

PCGIAP and the Asia-Pacific Spatial Data Infrastructure (APSDI)

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Summary

Following a resolution from the 13th UNRCC-AP, Beijing May 1994 on the formation of a committee to coordinate and promote development of GIS and related issues across the Asia and the Pacific region, a committee was formally established at its inaugural meeting in Kuala Lumpur, Malaysia, July 1995. Membership of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) comprises directorates of national survey and mapping bodies or equivalent organisations for the 55 countries of the region.

PCGIAP's overall aim is "*to maximise the economic, social and environmental benefits of geographic information in accordance with Agenda 21 ...*" PCGIAP is achieving this through the development of a regional spatial data (or geographic information) infrastructure (SDI). As well, its regional efforts are contributing to development of the global model, the global spatial data infrastructure (GSDI).

Significant progress has been made by PCGIAP in the development of the regional SDI particularly with the geodesy component. PCGIAP is identifying fundamental datasets and providing mechanisms for their access. As well the Committee is addressing the need for SDI related development for individual countries and across the region.

This paper outlines PCGIAP's aims and activities, its achievements to date, its progress in developing a regional SDI and in addressing development needs, what challenges lie ahead and its plans for the future.

Introduction

The Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) was established by the 13th United Nations Cartographic Conference for Asia and the Pacific (UNRCC-AP) - Resolution 16 - at its triennial meeting in Beijing, May 1994. PCGIAP operates under the purview of, and reports to, the UNRCC-AP.

The PCGIAP was formally established at its inaugural formation meeting held in Kuala Lumpur, Malaysia between 12-14 July 1995. Subsequent meetings of the Committee are as follows:

- 2nd Meeting - Sydney, Australia, 29 September - 4 October 1996
- 3rd Meeting - Bangkok, Thailand, 1-2 February 1997
- 4th Meeting - Tehran, I. R. Iran, 28 February - 4 March 1998
- 5th Meeting - Beijing, China, 19-22 April 1999

Aims

The aims of the Committee are to maximise the economic, social and environmental benefits of geographic information in accordance with Agenda 21 by providing a forum for nations from Asia and the Pacific to:-

- a. cooperate in the development of a regional geographic information infrastructure;
- b. contribute to the development of the global geographic information infrastructure;
- c. share experiences and consult on matters of common interest; and
- d. participate in any other form of activity such as education, training, and technology transfer.

Agenda 21

The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992, took steps to reverse environmental deterioration and establish the basis of a sustainable way of life into the next century. A programme for addressing global environmental challenges while continuing to support sustainable economic development was resolved.

Agenda 21 sets out measures for, among other things, protecting the atmosphere, combating deforestation, preventing pollution, halting the depletion of fish stocks, and safely managing toxic wastes. In Rio it was acknowledged that the availability of geographic information is critical for environmental decision making.

The Special Session of the United Nations General Assembly to Review and Appraise the Implementation of Agenda 21 (Earth Summit+5), held in June 1997, reaffirmed the importance of geographic information (or spatial data) for sustainable global development.

A spatial data infrastructure is a powerful tool for economic and social development, and environmental management, enabling the full potential of GIS technology to be realised in supporting decision making processes at the local, regional and global level. So you can see the Committee's efforts in developing a regional spatial data infrastructure are consistent with Agenda 21.

Additionally, the PCGIAP is playing an important role in helping countries develop national spatial data infrastructures and to incorporate them into the APSDI. In time the national infrastructures can be combined through the regional model into the global spatial data infrastructure. In this way the Committee's activities demonstrate the *"think globally, but act locally"* approach, a major principle of Agenda 21.

Recent meeting

The Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) held its 5th meeting in Beijing, China, 19 – 22 April, 1999.

Amongst the main items covered in Beijing were the PCGIAP's project plans, the Committee's relationship with other similar regional and global coordination bodies, and its objectives in contributing to a global spatial data infrastructure.

