

12. GIS Training for data dissemination

12.1. Status of Phase 1 dataset

The Phase 1 project is a starting point of GIS in Cambodia for national level Master planning. The Phase 1 project data is accessible via MPWT to everybody.

Table 6 shows the distribution of output of Phase 1 up to December 2002.

Table 6 Distribution of Phase 1 data

<i>December 31, 2002</i>				
Item Name	Donated Quantity by JICA	Distribution to Related Agency	The Rest in MPWT	Distribution in %
1. Infrastructure Map				
- English	54000	15354	38646	28
- Khmer	18000	12641	5359	70
2. Land use Map	900	742	158	82
3. Landform Map	75	63	12	84
4. CD-ROM ARC/INFO	100	103	-3	103
5. CD-ROM Adobe Illustrator				
- English	100	92	8	92
- Khmer	100	45	55	45

The above result suggests that the delivered Phase 1 data as initially agreed is used for urgent rehabilitation and development of Cambodia.

However, an interview with each user revealed the following remarks regarding the use of digital data.

- (1) Low-level expertise on GIS knowledge resulting in lack of understanding of data utilization method with ArcView, a software widely used within the nation.
- (2) Users do not understand how to benefit from the dataset to improve their work.
- (3) To date, only short workshops of one or two days have been organized. Users to whom technology transfer has not been completed do not understand how to benefit from the dataset to improve their work.

MPWT and the project team recognized that the use of database has been limited, due to lack of knowledge regarding GIS and how to use software. Therefore, they decided to organize a series of GIS trainings, also open to users from other ministries and agencies.

12.2. GIS Training results

GIS training was held five times since September 2002, with many participants from related ministries and agencies. The training period, number of participants and output samples produced by trainees are stated below.

- (1) Training period and number of participants

TERM	PERIOD	PARTICIPANTS
I	From 02-13 to Sept.02	4
II	From 23 Sept to 4Oct.02	5
III	From 14 - 25 to Oct.02	14
IV	From 25 to 11/26/2002	17
V	From 2 -13 to Dec 02	18
Total		58

Participating agencies are as follows:

MPWT: Inland Water Transport Department, Road Department, Harbor Department, Provincial Offices, etc.

Related ministries and agencies: Ministry of National Lands, Cambodia Mekong Committee, National Geographic Department, Ministry of Forestry, Ministry of

