

Toward Research Collaboration Between Korea and Russia: KSGPC's Research Activities and Corporational Issues in Geomatics

Kam-Lae KIM*, Ho-Nam LEE** and Uk-Nam KIM***

Abstract

In recent years, the importance of geospatial data have been emphasized not only for the national GIS programs and but also in the value added commercial and industry markets. There is no doubt that GIS, GPS, aerial and satellite imagery data were provided powerful tools to support national information infrastructure for geospatial database. While great emphasis has been laid on the geospatial data, there has been little analysis or evaluation of how to maximize the benefits of using these information sources. Also, with the proliferation of geographic data and information sources such as satellite imagery, digital aerial photography, digital topographic and vector data, there is a great need to inform professionals from all disciplines as to the benefits of these information sources and how to best put them to use within any given application. From the first publication of KSGPC(Korean Society of Geodesy, Photogrammetry and Cartography) papers in 1981, our objective was, and is, to help develop the wider spectrum of GIS in the academy and industry by exposing new users to the benefits of GIS, remote sensing, mapping, GPS and photogrammetry. In this presentation, we will introduce KSGPC works and will evaluate GIS-related governmental policies and programs in Korea for the past and the future to present different status between Korea and Russia. It is now important to investigate lessons learnt from two countries' experiences and developed an empirical framework to combine outcomes from GIS-related researches in Korea and Russia. This may enable GIS professionals to gain a wider range of experiences in the international context, and consequently, help them to develop new markets for GIS. Therefore, we arranged the possible action items and interesting points to corporate and to promote the academic growth in the practice of GIS.

Keywords : Research Activities of KSGPC, Geomatics in Korea, NGIS, Research Collaboration with Russia

1. Introduction

The increased use of geo-referenced data for various purposes and in different applications has put new demands on the ability of fast acquisition of accurate and reliable data. In recent years, the importance and use of geo-spatial data were increased dramatically not only for the national GIS programs but also in the value added commercial and industry markets. It is true that GIS, GPS, aerial and satellite imagery data provide powerful tools to support national information infrastructure for geospatial database. Also, with the proliferation of geographic data and information sources such as satellite imagery, digital aerial photography, digital topographic and vector data, there is a great need to inform professionals from all disciplines as to the

benefits of these information sources and how to best put them to use within any given application.

From experiences of mapping in practice, there is a large number of commercially available digital photogrammetric systems on the market. From the point of view in photogrammetric applications, the main interest lies in the growing use of automation. Automatic interior and relative orientation are already in use. Automatic aerial triangulation is on the verge of being widely applied in practice as a tool operating as a black box in particular. This however needs some operational interaction for set-up, verification, and the identification and measurement in controlling information. Digital terrain model (DTM) and ortho images generation have been in use as automatical tools in Korea, however, interactive DTM verification and editing by

*Member, Professor, Dept. of Civil, Myongji Univ., Seoul, Korea (E-mail : kam@mju.ac.kr)

**Member, Director, Chung-Ang Aerosurvey Co., Ltd., Seoul, Korea (E-mail : yhnhan@chollian.net)

***Member, Professor, Dept. of Cadastral, Sinku College, Sunghnam, Korea (E-mail : kun@shingu-c.ac.kr)

an operator is essential, especially in more complex terrain such like in Korea.

In order to tackle these kinds of issues, KSGPC's activities during the last 20 years demonstrated the tendency towards not only general geodetic surveying and photogrammetry, but advanced technology focused on space cartography and GIS. This includes accurate measurement and geodetic surveying to support high performance in practical applications as well as aerial triangulation with aerial and satellite images. Sensor orientation has further expanded beyond classical collinearity equations under central perspective projection, and beyond the exclusive use of points. The intelligent combination of multiple sensor information from frame and line images, black and white images, colour and multispectral images, GPS, INS, and laser scanner has been identified as a new and important challenge.

