JAPAN INTERNATIONAL COOPERATION AGENCY
SURVEY OF KENYA, THE REPUBLIC OF KENYA

THE PROJECT FOR
STRENGTHENING OF SURVEY OF KENYA
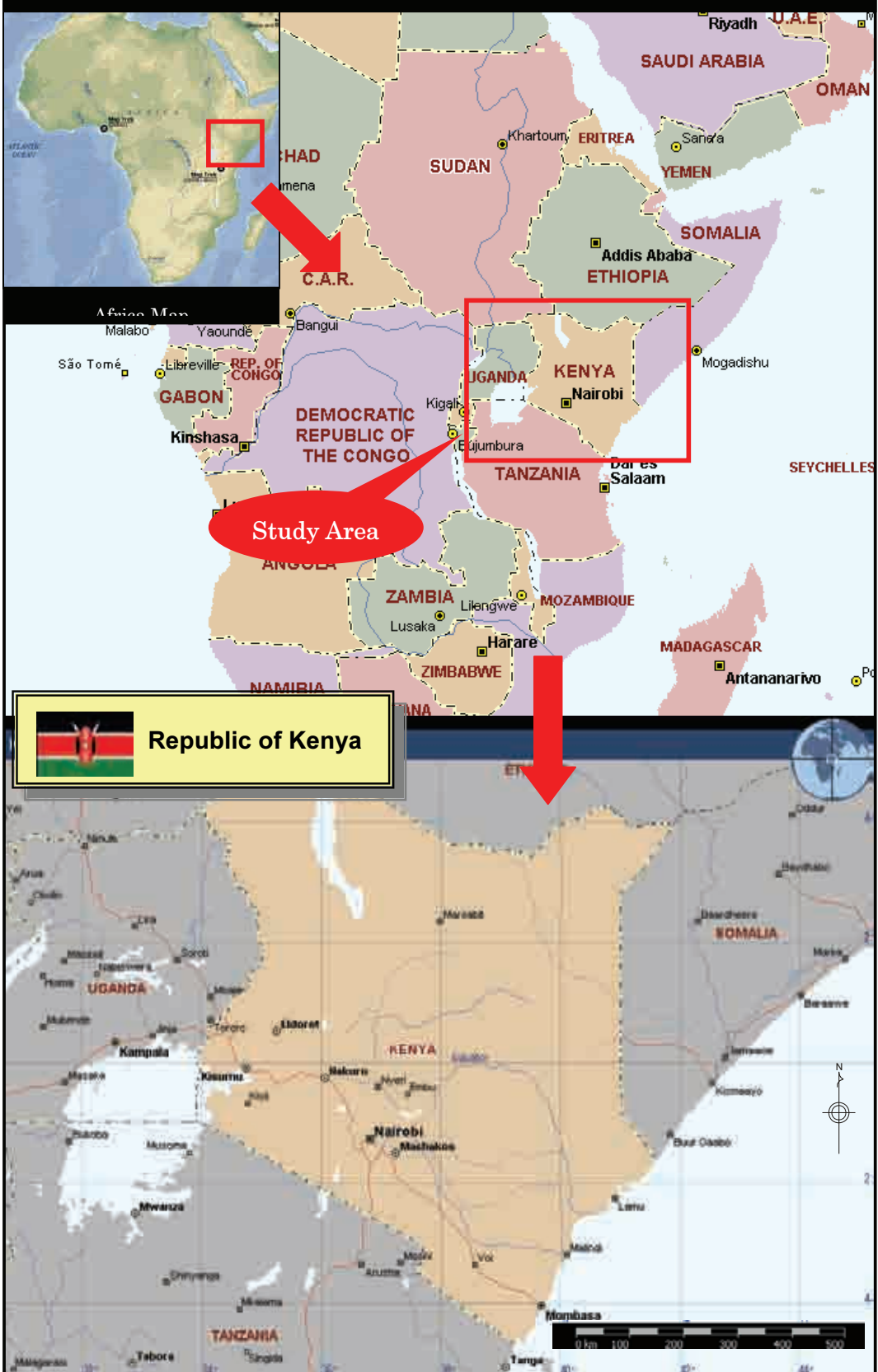# FOR GIS PROMOTION
IN THE REPUBLIC OF KENYA

FINAL REPORT

NOVEMBER 2008

EXPERTS TEAM

KOKUSAI KOGYO CO., LTD.