Operational areas

The Committee critically analysed the future directions of the PCGIAP (at the 4th meeting in Iran) and its relationship with the UNRCC-AP. The main outcome being a move to more of a production focus supported by a restructure of working groups. There are now four inter-related operational areas as follows.

1 Executive/Secretariat

Chaired by Malaysia, the Executive Board, with support from the Secretariat, covers institutional and policy matters including the PCGIAP statutes and the definition of the Asia-Pacific Spatial Data Infrastructure (APSDI).

2 Regional Geodetic Network Working Group

Chaired by Indonesia, with Australia and China as Vice-Chair's, this group's work program includes the following main stages:

- Implementation of a regional precise geodetic network;
- Regional geodetic observation campaigns;
- Definition of a regional horizontal geodetic datum; and
- Investigation of a regional vertical geodetic datum.

This geodetic work will provide the basis for the development of transformation parameters for conversion of existing spatial data into a common regional spatial data infrastructure.

3 Regional Fundamental Data Working Group

Australia chairs this working group which has as the following main objectives:

- Establish regional fundamental datasets and mechanisms for sharing these data; and
- Foster an understanding of the benefits in using regional fundamental data.

The group has developed the following comprehensive work plan:

- Develop a policy for sharing regional fundamental data;
- Define and facilitate development and integration of regional fundamental datasets;
- Establish a regional network of APSDI data nodes (directories); and
- Promote applications of spatial data for example through regional GIS application demonstrations.

4 Development Needs Taskforce

Chaired by Malaysia and including Australia, Iran and Japan, the Taskforce Committee plans to identify members' GIS related development needs and recommend support programs and funding options.

The main project of the Taskforce is:

- **Member Countries' Development Needs.** This project is to be completed in a number of stages. Member countries would report on their progress towards an NSDI and be surveyed on their GIS related development needs. The Taskforce will analyse returns and make recommendations to the Executive Board for programs and funding.

As well the Taskforce will prepare a:

- **Glossary of Spatial Data Infrastructure Terms** to ensure a common understanding between countries on basic terms and definitions relevant to the Asia and the Pacific region; and a
- **Communications Plan** to maximise participation and knowledge exchange in NSDI matters for member countries through meetings, Web site development, training, publications, and by seeking funds to aid participation at key events.

A proposal by FIG Commission 7 that a Working Group on Cadastral Issues was discussed at length by the Beijing meeting. It was decided that further consultation with FIG was needed at the coming for consideration at the 6th Meeting of the Permanent Committee due to be held in early 2000.

Executive/Secretariat

This group operates as the Executive Board, with support from the Secretariat, undertaking strategic, coordination and planning issues on behalf of PCGIAP.

The Board currently comprises the following members:

Malaysia (President), China (Vice President), Australia (Secretary), Philippines, Indonesia, Iran, Japan, South Korea and Thailand.

Through the Executive the regional infrastructure — the Asia-Pacific Spatial Data Infrastructure (APSDI) — has been defined in PCGIAP Publication No.1, which can also be found on the PCGIAP web site.

The Secretariat provides support to the Executive Board, the Committee and the working groups, including the Taskforce.

Regional Geodetic Network Working Group

Background

The Asia and the Pacific Regional Geodetic Networks Working Group was formed at the inaugural meeting of the PCGIAP held in Kuala Lumpur in July 1995. The role of the Working Group was defined "to

design a strategy for the development of an Asia and the Pacific geodetic network infrastructure as the basis for an homogeneous regional GIS".

The Working Group first met during the 2nd PCGIAP meeting held in Sydney, Australia during October 1996. At this meeting a number of project responsibilities were identified and a program of regional geodetic activities endorsed, as published in the proceedings of the meeting.

The initial activity of the Working Group was to establish a precise regional geodetic network for the future integration into a common datum of the various national geodetic datums in the region. This geodetic framework would then form the base for an homogeneous spatial data infrastructure for the Asia and the Pacific region – the APSDI. (PCGIAP Publication No.1 explains and defines APSDI.)

