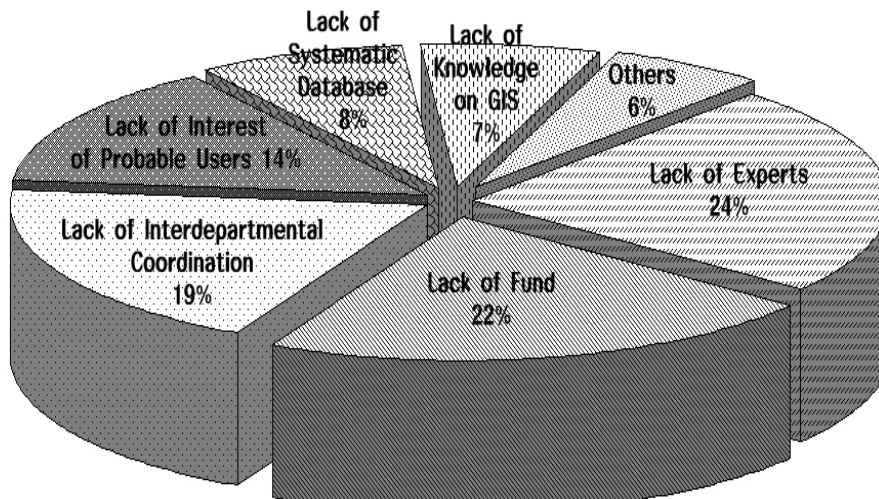

FIGURE 3. Trouble-some factors in GIS implementation process

Regarding the question on the contribution of GIS utilization, 29% of employees expect that there would be good improvement for facility management, while 23% for administrative work, and 15% for public services.

When asked whether they know about the comprehensive land information system which the Kyongsan City plan to implement as a major prime GIS project, 56% of employees know well, and 44% not know.

For the questions on previous experiences and/or participations on GIS education or seminars, 74% of employees did not have experience at all, while 22% participated one to five times and 4% more than 5 times.

3. Survey Results from Gyeongsangbuk-Do

An internet questionnaire survey on GIS implementation from the employees of Gyeongsanbuk-Do province office and 23 major local governments was done in February 2001 by the Gyeongsangbuk-Do Department of Information and Telecommunication and the Handong University GIS Institute, and 416 interview responses were gathered from the survey. The survey was done through Internet because of two major reasons, one is for convenience in data processing and the other is for government employees to be familiar with internet. To supplement the weakness of the internet survey, some direct surveys were done at the Gyeongsangbuk-Do province office and 7 major local cities.

64% of those respondents said they understand what is GIS, but only 30% have somewhat precise ideas on GIS application to their works. However, 90% of those respondents still think that GIS would be helpful to improve public services.

Regarding the most important part for GIS implementation at the local government, 38% of those respondents said establishment of administration systemization, 35% internet GIS, and 25% basic geographic information data bases.

Regarding the most requested supports for the GIS implementation in the local government from the province government, 32% of those respondents said provision of GIS education,
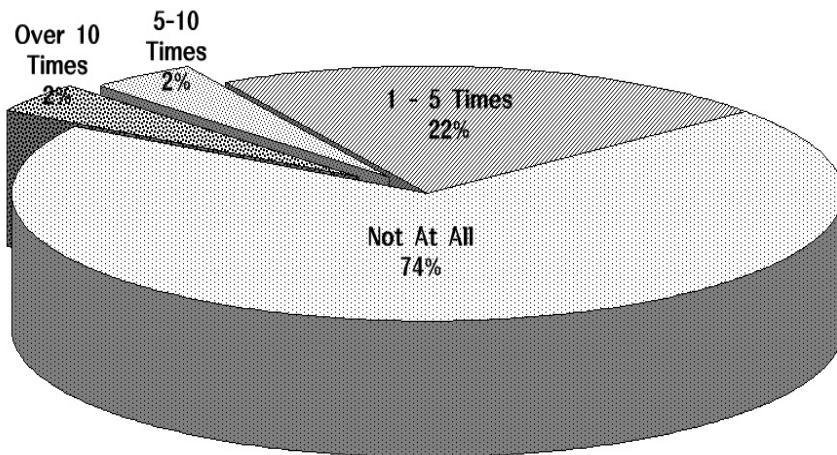

FIGURE 4. Previous experiences and/or participations on GIS education or seminar of Kyongsan City employees

29% financial support, 14% sharing information, 13% institutional and policy supports, and 12% support for GIS industry.

FINDINGS AND POLICY IMPLICATIONS

Korean government employees' expectations for GIS is very high, but they are not very specific on the issues and confronting difficulties on implementation. But we can say that they are experiencing trials and errors in their pilot project implementations.

For the reasons that make GIS implementation difficult, 25% of employees in line department answered lack of departmental coordination, 22% lack of interest of probable users, and 15% lack of experts.

However, expectation for utilization is very high, especially for the planning and management group, 76.5% of them said very high or high. Even though somewhat vague, their expectation could be the driving force for spreading GIS. According to Chan and Williamson(1999), a GIS vision, especially of the director, is the driving force behind the decision for GIS diffusion.