Study Area for the Project for Strengthening of Survey of Kenya for GIS Promotion

Study Area

Republic of Kenya

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Chapter 1 Project Overview
1.1 Project Purpose

1.1.1 Background

In Kenya, there are insufficient social infrastructures for such things as roads, water and sewage services, electricity, residential facilities and communications, and this inconveniences the lives of the people. Upon developing these basic infrastructures, spatial data such as maps are essential, however, as each relevant organization is individually developing spatial data, it is an inefficient system with problems such as the inability to exchange data and duplicate data.

Therefore, Kenya's National Development Plan specifies the construction of the National Spatial Data Infrastructure (NSDI), which aims at shared use and efficient utilization of spatial data in Kenya. The Survey of Kenya Ministry of Land (abbreviated as SOK) is the head office for undertaking the work and activities to construct the NSDI, which includes holding workshops with related agencies.

However, the technological level of SOK related to geographic information systems (GIS), which is the basis for developing a National Spatial Data Infrastructure, is still inadequate so that gaining substantial results in the construction of the NSDI under these conditions would be extremely difficult.

In light of this fact, the Kenyan government requested Japan to implement a project in order to construct the NSDI. In receipt of this request, the Japan International Cooperation Agency (JICA) dispatched an evaluation study team in mid-March 2006. They held discussions with relevant organizations from Kenya and, as a result, it was recognized that, as an initial step to constructing the NSDI, was the need to promote the application of GIS. Following this acknowledgement, the parties involved signed a Record of Discussion (R/D) agreeing to implement a project that aims to strengthen the capacity of SOK in order to promote the application of GIS. The project is then to strengthen SOK with a focus to cooperate on the technical aspects of that development.

1.1.2 Objectives

The project is a Technical Cooperation Project based on the Record of Discussion (R/D) which was agreed to and signed by SOK, Ministry of Land and the JICA Kenyan Office on 4 July 2006, as well as the Minutes of Meeting (M/M) from the same discussion. An overview of the project activities is shown in Diagram 1-1.

（1） Project Outcome

Strengthen SOK's capacity to promote the application of GIS.