Metal Industry, Historic Remains Department



Figure 24:GIS Training at MPWT Mapping Center

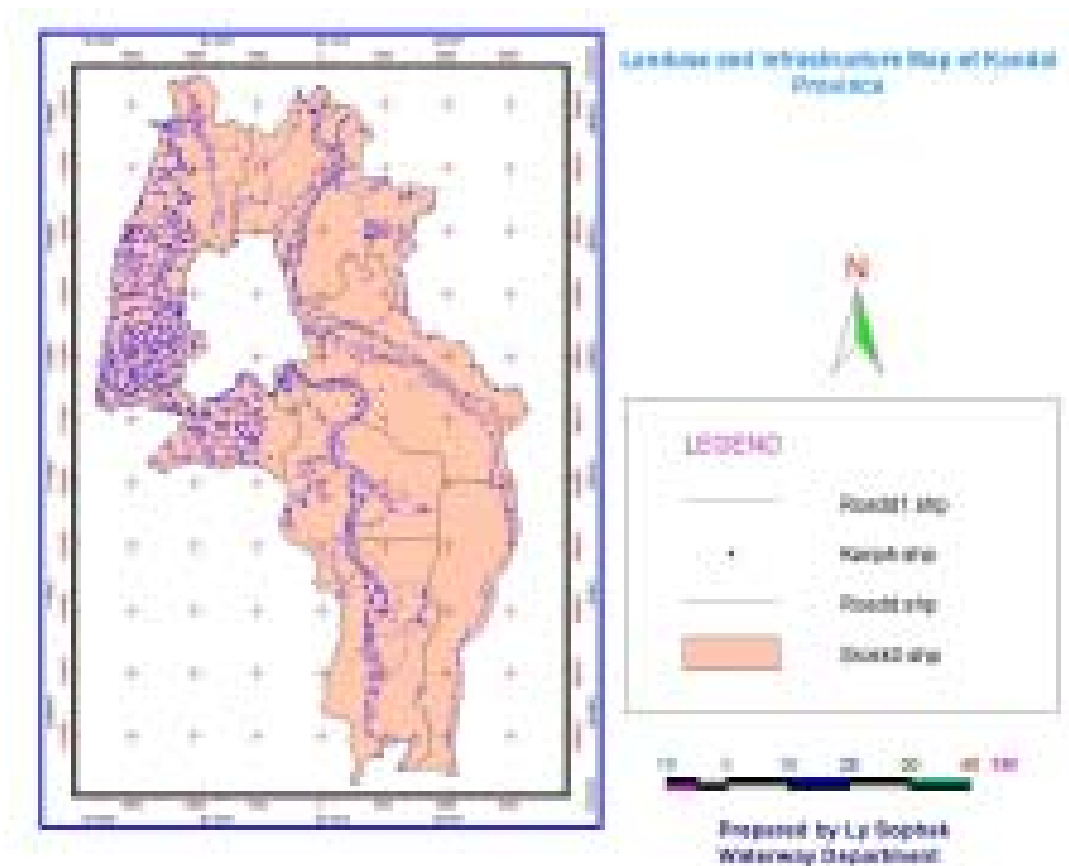


Fig.25 Examples of output produced by trainees

12.2.2. Request and comment from participants

Requests and comments given by the participants after the GIS training, could be summarized as follows:

- (1) Longer period of training and organization of further sessions.
- (2) Through the training, the participants came to understand the importance of GIS data prepared in the project as well as the benefits of using GIS to support the study.
- (3) The Phase I data should be updated because of the emergence of new development features such as the location of primary schools, many of which were constructed after 1992. They are not presented on the map and GIS data.

- (4) The project office at MPWT should become a GIS center to support the GIS training as well as infrastructure mapping service to the Provincial Public Works Office as well as the user of GIS base data in Cambodia.

12.2.3. Training Topics

The training consisted mainly of the use of ArcView, a desktop GIS software, as well as Illustrator, a map editing software.

After the training, a certificate was issued by the JICA study team to the trainee.

(1) Training Topics for ArcView :

- 1) Installation of ArcView and Extension
- 2) Data structure
- 3) Vector and raster data format
 - Vector data
 - Raster data
- 4) General information of ArcView
- 5) View document type
 - Displaying layer
 - Querying information
 - Labeling feature
- 6) Legend edition
 - Change data appearance
 - Customizing legend
- 7) Table document type
 - Data type (types of tables)
 - Sorting, selecting, querying information
 - Calculation table fields
 - Joining table
- 8) Getting basic statistical data from the spatial data
 - Getting summary
 - Getting statistical data

- 9) Layout document type
 - Creating a map
 - Customizing a layout
 - Adding map components
 - Printing a map
- 10) Editing and updating of existing vector data in Arcview
- 11) Update the existing spatial data
- 12) Digitizing in Arcview
- 13) Preliminary remark to digitizing in Arcview
- 14) Screen digitizing / vectorization
- 15) Import GPS/tabular data
- 16) Introduction to combination of spatial data
- 17) Clipping
- 18) Union
- 19) Intersection
- 20) Dissolving
- 21) Buffering
- 22) Introduction to the concept of map projection

(2) Adobe Illustrator Topics:

- 1) Installation of Adobe I.
- 2) Adobe I. user guide for map preparation
- 3) Introduction
- 4) Adobe Tools
- 5) Adobe Toolbox
 - Layers Palette
 - Swatches palette
 - Brushes Palette
 - Colors Palette
 - Gradients Palette
 - Align Palette
 - Pathfinder Palette

- Group / ungroup toolbox
 - Lock / unlock toolbox
 - Transform toolbox
 - Stroke toolbox
 - Typing toolbox
 - Paragraph
- 6) Map Symbolization
 - 7) Map Preparation by area selected
 - 8) Map Plotting

13. New Findings

Note: This chapter has been contributed by Dr. Heng Thung, geologist and Technical adviser of the project

In the process of mapping a country using new technology, such as remote sensing, many interesting discoveries were made of the environment, cultural heritage, and other subjects, which can be important in the present or at some future date. The list here is just a small number of activities and signatures that we quickly scanned, but which were outside the main objectives of this project and should eventually be undertaken by the agency in charge or interested parties.