In this presentation, we will introduce KSGPC's works and will explore GIS-related governmental policies and programs in Korea for the past and the future. This may different status between Korea and Russia. It is now important to investigate lessons learnt from two countries' experiences and develop an empirical framework to combine outcomes from GIS-related researches in Korea and Russia. This may enable GIS professionals to gain a wider range of experiences in the international context. Consequently, this may help them to develop new markets for GIS. Therefore, we suggest the possible action items and interesting points to incorporate and to promote the academic growth in the field of geodesy, photogrammetry, cartography, and GIS.

2. Technical Activities of KSGPC

KSGPC (Korean Society of Geodesy, Photogrammetry and Cartography) is a non-governmental organization. The central aims of KSGPC are 1) to devote advance knowledge, and improve understanding, of mapping sciences; and 2) to promote the responsible applications of geodesy, photogrammetry, cartography, GIS (geographic information systems), and their supporting technologies. Our objective was, and is, to support the academy and industry by exposing new users to the benefits of the geomatics technologies. Since the first publication of KSGPC papers and proceedings in 1981, professional membership of KSGPC has been over 500 in Korea and the numbers are increasing. KSGPC involves individual members from private industry, the government, and academia. To review the general technical activities for KSGPC, the main stream of research agendas and results last 20 years are sum-

marized.

In order to review the Korea's trends in geomatics, the primary issue can be firstly addressed by acquisition of vector data. Bearing in mind, as discussed previously, the acquisition of vector data for GIS has remained the most important interactive phase in the whole mechanism of photogrammetric process. Some results on semi-automatic feature extraction indicate that future systems will be equipped with more powerful tools for this time-consuming task. In the mid 1990s, progress in the developments of digital systems has been primarily driven by advanced technology. These advances come from the fields of computer science, photogrammetry, remote sensing and GIS. Research and development in this area have been concentrated on digital mapping and facility mapping for central and local governments. In this period, several studies and researches are carried out for automatic extraction of information from scanned maps showing efficient techniques, incorporating knowledge-based algorithms classification; automatic map revision and data capture for digital mapping were also demonstrated.

Relevant developments concerning multi-scale approaches for object aggregation are in the field of map-generalization. This work is mainly directed at handling maps at different scales and thus oriented towards the production of graphical output. Although prior researchers addressed issues of linking thematic aspects and keeping consistency between different levels, but this research agenda requires further in-depth studies.

Secondly, algorithms seem to be relatively robust in feature identification, due to the limited set of objects represented. There is a widespread acknowledgement that a considerable number of map generalization studies in the digital mapping have been carried out in great success. There is increasing demand for fast, reliable, and automated extraction and updating of GIS and CAD data from images. In order to meet this demand successfully, the works have been focused on solving problems dealing with aerial and satellite images. Several new trends include an increasing number of photogrammetric software modules in remote sensing systems and in GIS. Additionally, visualization of GIS database objects of urban environments has most notably become a major research and development topic. Such visualizations are of considerable value in application such as flight simulation, video games, town and regional planning, architecture etc.

Thirdly, several academic institutes and governmental organizations sponsoring KSGPC have been concentrated on the developments of digital photogrammetric work-

stations based on their theoretical foundation and associated algorithms. A considerable number of papers for the DPW have been presented in the KSGPC's congress. Several systems have been recently developed by the governmental research organizations. Photogrammetric software is also becoming more widespread within image processing systems. Furthermore, there is a particular interest in the integration of photogrammetric systems with semi-automated and automated computer vision systems, particularly for cartographic feature extraction. Some results on semi-automatic feature extraction indicate that systems need to be equipped with more powerful tools for this time-consuming task. Besides the implemented algorithms themselves, which combine computer vision approaches with rigorous photogrammetric modeling, the quality of the human-computer interface is increasingly seen as an important factor.

Fourthly, the late 1990s can be characterized as a digital mapping era in Korean. In this period, several geometric and radiometric performances of off-the-shelf scanners were investigated and presented at the KSGPC's papers. It was shown that scanners could be efficiently calibrated to sub pixel accuracy and that their radiometric quality was generally good and sufficiently stable.