To be able to provide data to this common datum, individual countries whose working datum is not the regional datum need to be able to transform from their individual datum to the regional datum. To determine datum transformations the individual datums need to be well defined and have sufficient common stations in both the individual and regional datums.

Since the individual datums within the Asia and the Pacific region differ from country to country, some countries may need assistance to perform the datum transformation. This assistance could range from GPS surveys and datum definition to the determination of datum transformation parameters.

Asia-Pacific Regional Geodetic Project 1997

The strategy adopted to establish the regional geodetic network was to launch a campaign in October 1997, under the name of the Asia-Pacific Regional Geodetic Project 1997 (APRGP '97). In this campaign both the radio techniques (Global Positioning Systems, Doppler Orbitography Information System and Precise Range and Rate Experiment), as well as the space techniques (Satellite Laser Ranging and Very Long Baseline Interferometry) were employed. Data acquired by the participating countries during this campaign were assembled in Australia, which furthermore redistributed the data exclusively for Asia and the Pacific member countries who then had the opportunity to process the data set.

An associated project activity has been the investigation of techniques, which can be used to transform national spatial data. Iran, Thailand, Japan and Australia have presented working papers on this topic at the 4th PCGIAP meeting in Iran, in 1998. It is evident that individual countries with different circumstances will need different transformation techniques. Here, the role of the PCGIAP Geodesy Working Group is to offer expertise leading to a sound implementation strategy for transformation onto the regional datum.

In addition, the Working Group has been gathering information on geodetic datums used within the region. Australia has listed best known information on existing geodetic datums for all countries in Asia and the Pacific region on the PCGIAP Web site. A feedback mechanism has been established on the Web page for member countries to update or amend their entries.

At the 4th Meeting of the PCGIAP in Tehran in March 1998, the role of the Regional Geodetic Networks Working Group was reaffirmed and renamed Working Group 1: Regional Geodetic Network.

At the Tehran meeting the Committee decided to expand the single Regional Geodetic Datum project initially into separate horizontal and vertical elements although it was considered that in the long term a full three dimensional approach will need to be employed. The Working Group developed a workplan for each of the following three priority projects:

- Implementation of a precise Asia and the Pacific regional geodetic network.

- Definition of a regional horizontal geodetic datum.
- Investigation of a regional vertical geodetic datum.

The PCGIAP subsequently endorsed these plans and a proposal by Australia to host a Working Group 1 Regional Geodetic Network Workshop in Canberra in July 1998.

Regional Geodetic Network Workshop, 1998

Representatives from ten member countries of the PCGIAP attended the workshop, presenting and analysing results from the 1997 campaign, thus concluding the core component of the original project. The proceedings from this workshop were published and copies are available through the PCGIAP Secretariat (PCGIAP, 1998b).

The workshop examined the options for definition of a regional geodetic datum in a global setting and recommended an interim product based on a combined GPS solution, pending further work on an integrated solution of all geodetic observation techniques utilising ground ties at collocated sites.

The workshop developed concept plans for the expanded geodetic campaign observed in November 1998 (APRGP98).

Asia-Pacific Regional Geodetic Project 1998

This new project utilised data from permanent GPS, SLR, DORIS and VLBI sites. In addition it aimed at regional datum densification and linking of vertical datums by GPS occupation of key geodetic network and tide gauge sites in individual countries. A cooperative strategy was arranged with the GEODYSSSEA project for a common observational campaign and sharing of data from key sites.

There was greater participation by member nations in APRGP98 than in APRGP97, with 17 members participating in the 1998 campaign. AUSLIG is collating the APRGP98 GPS data set for distribution in March 1999 to member nations who intend processing the data set.

The APRGP98 geodetic campaign will provide the basis for the determination of observed positional site velocities at permanent sites. The epoch GPS occupations on key geodetic network sites will facilitate the development of transformation parameters for converting existing spatial data into a common geodetic datum to form the regional spatial data infrastructure.