（2） Project Outputs

- SOK's capacity improved for reliable map digitizing to promote the application of GIS.
- The standards for the spatial data infrastructure will be formulated.
- The resources for GIS dissemination will be developed.
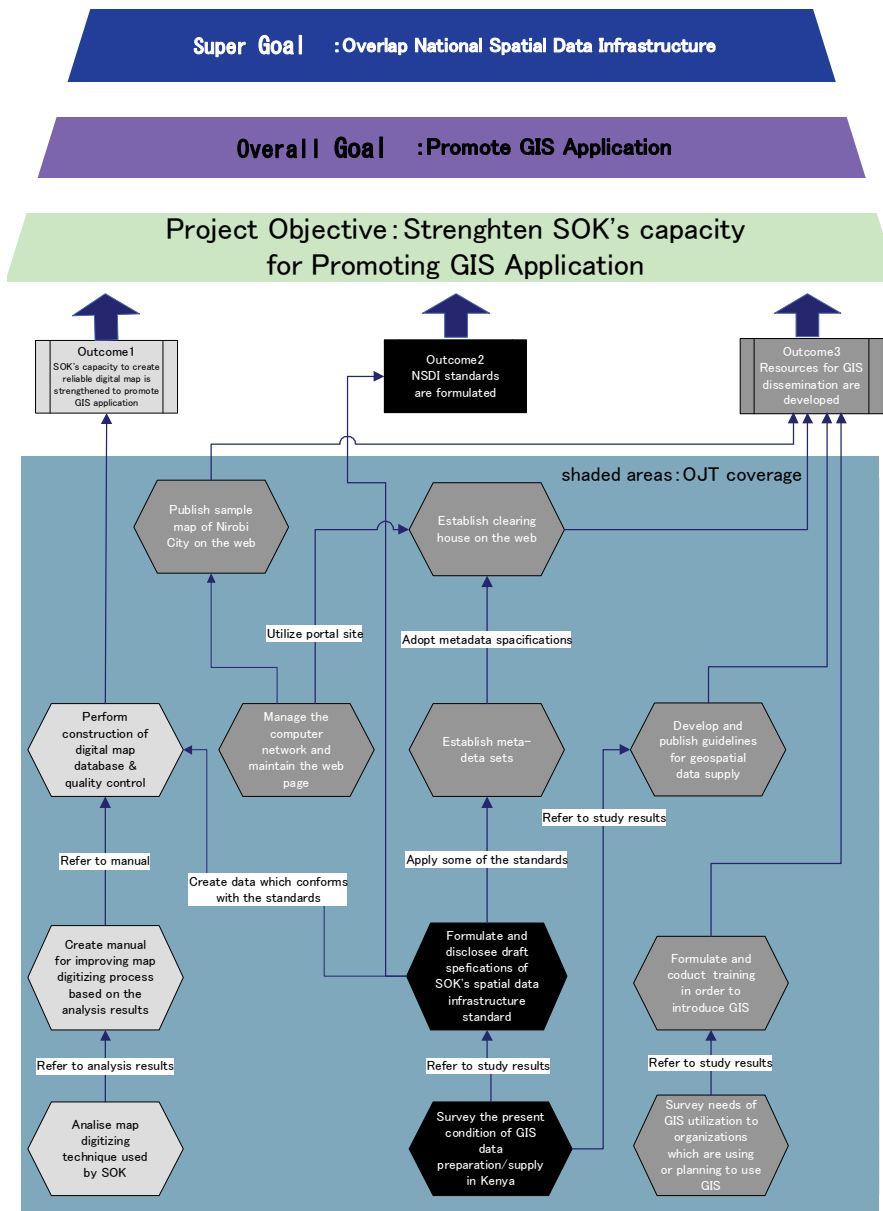
Diagram 1-1: Overview of Project Activities

1.1.3　　　Scope
（1）　　Project Area
　1）　　Activity Base

　　　Nairobi is the base for activities.

　2）　　Selected Range for Each Activity

　　　The entire country of Kenya is the selected range for each activity carried out in the project.

（2）　　Relevant Organizations
　1）　　Counterpart　Agency

- Survey of Kenya（SOK）

　　　(The Counterpart Agency, including personnel working with the project, is abbreviated in this document as "C/P")

　2）　　Relevant Organizations

- African Institute for Capacity Development (AICAD）
- Kenya Institute for Survey and Mapping (KISM）
- Kenya Bureau of Standards (KEBS）
- Regional Centre for Mapping of Resources for Development (RCMRD）

　3）　　Joint Coordinating Committee (JCC）

- The JCC consists of the Kenyan side (stakeholders from the Ministry of Land, Ministry of Finance, KISM, KEBS and others, and project managers from SOK), Japanese side (JICA experts and the JICA Kenya Office) and observers (RCMRD, Japanese Embassy and other relevant organizations). The aim of this committee is to approve the operational plan and implementation schedule, evaluate annual reports and current progress, and to coordinate views on any issues which arise during the course of the project. Moreover, the committee will be held after discussion with SOK and the team advisor every six months or as frequently as necessary.

　4）　　Other Project Implementation Agencies

　　　Information will be actively provided to JICA projects and projects by other donors currently being executed in Kenya, and this will be linked to the promotion of the application of the project results.

（3）　　Project Scope

The experts will implement the project using appropriate methods based on the Project

Design Matrix (Table 1-1).