Fifthly, substantial progress has been achieved in the last three years. On the operational side, GPS photogrammetry has made tremendous progress. Many works have been devoted to solve the problem of on-the-fly ambiguity resolution. Today, the use of GPS for measuring the projection centers of an aerial camera during the aerial triangulation is in use and provides a certain level of reliability in its operation. Moreover, there has been great interest in real-time mapping systems over the last three years. Real-time mapping technologies have been developed by major research institutions, such as the ETRI, and spin off for commercial uses. They have integrated GPS/INS with laser scanners and video cameras for mapping of utility corridors, and achieved a notable improvement of the accuracy of the positioning sensors. Many members of KSGPC have actively participated and/or organized several conferences and workshops on obtaining 3D GIS data using mobile mapping systems over the past three years.

Sixthly, in particular, as the use of interferometric SAR data for DTM generation and the change of detection showed impressive performances and potential, its integration with photogrammetry for mapping is strongly recommended. Although many operational difficulties are still arisen when systems are placed into

the production environment, combined adjustment techniques are however already in use.

The seventh point of this section is related to the applications of digital photogrammetry to the emerging in the field of virtual reality. Environmental modeling is one of topics interested and they stressed the need for total equipment calibration if accurate representations of objects are to be made. 3D modeling has seen vivid activity in urban environments, mainly for three-dimensional city models. Vector data, DTM information and texture are combined for visualization and computer animation.

Eighthly, still a considerable number of papers at KSGPC concerned those in architectural and archaeological representations. These are ranged from the reconstruction of historic monuments and buildings using conventional photographs to the use of CAD modeling, video, surface matching, digital-still cameras and digital orthoimages to methodologies for the maintenance of inventories of historic and cultural items.

Ninthly, digital data storage and archiving is still a widely discussed problem in a variety of applications, from vector to high resolution of image data. Data compression algorithms were illustrated with respect to their effect on accuracy degradation. Problems in handling digital data in photogrammetry and remote sensing, which are originated from different environments and with specific characteristics have been identified and efforts are made to solve in an efficient way.

Finally, research activities in very large volume of spatial data are now perceived as one of the major governmental issues in Korea. A number of researches in KSGPC concentrated on the programs to establish NSDI(National Spatial Data Infrastructure) in order to provide minimum degree of standardization in spatial data formats; define the base information content of the metadata for spatial databases; and define the core content of information for spatial database repositories and clearing houses.

3. National Mapping & GIS Program in Korea

In May 1995, the Korea government has announced A Master Plan of the National Geographic Information System (NGIS) in order to develop the information infrastructure for geo-spatial information management. Since then, the GIS data compilation work in various sectors is making successful progress. There has been a widespread acknowledgement that a legal supporting system is necessary to ensure the effective implementation of NGIS. Therefore the NGIS law and

regulation enacted in January 2000 and has taken effect from July 2000.

The Korea government has initiated a full-scale implement of the NGIS Master Plan in 1995. The production of GIS data compilation work is successfully in progress in various sectors. The national digital base map has been rapidly produced. Plans for digital underground facilities and thematic maps are also underway. Furthermore, the local governments are promoting the use of GIS in various fields including the management system for urban areas and facilities. The goal of the NGIS master plan is broadly defined: to promote sustainability and land development for local amenity as well as to promote national competitiveness and productivity. It is expected the success of the NGIS Master Plan to mark a turning point in the land management system in Korea.