Korean government's ambitions for GIS has been very aggressive, but its plans, especially master plans and/or implementation plans, may not have been properly established. Since it was pursued in a very short time period and/or with technological optimism, current work traditions and technological status could not be fully integrated properly. Employees answered that they do not have enough knowledge and interdepartmental coordination. One of the hidden reasons could be frustration or anxiety about the new technology. As Chan and Williamson(1999) argue, employees might perceive GIS, a new technology, as a burden.

In the case of Kyongsan City, for the question on previous experiences and/or participation in GIS education or seminars, 74% of employees did not have any experience at all, while 22% participated one to five times and 4% more than 5 times. In order to improve GIS implementation, the government has to
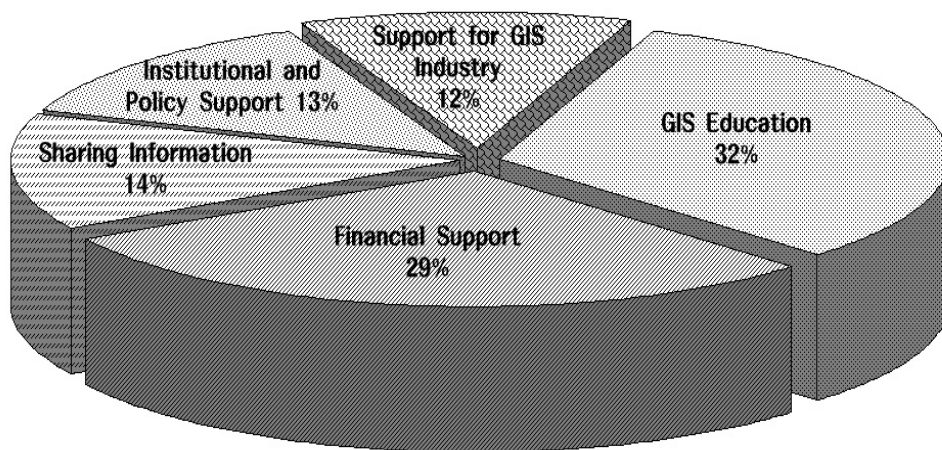

FIGURE 5. Supports requested for GIS implementation

have a better understanding on target groups' organizational culture, experience and perception on new technology, etc.

During the dynamic process of any innovation, an organization adopts the technology to suit its needs, however, the organization also is modified by the technology(Sieber, 2000). Within the organization, GIS implementation suggest that, for the effective adoption of an innovation, an organization must also be sufficiently flexible to reinvent itself(Sieber, 2000). Markus(1983) argues that simply laying an innovation on top of old processes will not induce the implementation to succeed. Kim(2000) argues, since government employees tend to resist on changes and/or accepting new systems and technology, it is necessary to introduce certain incentive systems related to customer-oriented administration and information technology education for alleviation of the resistances.

There are also overlapping investments and technical problems such as discrepancies between digital maps drawn by different agencies and between traditional parcel maps and digital maps because of non-uniform standards and system for GIS. In Korea, various local governments and institutions have been pursuing GIS map-making and related projects separately. To avoid overlapped investments and technical problems, a unified and/or coordinated GIS map making system and departmental cooperation are required.

Another important immediate trouble-some reason for GIS implementation in local governments, even though this study's employees' perception survey does not show, is a lack of usable data bases. There have been continuous efforts in central and local governments for computerization of data bases,

but most of their administrative data such as building permit data and parcel data are recorded in hard copies, not in electronic files. Also, as other developing societies do, systematically accumulated socio-economic data bases are very limited because of elementary level of census functions and no needs and/or demands in the past.

CONCLUSIONS

For better implementation of GIS in Korea, it is recommended that the following factors be integrated into the GIS implementation plans.

First, in establishing GIS master plans the Korean government has to have better understanding not only on financial and technological feasibilities, but also on organization culture, employees' experience and perception on new technology, etc. The governments' ambitions for implementing GIS should be realized practically and gradually through encouraging departmental coordination, employees' positive perception on GIS, GIS education for employees, and/or certain incentive systems.

Second, to avoid overlapping investments and technical problems such as discrepancies between digital maps drawn by different agencies and between traditional parcel maps and digital maps, more careful and intensive financial and technological analyses are required. More importantly, a unified and/or coordinated GIS map-making system and departmental coordination are required.

CONCLUDING REMARKS

This study was performed mostly with employees' perception survey results. However,

the survey results include only general or simple questions and answers, not very specific nor various questions regarding organizational behavior and culture. Except some brief technological reviews, this study also does not include intensive analysis and discussion on technological feasibilities, which are anyway related to organizational issues. Nonetheless, this study still has its own importance in light of its new view points on GIS implementation in Korea. This study could be regarded as a preliminary study for future intensive research on such issues as employee's perception, organizational culture, technological feasibility, and data availability. **KAGIS**

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