Future plans

A workshop is planned for June or July 1999 in Vietnam for presentation of APRGP98 results. Recommendations will be developed on finalising the Asia and the Pacific regional geodetic network and adopting a set of coordinate values defining the regional geodetic datum. Further work will be done on the individual geodetic datum transformation strategies and the development of a regional vertical datum with links to individual country's vertical datums.

The ability of the majority of countries in the Asia and the Pacific region to participate in the development of a wider geodetic infrastructure is extremely limited and it is recognised that external funding assistance for many nations is required for them to participate meaningfully in future activities.

The role of Working Group 1 in determining a regional datum is fundamental to the integration of three-dimensional data to support economic and social development and environmental management across the region.

Regional Fundamental Data Working Group

Background

The working group on Regional Fundamental Data was established at the 3rd PCGIAP meeting in Tehran, Iran, 28 February to 4 March 1998. Its title is Working Group 2 - Regional Fundamental Data.

The objective of Working Group 2 is to establish regional fundamental datasets and mechanisms for sharing these data, and to foster an understanding of the benefits of use of regional fundamental data.

There are 4 separate projects the Working Group has identified in its work plan:

- Develop a policy for sharing regional fundamental data;
- Define and facilitate development and integration of regional fundamental datasets;
- Establish a regional network of APSDI data nodes (directories); and
- Promote applications of spatial data for example through regional GIS application demonstrations.

The work plan also complements the initiatives of the PCGIAP Taskforce described below.

Policy on sharing fundamental data

An important aspect of any regional spatial data infrastructure is how the spatial data will be shared across the region. This is a particularly complex issue in the Asia and the Pacific region due to the geographical diversity of the members and also the number of countries involved. A draft policy on the sharing of fundamental data has been developed and distributed to Working Group members and the PCGIAP Executive Board for consideration.

The draft policy document draws on the work already conducted by the previous PCGIAP Working Group 4 (Legislation and Administrative Arrangements for the Acquisition and Sharing of Spatial Data) and the current data sharing policy of the Australian and New Zealand Land Information Council (ANZLIC). Working Group 2 has also examined (and where appropriate included) similar literature from such organisations as the European Commission, the US Federal Geographic Data Committee, MEGRIN and the Map Baltic Sea Region (MapBSR) project being undertaken by the National Land Survey of Finland.

Included as part of the draft policy a guideline on the concept of custodianship has been formulated and circulated to Working Group members and the PCGIAP Executive Board for consideration.

It is expected that the policy will be endorsed at the 5th PCGIAP meeting in Beijing, China.

APSDI data nodes

A draft paper outlining the rationale behind the development and implementation of APSDI data nodes has been written by China and has been circulated to Working Group 2 members for comments. The Chinese member has indicated a demonstration of APSDI data node concepts may occur at the next PCGIAP meeting in Beijing.

Regional fundamental datasets

There has been some progress on this project in the last few months. The PCGIAP member from Iran, Mr Abbas Rajabifard, has started on a two-part project, as part of his PhD studies.

The first part of Mr Rajabifard's work is to provide a report on the nature of Spatial Data Infrastructures and the justification for the APSDI. The second part is to undertake — as a trial — a detailed technical questionnaire of GIS data in a number of member countries and to provide a status report on the current situation of fundamental datasets. It is also expected this report will make recommendations on how to progress a pilot project for the collection of Administrative Boundary data - the first step in populating the APSDI with data.

Regional GIS demonstration applications

The importance of this project will be realised once the APSDI is populated with data. Currently there are a number of regional initiatives using GIS-ready data to help in regional planning issues.

Future plans

Work will continue on guidelines (relating to the themes of custodianship and sponsorship of fundamental data) to supplement the policy for sharing fundamental data.

Once the pilot project on Administrative Boundaries data has been completed an analysis of the project will be undertaken to see if this data could be collected for the rest of the Asia-Pacific region. The output being the first completed fundamental dataset for the APSDI.