The major issues of the NGIS Master Plan can be categorized as follows:

- Establishment of spatial databases for the NGIS
- Establishment of data standardization
- Assistance of GIS-related technical development
- Development of framework for utilization and application of the NGIS

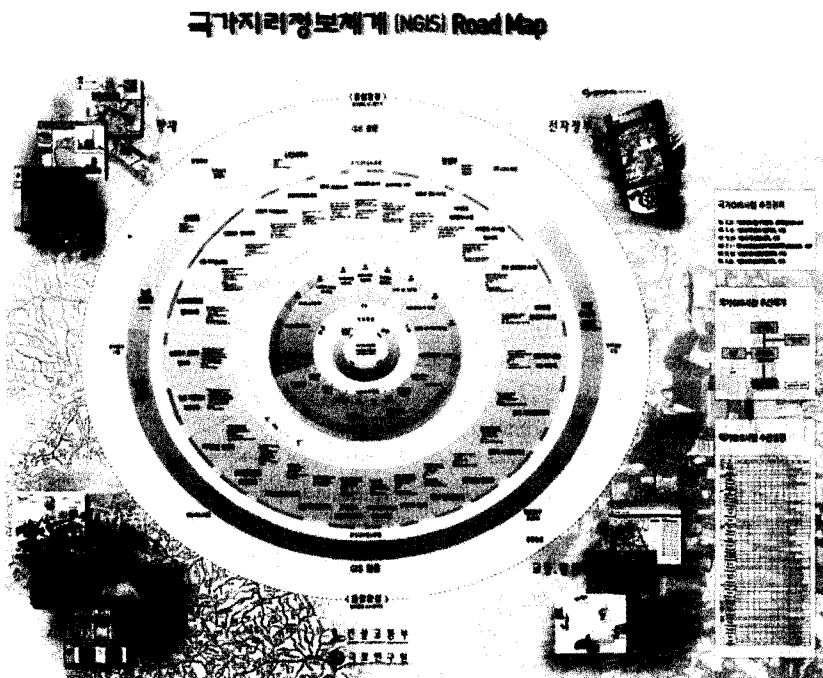
Currently, the Korea government plays a major role

in implementing the NGIS, especially in the area of the development of spatial database and the standardization of spatial data. Technology development and training for GIS specialists are also important parts of public sectors led by the central government.

The overall objectives of the NGIS are i) to establish a geographic information infrastructure in Korea, and ii) to eliminate unnecessary duplicate investment for GIS. To achieve the objectives of NGIS, the NGIS Steering Committee has developed phase-by-phase strategies.

To accomplish the Master Plan effectively and efficiently, the NGIS Steering Committee selected several major tasks and projects to tackle; a) national framework database, b) development of integrated underground facilities management system, c) development of thematic maps and public utilization system, d) establishment of national clearinghouse, e) standardization of geographic information, f) GIS human resource development.

The first phase of the NGIS Master Plan was completed in the year of 2000. The main purpose of the first phase is to establish a basis of GIS infrastructure such as to produce various kinds of digital maps. The second phase of the NGIS which plan to finish in 2005 will be enhanced NGIS in terms of operating GIS applications and maintaining the digital maps.



Road Map for Korean Government's National Geographic Infrastructure System
(Source: Korea Ministry of Construction and Transportation, 2003)

4. Conclusion

In this short presentation, we reported some general activities of KSGPC and the major topics addressed during the last 20 years in Korea. Rather than concluding this report with some general views about the state-of-the-art of theory and algorithms in geodesy, photogrammetry and cartography, the main recommendations for collaboration between two organizations are summarized here, since they reflect appropriately the future directions of the KSGPC.

We recommend;

- that communication with the members between the two organizations should be improved through the exchange of academic research activities.
- that relations with other organization in Russia and Korea should be introduced and promoted for active individual professionals under the two organization's umbrella.
- that collaborative research topics between the two countries should be investigated, particularly in the area of space cartography, real-time mapping, positioning systems, and performance test for the commercial products.

For further actions, it is particularly important to initiate a regional network for enhancing professional cooperation and collaborative research in the field of geodesy, space cartography, geomatics, and international comparative studies. Among those, the possible joint research agenda we suggest initially is the development of framework for problem solving in mapping and cartography with satellite technologies.

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