13.1.Limestone Deposits

For instance, belts of sinkholes, formed by the solution of the calcareous material, are visible through an area extending along both sides of the Tonlé Sap coastline, which have not been mapped, because they are covered by alluvial fans, laterite and other material. These beds are important geologically as they could be an economical source material for cement, and are also possible host rocks with mineral deposits.

13.2.Erosion Patterns

Large areas, especially east of the Mekong River show erosional features showing bedrock and indicating a period of heavy erosion, most likely caused by extensive deforestation in the past.

13.3. Deforestation

It is possible to use satellite imagery to map the different deforestation activities, from the legal logging, to the slash-and-burn activities of the landless farmers. This system is fast and unbiased in its results.

13.4. Environmental Destruction

A large part of forest areas are subject to slash-and-burn agriculture, and the extent and type of destruction can be documented to design preventive measures.

13.5. Archaeological Sites

Many unknown sites are still to be discovered. Often these smaller ruins are not visible on the ground.

This is just a small sample of activities, which the available aerial photos, satellite imagery can produce. Some of these are important in the development and rehabilitation of the country, while others may have more academic value.

14. Final Output

Outputs and other information for the study are shown as below. Following outputs

Table 7 Final Output

Items	Quantity
(1) Reports of the study	
1) Inception Report	20 copies in English
2) Interim Report	20 copies in English
3) Draft final report	20 copies in English
4) Final report	
1.Main Report	50 copies each in English
2.Summary (English)	50 copies each in English
(2) Outputs	
1) Aerial photos	
1. Negative films of the aerial photos	1 set
2. Positive films of the aerial photos	1 set
3.Photo image files	1 set
4. Contact prints	2 set
5. Index map	1 set
2) Printing maps and data outputs	
1. Topographic maps	1000 copies each in English and Khmer
2. Land use maps	25 copies in English
3. Geology/Geomorphology (Landform) maps	25 copies in English
4. 1/500,000 maps of the general use	1000 copies in khmer
5. Films for printing	1 set
3) Digital data	
1. ArcInfo coverage & Illustrator files (CD-ROM)	100 set
2. The data for Internet home page	1 set
4) Textbooks for workshops 1~3	50 copies for each workshop
(3) Collected data and materials	1 set
(4) Others	

15. Conclusion

The two-phased project, which started in 1996, has been completed as the second phase of the study was finished in 2001. The geographic information database has been completed for the National master plan of Kingdom of Cambodia. Technology transferred, through the course of the study, enabled the establishment of the MPWT Mapping Center and technological self-reliance of engineers of the counterpart agency. The MPWT Mapping Center grew to become a hub of GIS technology, education and training in Cambodia.

The geographic information database contains not only topographic mapping data required for drafting a rehabilitation/development plan on a national level, but also land use and geology/landform classification data.

Data and information on socio-economic infrastructure, topography, and land use will help planners and decision makers in preparation of national level plans and programs. And at the same time, public policies prepared from unbiased data and information would guarantee their accountability to the public. Through GIS technology with scientific methodology would enable fast preparation and dissemination of planning information. The potential of social responsibility in the basic database prepared in the Study is considered very high.

The end of the Study, however, is a new beginning for GIS in Cambodia. After the Study, it is up to the counterpart or the government of Cambodia to go beyond the framework of the Study. The aerial photos that serve as data source used to produce spatial information of Phase 1 are already ten years old, and no longer reflect the current status. They need to be updated at the soonest. Therefore, it is a new challenge for the government to update the database and to provide results of database analyses, not raw data, to decision makers.

Now that the national GIS database is completed, the cost of updating is significantly small in comparison with the initial investment made under the Japanese assistance. By acquiring and interpreting aerial photographs and satellite images used for other projects in Cambodia, the counterpart is now technologically ready to update its own database. Logistics support, however, would be necessary to execute the field identification work.

The latest technology introduced in Phase 2 has considerably improved the data preparation skill of the counterpart personnel; however, technologies on GIS analyses and application development have not been fully transferred, because the scope of work did not fully cover the aspects. It is necessary to upgrade the GIS technology to a more applicable level, and to train GIS engineers with practical skills.