Table 1-1: Project Design Matrix (PDM) Ver.2

The Project for Strengthening of Survey of Kenya for GIS Promotion in The Republic of Kenya

Cooperation Period : 2006-2008 (3years)
Target Group: SOK and other related organizations

Implementation Agency : Survey of Kenya (SOK), Ministry of Lands, JICA
Working Area : Nairobi

Made on March 8th, 2007, Ver. 2

Narratives Summary	Indicators	Means of Verification	Important Assumptions
Super Goal			
National Spatial Data Infrastructure (NSDI) is constructed.	1. GIS users can collect necessary information on the web page. 2. GIS users can receive technical support from relevant organizations.	- SOK web site - Document of related organization.	
Overall Goal			
GIS utilization is promoted.	- Utilization of GIS will be promoted by 2010.	- Document of related organization	- Demands for GIS utilization will be increased. - Hardware and Software for GIS will become common. - The direction of the government for the use of national spatial data will be maintained. - Institutional rules for NSDI will be elaborated.
Project Purpose			
The capacity of SOK is strengthened for promotion of GIS utilization.	1. Number of organization using SOK's services will be increased. 2. Related organizations with appreciate the services of SOK.	- Questionnaire for GIS users	- Related organizations are positive to GIS promotion.
Outputs			
1. SOK's capacity on reliable map digitization is improved for GIS promotion.	1-1. Productivity of map digitalization will be improved. 1-2. The specification of map digitizing will be prepared. 1-3. The manual of map digitizing will be prepared.	- Project document	- The trained staff of SOK in this project will be retained.
2. Spatial data infrastructure is standardized.	2-1. Specifications for spatial data infrastructure, developed by the Project, will be appreciated by the standard working group (WG) of NSDI. 2-1-1. Result of Survey of GIS development and Provision is published. 2-1-2. KSIRO 19000series(Geographic Information) are published. 2-1-3. Product Specification for Spatial Data Infrastructure is published.	- Questionnaire to the WG	
3. Resources for GIS dissemination are developed.	3-1. GIS users will be satisfied with the training provided by SOK. 3-1-1. Result of Survey of GIS data Aplication is published. 3-2-1. Guidelines for geospatial data supply will be published. 3-2-2. Computer network system and Web site are developed and managed. 3-2-3. Clearing house will be developed and managed. 3-2-4. Nairobi City sample map will be posted on pilot web site	- web site	
3-1. Capacity of GIS users is developed.		- Questionnaire for trainees - Training records	
3-2. Capacity of SOK in development and management of clearing house is developed			
Activities	**Input**		
1.1 To analyze map digitizing methods used in SOK	Kenyan Side	Japanese Side	- Appropriate budget of Kenyan side will be secured. - Adequate number of counterpart personnel will be assigned
1.2 To formulate a manual to improve the map digitizing process based on the analysis result	1. Assignment of counterparts personnel	1. Assignment of Japanese experts;	- The related organization will be cooperative.
1.3 To formulate a digital map database and to implement quality control	- Project Manager	- Leader	
1.4 To build capacity of SOK staff on the above mentioned technical skills	- Deputy Project Manager	- Map digitizing	
2.1 To survey the present condition of GIS data preparation/ supply in	- Map digitizing	- training	
2.2 To formulate and publish draft specifications of SOK's spatial data infrastructure based on the survey result	- Standardization	- GIS standardization	
	- GIS Training	- Clearinghouse/Metadata	
3.1.1 To survey needs on GIS utilization to organizations which are using or planning to use GIS	- Clearing house/Metadata	- Network/Web operation	
3.1.2 To organize and conduct necessary training in order to introduce GIS based on the survey result of "3.1.1"	- Information technology - Communication	2. Equipment - PCs	**Preconditions**
3.2.1 To prepare meta-data sets based on the survey result of "3.1"	- Data Supply	- Hardware	- Appropriate budget of Kenyan side will be secured. - Adequate number of counterpart personnel will be assigned - The related organization will be cooperative.
3.2.2 To develop and publish guidelines of geospatial data supply based on the survey result "3.1"	- Secretaries, etc.	- Software	
3.2.3 To develop and manage computer network system and web site	2. Facilities	- Others	
3.2.4 To prepare and publish sample map of Nairobi City on web site	- Japanese experts' room - Telephone line and Internet facility etc.	3. Training in Japan	
3.2.5 To develop a clearing house on web site	3. Project expenses		