Development Needs Taskforce

Building the APSDI

It has been explained that PCGIAP's primary role is the development of the Asia-Pacific Spatial Data Infrastructure (APSDI).

However, without a full cover of nations involved in PCGIAP activities the APSDI is incomplete and would not provide its full potential benefit across the Asia and the Pacific.

It is worth noting here that a parallel applies to regions of the world in relation to the development of the global spatial data infrastructure (GSDI). In other words there will be gaps in the GSDI until all regions of the world have developed regional SDIs.

PCGIAP has been undertaking geodesy and fundamental data activities across the region through the countries that are active in the PCGIAP. Recognising the barriers to participation by over half the 55 member nations, the Committee has identified the pressing need to expand the number of active members.

The PCGIAP Development Needs Taskforce

The 4th PCGIAP meeting held in Tehran during March 1998 established a working group to identify the spatial data infrastructure (or GIS) related development needs of members, and to recommend programs and funding options to address those needs. This approach includes addressing PCGIAP participation issues.

The working group, called the PCGIAP Development Needs Taskforce, has been divided into four operational areas for a number of reasons, not least being the geographical diversity of the Asia and the Pacific region. The sub-regions are SE Asia, North Asia, West Asia, and Pacific, with Chairs as follows:

SE Asia sub-region

Chair is Dato' Abdul Majid bin Mohamed, PCGIAP President, from Malaysia. Dato' Majid is also the Taskforce leader.

North Asia sub-region

Chair is Mr Kunio Nonomura, PCGIAP Executive Board Member from Japan

West Asia sub-region

Chair is Mr Abbas Rajabifard, PCGIAP Executive Board Member from Iran

Pacific sub-region

Chair is Mr Drew Clarke, PCGIAP Secretary, from Australia.

Taskforce workplan

The Development Needs Taskforce has commenced an ambitious program of work across the Asia and the Pacific region. This work is being achieved through the respective activities of the four sub-regions in a staged approach over three years.

At the 5th Meeting held in Beijing, the Chairpersons of the sub-regions reported on their progress and plans in hand for future meetings of countries of the sub-regions. A tentative workshop would be held in Canberra in October to analyse and collate these reports.

There are two main limiting factors towards progress with the APSDI:

- Limited participation of member countries in PCGIAP activities; and
- Insufficient knowledge to make informed decisions about the APSDI.

First is the capacity of many members to actively participate in PCGIAP activities. In the field of geodesy an excellent start has been made with the involvement of 17 countries over two observation campaigns described under the geodesy section of this paper. Participation at annual meetings generally comprises 15 - 20 member nations, as was the case in Beijing, with only 30 % participation. However, despite the participation rate a lot has been achieved by PCGIAP.

Second is a limited knowledge by the PCGIAP Executive Board and the working groups of for a significant number of member countries' geodesy, mapping, GIS, cadastral and related capacities.

This understanding is vital in harmonising PCGIAP activities in the quest for developing and enhancing the various components of the APSDI. Without the appreciation of region wide capacities it is difficult to make informed decisions in a spirit of collaboration.

The PCGIAP, through its Taskforce, is striving to improve both areas.

PCGIAP Taskforce development needs survey

The initial Taskforce activity is to carry out a questionnaire. The results of this survey will enable information about member countries to be collated and used in consultation with members to help:

- identify development needs projects and recommend funding options to the PCGIAP Executive Board; and
- determine options for assistance to attend PCGIAP meetings and workshops, and to participate in other PCGIAP activities such as regional geodesy observation campaigns.

The development needs may relate to issues such as the development of geodetic, mapping and GIS/LIS systems, cadastral management, NSDI policy and administration, and staff training.

PCGIAP response to review of UNRCC

Noting that several resolutions of the 14th UN Regional Cartographic Conference for Asia and the Pacific, Bangkok 1997 called for an assessment (review) of the UNRCCs, the Beijing meeting agreed that new arrangements for the operations of the UNRCC A-P be proposed to the United Nations to take effect at the 16th UNRCC A-P in early 2000.