During the project, the counterpart agency MPWT Mapping Center has invited technical users from other ministries on its own initiative to provide GIS training in order to make the compiled data available throughout the country. The training received lots of response. This result suggests that the efforts made during the project made an enormous contribution to the technical development. We hope to continue such GIS education and training to fully utilize the national GIS basic data developed through Japan's ODA. Currently, there is no other GIS training organization, within the government sector, with the facilities, equipment and technical capabilities of the MPWT Mapping Center. Through education and training, the dissemination and the use of geographic data shall be promoted with the goal being the rehabilitation and development of the land of Cambodia by each sector. The MPWT Mapping Center is capable of handling these tasks.

After the Phase 2 Study, a new challenge evolved. Early updating of the Phase 1 database, study of GIS application technology and upgrading of facilities and equipment are required to arrange a proper environment for GIS project implementation. Arranging and establishing a systematic financial scheme by requesting assistance from international organizations, distributing national budget, or generating revenues from sales of maps in both paper and digital media would solve some of the challenging issues on promoting GIS projects.

Through continued development, the project shall earn itself a position as a national project that will contribute to national development plan and creation of an electronic nation.

16. Recommendations

16.1.RECOMMENDATIONS FOR CONTINUING OPERATIONS.

16.1.1. Recommendation for MPWT (Main counterpart)

- (1) Data distribution
 - 1) MPWT should investigate the demand of Government agencies concerned, NGO and International Assisting organization to send a questionnaire, which includes all the results of Phase 1 and Phase 2
 - 2) MPWT should collect the questionnaire, and make a distribution plan of the project results based on their demand, then MPWT should inform a distribution plan and delivery as a free of charge to Government agency concerned.
 - 3) MPWT should deliver the materials of aerial photography (except one (1) set of contact print) to Cambodia National Mekong committee (CNMC), which has enough facility for additional printing in Cambodia.
 - 4) MPWT should delivery all the printing maps (except set of maps necessary for MPWT) to National Geographic Department (NGD) which is responsible agency for Topographic mapping activity in Cambodia including the rest of Phase1 printing maps
- (2) Institutional enhancement for Mapping Center of the Research Center
 - 1) MPWT should make an institutional enhancement for the Mapping Center as a core counterpart unit for JICA project that started from 1996.
 - 2) MPWT should specify the role and responsibility of the Mapping center in Sub-degree of Ministry to reinforce the organization for maintaining and updating GIS database.
 - 3) MPWT should allocate the budget to Mapping Center of Research Center for maintaining and updating GIS database..

- 4) MPWT should give permission to Mapping Center to manage income (from data selling) and expenditures to maintain the dataset under the control of a foreign expert.

(3) Opening of Data distribution to public

1) Working group

MPWT should organize a working group to discuss about the opening of data to public. Working group should consist of the participated agency in the project such as Geography Department, Geology Department, Ministry of agriculture, and Cambodia National Mekong Committee.

Working group should also discuss data sharing, how to develop a future GIS activity for National rehabilitation and development plan.

2) By-product

It is worthwhile to introduce not only the final product but also by-products, such as satellite images. If it seems to attract the interest of any users, such information should be available to the public also.

3) Pricing policy

Working group should discuss a charging system for data handling while selling to general users. There should be use self-sustaining program and charged to the users same as charged by MRC.

(4) Continuation of GIS training course

MPWT Mapping Center, equipped with capacity and facility to organize GIS training, should continue the GIS training course not only for inside staff also related agency concerned. The staff of mapping center should be core group for the training. Training program will highly promote the utilization of prepared GIS dataset.

(5) Data maintenance

- 1) Infrastructure data should be updated on a regular basis using new aerial photographs and or by the field verification. Especially, Central area of Phase 1 needs to be updated as soon as possible, because of the fact that Phase 1 of the project used 1992 aerial photographs. After that date, many of the people returned to the land from across the border resulting the major change in land use, settlements and roads. Thus, there were many new villages and roads constructed since then.
- 2) Land use data should be updated every five years for the whole country. As the detailed data has been generated using aerial photography, the five-year updating should be conducted using satellite imagery, which is detailed enough for such purpose. However, the Phase 1 area should be immediately updated as the time gap between Phase 1 and Phase 2 is too large for GIS correlation.
- 3) Landform data data should be updated continuously by the Geology Department which has provided the personnel to interpret aerial photos and imagery of the project areas. It is recommended to request for such by-products as satellite images and aerial photos to conduct mapping surveys on detailed geology mapping and distribution of mineral resources, etc.