1.2   Basic Policies of Project

Basic Policies of the project are as follows:

（1）   Support for SOK Leadership Strengthening

From the viewpoint of strengthening SOK's capacity, we will explore the basic position taken by SOK employees as "the performer", while the expert will assume the "background role". The initiative for specifically drafting and implementing every activity for the project shall be entrusted to SOK and we give our support to strengthen their leadership within the activities.

- Expose the expectations of relevant organizations to SOK

    Through a survey of relevant organizations, we can uncover the degree of expectation and dependence on SOK in this field, raising SOK's motivation.

- Ensure continuity of capacity building

    The project activities will be planned and implemented based on the current capacity that have been ascertained as a starting point. Hence, continuity between the activity and current level of capacity is ensured and the continuity of capacity building is guaranteed.

- Maintain employee work ethic at SOK

    In order to maintain the work ethic that the related SOK employees have towards their work, they will be made aware of the degree of external expectations toward their activities and the future prospects of SOK.

（2）   Establish Digitization Technology

A survey of the current status of map digitization, creation of work manuals and establishment of quality control techniques will be carried out mainly by SOK with the support of the experts.

- Create a work manual suited to actual conditions

    A work manual for users will be created based on the results of a survey of current map digitization conditions. Moreover, a required step in producing the work manual will be a trial and evaluation, followed by revisions reflecting those results.

- Establish quality control techniques and create a map database based on standards of spatial data infrastructure

    In accordance with the standards formulated for the spatial data infrastructure, the digitized map data will be compiled into a database. In addition, quality control techniques will be applied according to those standards for the digital map data created. Furthermore, quality control of digital data will be carried out in a systematic

and organized way during the map digitization process.

（3）	Formulate standards for spatial data infrastructure based on international standards

The standards for the spatial data infrastructure will be formulated based on the international standards for geographic information, the ISO19100 series, and will take into consideration SOK's technological strengths and user needs, and include high priority standardization items.

- Hold a workshop on standards

    SOK is encouraged to hold a workshop on the standards in order to deepen their employees' understanding of the standards for the spatial data infrastructure. The experts, in turn, will offer advice regarding management and lecture content.

- Hold a standards seminar

    A seminar will be held on the standards in order to reflect requests from users and disclosure of the standards in draft revisions. SOK employees with study session experience will be the main persons to create the seminar program and select the participants while the experts will support operation of the seminar.

（4）	Develop resources to disseminate GIS based on needs

Resources will be developed that respond to user needs in line with the study on the application of GIS.

- Carry out differentiated training for exisiting and potential GIS users

    Training for GIS application will be differentiated between existing users of GIS and those who plan to use GIS in the future.

- Implement training

    SOK employees will be supported so as to be able to continuously plan (create a curriculum, outline work procedures, etc.) and carry out training. In addition, technology transfer will be carried out for SOK employees to be able to take the role as lecturers at the training sessions.

- Create metadata specifications

    Metadata specifications will be created based on ISO19100 global standards.

- Disclose sample maps

    The topographic maps of Nairobi now under development will be publicly released through the Internet during the initial stages of the project.

（5）　Smooth project operation

At the time of project implementation, consistency is sought in each policy, practical advice and evaluation of output. Also, the stakeholders, such as the chief advisor, SOK and the NSDI committee, will maintain close communications to ensure smooth and steady management of the project.

（6）　Thorough Safety Control

Among the East African countries, Kenya is regarded as a relatively safe country. However, in large cities such as Nairobi, there are high rates of minor offenses and the danger of isolated acts during the day. For this reason, together with the prompt construction a communication system for the project team with SOK and the JICA Kenya Office, we will strive to obtain safety related information consistently and put priority on safety when establishing project organizaion.