Global initiatives

It is worth noting here that the Taskforce initiative has a different emphasis from other surveys such as the one carried out in 1998 by the USA Federal Geographic Data Committee (FGDC) for its survey on national spatial data infrastructures. Some countries here would have participated in the USA and the Taskforce questionnaire surveys.

The Taskforce work is specific to the Asia and the Pacific region and the aims of the Committee. The two activities complement each other and both contribute to the emerging Global Spatial Data Infrastructure model.

The links within the global infrastructure are as follows:

- Countries' national spatial data infrastructures contribute to their regional infrastructure (for example the Asia-Pacific Spatial Data Infrastructure) and in turn the regional infrastructures contribute to the global spatial data infrastructure.

- National, regional and global spatial data infrastructures (both individually and together) provide the means for the identification, acquisition and use of spatial data for strategic decision making in areas such as economic and environmental management.

Another world-wide initiative is the Global Mapping project being managed and coordinated by Japan (<http://www1.gsi-mc.go.jp/iscgm-sec/index.html>). The work of the Permanent Committee is consistent with the Global Mapping project which is producing mapping specifications and 1:1million global datasets for use with environmental protection as well as the mitigation of natural disasters and to encourage economic growth within the context of sustainable development.

As well, the Committee works closely with the Global Spatial Data Infrastructure (GSDI) Steering Committee to minimise unnecessary duplication of effort and to maximise the effectiveness of global spatial data activities.

Progress

The Taskforce questionnaire has been prepared and circulated by the sub-region Chairs to the countries in the four sub-regions; in total to all 55 PCGIAP members.

Chairs of the sub-regions are collating the information from the questionnaires. Each sub-region is managing the collection of information differently with a combination of:

- visits to member countries;
- receipt of completed questionnaires through the post and via email; and
- in Oceania through a centrally located workshop.

The results are being collated within sub-regions for appropriate development needs action and are being brought together for PCGIAP's consideration.

The PCGIAP Development Needs Taskforce has established the mechanism to identify and seek support for development needs projects and to increase participation rates of PCGIAP member countries.

Conclusion

Significant developments towards a GIS infrastructure for Asia and the Pacific have been achieved in the past 4 years by each of the PCGIAP operational areas. In addition the PCGIAP is considering the establishment of a cadastral working group.

There have been positive links established between PCGIAP and global spatial data infrastructure initiatives, further reinforcing the work that PCGIAP is undertaking.

There is still a lot of work to be done and there are a number of challenges that remain. These include:

- Increasing the participation rate of PCGIAP member countries – currently running at about 30 % – in Permanent Committee meetings and Working Group activities;
- Seeking funding options and arrangements for increasing the participation rate and funding for GIS-related development projects;
- Definition of the Asia-Pacific geodetic datum;

- Technical implementation of the Asia-Pacific Spatial Data Infrastructure; and
- Populating the APSDI with fundamental datasets.

These formidable tasks are currently being tackled by the Board, the Committee and the PCGIAP working groups.

The PCGIAP believes, that the region can benefit from better management of its spatial information by taking a perspective that starts from the national level and works up to the regional level. Studies have revealed that there is a benefit:cost ratio for spatial data usage of approximately 4:1 (ANZLIC, 1995). Benefits are distributed across the broad spectrum of economic activities ranging from the operation of electricity, gas and water utilities, to projects involving agriculture, mining and environmental management.

The availability of consistent regional datasets, based on the integration of national datasets will improve our ability to reduce land use conflict, resolve environmental issues, manage large scale natural disasters, manage our land and ocean resources in a sustainable way, develop our communications and transport infrastructures, undertake population studies, and support international treaties.

For more information on PCGIAP and related activities refer to the PCGIAP web site at <http://www.permcom.apgis.gov.au/>

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