(6) Maintaining a website

The website should be kept up-to-date so that users can refer to it to find the latest information on the GIS data of Cambodia.

16.1.2. Recommendation for NGD (cooperation agency)

(1) Updating and Maintaining the Topographic Map Data

NGD, with its responsibility, should update and maintain the Topographic map data on regular basis, especially the Phase 1 data is already outdated. Because the Aerial photos used for Phase 1 data were acquired in 1992.

(2) Map sales

NGD should set up a map sales division as a responsibility agency of topographic mapping activity for the user. A sales price should be set up appropriately after a pricing study at Public Market in Town that they are selling a old topographic maps.

Also consigning the printed maps to a bookshop in town shall be considered as one of the ways project data can be made accessible to the public.

(3) Request of Leveling Data from MRC

MRC is carrying out 2nd order leveling along the National route 5 and 6 from Nov.2002 to 2003 for WUP-FIN project. After completion of the project, NGD should request for the data and description sheet of the Bench Mark.

16.2. RECOMMENDATIONS FOR THE FUTURE PLANS OF GIS IN CAMBODIA

It is proposed to create a GIS Coordination Center, which will eventually undertake the coordination, management and dissemination of the GIS data to all users. It will also become the training and assistance center to ensure the utilization of these data for planning, development and implementation programs through a training and assistance to all agencies on a sustainable way.

The program should be discussed by the working group and have the following phases:

The extension program should have the following phases:

1. Preparatory phase
2. Organizational phase
3. Operational phase

16.2.1. Preparatory phase.

During this phase, foundation of a GIS coordination centre should be planned, so that it can have the proper program to operate. These tasks are mainly in

preparation for the full operation of a GIS coordinating centre. Following action shall be implemented.

- (1) Make a total inventory of data on all equipment, CDs and hard paper films owned by the Mapping Center, MWPT.
- (2) Preparation and distribution of a questionnaire to all personnel involved in map drafting, GIS activities and remote sensing.
- (3) Making a meta-database in cooperation with the Mekong River Committee on Secretariat and GIS taskforce.
- (4) Preparation of the flight indexes and inventory of all aerial photographs, including such information as scale, type (color, B&W, etc.), year of flight, and sponsor.
- (5) Preparation of an inventory of satellite imagery created during the projects in Cambodia.
- (6) Preparation of a list of suppliers and prices of satellite imagery.
- (7) Make a program to inventory all projects, which require map support. This inventory will have a GIS database, which will identify not only the type of project, the agency implementing it, but also the outline of the geographic so that overlaps of activities can be observed. The GIS program would then be able to assist these projects to coordinate their effort to prevent overlaps.

- (8) Design the organizational structure of a GIS Center:
 - 1) Administrative location of the GC.
 - 2) Personnel requirements and sources.
 - 3) Facility requirements.
 - 4) Equipment requirements.
 - 5) Financial resources.
- (9) Coordination and discussion with the consultative bodies of the ministry
- (10) Conduct research on applications in support of activities of other agencies.

16.2.2. Organizational Phase.

It is recommended to follow the following procedure

- (1) Prepare the program for a GIS Coordination Center.
- (2) Order equipment.
- (3) Reorganize personnel Mapping Center staff core, and new staff from the list of experts and technicians of the working group. 16.1.2 (1)
- (4) Starting to organize the operation.
- (5) Training in GIS operation and maintenance of data.
- (6) Assist in GIS application of the user agencies.
- (7) Setting up procedure for updating and correcting data returned from users.
- (8) Continue to conduct digitizing work of the updated data.
- (9) Setting up dissemination procedure.
- (10) Maintaining the GIS network.

16.2.3. Operational phase

- (1) Training of staff of other agencies on using GIS for evaluation, planning and implementation of specific projects of the various agencies.
- (2) Coordinate the correction and updating new data and inputs from other agencies. Such as the case when new aerial photos or satellite imagery are acquired.
- (3) Finalize the operational procedures and monitor the operation for a specific time as agreed in the beginning.
- (4) Set up a coordinating agency, using the network as base.
- (5) Develop a sustainable program for the proposed GIS center.