1.3　　Enforcement Planning

（1）　Flowchart of Activities

The activities for the project are shown in the following flowchart (Diagram 1-2).
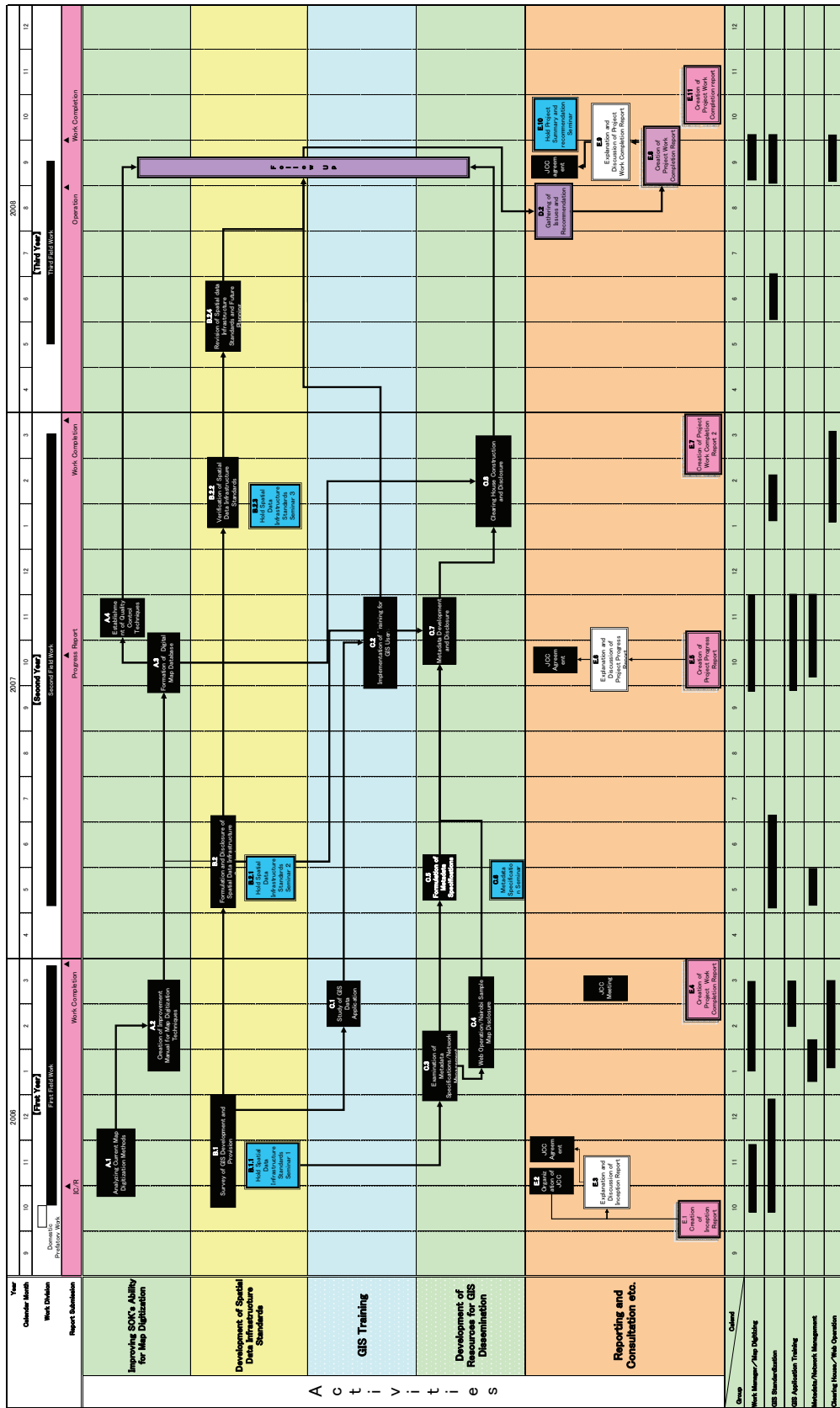
Diagram 1-2: Flowchart of Activities

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（2）   Overall Project Planning

  1）   A. Improving SOK`s Ability for Credible Map Digitization

A.1 [Analyzing Current Map Digitization Methods]

A.2 [Creation of Improvement Manual for Map Digitization Techniques]

A.3 [Formation of Digital Map Database]

A.4 [Establishment of Quality Control Techniques]

  2）   B. Development of Spatial Data Infrastructure Standards

B.1 [Survey of GIS Development and Provision]

B1.1 [Hold Spatial Data Infrastructure Standards Seminar 1]

B.2 [Formulation and Disclosure of Spatial Data Infrastructure Standards]

B.2.1 [Hold Spatial Data Infrastructure Standards Seminar 2]

B.2.2 [Verification of Spatial Data Infrastructure Standards]

B.2.3 [Hold Spatial Data Infrastructure Standards Seminar 3]

B.2.4 [Revision of Spatial Data Infrastructure Standards and Future Planning]

  3）   C. Development of Resources for GIS Dissemination

C.1 [Study of GIS Data Application]

C.2 [Implementation of Training for GIS Users]

C.3 [Examination of Metadata Specifications/ Network Management (draft)]

C.4 [Web Operation/ Disclosure of Nairobi Sample Maps]

C.5 [Formulation of Metadata Specifications (draft)]

C.6 [Metadata Specifications Seminar]

C.7 [Metadata Development and Disclosure]

C.8 [Clearinghouse Construction and Disclosure]

  4）   D. Follow Up

D.1 [Follow Up]

D.2 [Gathering of Issues and Recommendations]

  5）   E. Other Work

E.1 [Creation of Inception Report (Work in Japan)]

E.2 [Organization of JCC]

E.3 [Explanation and Discussion of Inception Report]

E.4 [Creation of Project Work Completion Report 1]

E.5 [Creation of Project Progress Report]

E.6 [Explanation and Discussion of Project Progress Report]

E.7 [Creation of Project Work Completion Report 2]

E.8 [Creation of Project Completion Report]

E.9 [Explanation and Discussion of Project Completion Report]

E.10 [Hold Project Summary and Recommendation Seminar]

E.11 [Creation of Project Work Completion Report 3]

1.4 Work Schedule

The project, which began in mid-October 2006, is scheduled to finish November 2008. The general schedule is illustrated in Table 1-2 and a detailed schedule is shown in Table 1-3.

Table 1-2: General Schedule

	2006												2007												2008											
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Work in Kenya							←First Year→						←Second Year→												←Third Year→											
							First Year Phase in Kenya						Second Year Phase in Kenya												Third Year inKenya											
Work in Japan							□ Domestic Work																													
Report							▲ Inception Report			▲ Work Completion 1									▲ Progress Report			▲ Work Completion								▲ Final Report		▲ Work Completion			

Legend: ■ Work in Kenya
□ Work in Japan
▲ Report Creation

Table 1-3: Detailed Work Schedule

1.5   Product Items

Table 1-4 shows the products achieved in the project.

Table 1-4: Products

Year	Report	Submission Time	Type	No. Submitted		
				JICA	Kenyan side	Total
1st Year	Inception Report (IC/R)	Approx half a month after commencement	English	10	10	20
	Project Work Completion Report 1	March 2007	Japanese	3	-	3
	Map Digitation Method Manual 1	March 2007	English	3	10	13
2nd Year	Project Progress Report	October 2007	English	10	10	20
	Project Work Completion Report 2	Upon end of second year contract	Japanese	3	-	3
	Map Digitization Method Manual 2	Upon end of second year contract	English	3	10	13
	Spatial Data Infrastructure Standards (Draft)	Upon end of second year contract	English	3	10	13
	Training Curriculum	Upon end of second year contract	English	3	10	13
	Training Materials	Upon end of second year contract	English	3	10	13
	Metadata Specifications (draft)	Upon end of second year contract	English	3	10	13
3rd Year	Project Work Completion Report 3	November 2008	Japanese	3	-	3
	Project Completion Report	November 2008	English Japanese CD-ROM	10 10 1 copy	10 - 1 copy	20 10 1 copy

Chapter 2 Results of Project Operations
2.1   Summary of Results

The results are as follows (Table 2-1).

Table 2-1: List of Results

Area of Project Work	Project Work Results
Improving SOK's ability for map digitization	a Implementation of Survey for current situation and creation of report for the results b Creation of Specifications (draft) for each type of digitized map c Creation of manual (draft) for each type of digitized map d Revision of Specifications (draft) for each type of digitized map e Revision of manual (draft) for each type of digitized map f Creation of relational database for digital topographic maps and related technical transfer g Technology transfer of the concepts and measures for quality evaluation based on quality control and ISO standards
Development of Spatial Data Infrastructure Standards	a Implementation of survey for GIS Development and Provisions, and creation of report (draft) on the results. b Holding Seminar 1 for Spatial Data Infrastructure Standards c Development and Disclosure of Spatial Data Infrastructure Standards d Holding Seminar 2 for Spatial Data Infrastructure Standards e Examine Spatial Data Infrastructure Standards f Holding Seminar 3 for Spatial Data Infrastructure Standards g Revision of Spatial Data Infrastructure Standards and drafting a plan of action
GIS Training	a Implementation of study for GIS Data Application and report (draft) of the results. b Establishment of contents for GIS training to be conducted c Creation of training curriculum and teaching materials d Management of the training course
Development of Resources for GIS Dissemination	a Review of draft metadata specifications b Construction of a network at the project work office c Implementation of technology transfer for network construction d Construction of Website and the disclosure of the Sample Map e Formulation of metadata specifications f Holding seminar on draft metadata specifications g Preparation and Disclosure of Metadata h Construction and Disclosure of a Clearinghouse
Reporting and Consultation	a Creation of Inception Report b Implementation of Explanation and Discussion of Inception Report c Organization of JCC d Holding First JCC meeting e Holding Second JCC meeting f Creation of Work Completion Report 1 g Creation of Project Progress Report h Conduct Explanatory Meeting and Discussion of Project Progress Report i Holding Third JCC meeting

	j Creation of Project Work Completion Report 2 k Holding a General Seminar at completion of project l Creation of Project Completion Report m Creation of Project Work Completion Report 3 n Holding Fourth JCC meeting

2.2   Work Operation Achievements

All of the completed project work is shown below.

（1）   Improving SOK's ability for map digitization

A.1: [Analyzing Current Map Digitization Methods]

A.2: [Creation of Improvement Manual for Map Digitization Techniques]

A.3 [Formation of Digital Map Database]

A.4 [Establishment of Quality Control Techniques]

（2）   Development of Spatial Data Infrastructure Standards

B.1: [Survey of GIS Development and Provision]

B.1.1: [Hold Spatial Data Infrastructure Standards Seminar 1]

B.2: [Formulation and Disclosure of Spatial Data Infrastructure Standards]

B.2.1: [Hold Spatial Data Infrastructure Standards Seminar 2]

B.2.2 [Verification of Spatial Data Infrastructure Standards]

B.2.3 [Hold Spatial Data Infrastructure Standards Seminar 3]

B.2.4 [Revision of Spatial Data Infrastructure Standards and Future Planning]

（3）   GIS Training

C.1: [Study of GIS Data Application]

C.2: [Implementation of Training for GIS Users]

（4）   Development of Resources for GIS Dissemination

C.3: [Examination of Metadata Specifications/Network Management (draft)]

C.4: [Web Operation/Disclosure of Nairobi Sample Maps]

C.5: [Formulation of Metadata Specifications (draft)]

C.6: [Metadata Specifications Seminar]

C.7 [Metadata Development and Disclosure]

C.8 [Clearinghouse Construction and Disclosure]

（5）　Follow Up

D.1 [Follow Up]

D.2 [Gathering of Issues and Recommendations]

（6）　Reporting and Consultation

E.1: [Creation of Inception Report]

E.2: [Organization of JCC]

E.3: [Explanation and Discussion of Inception Report]

E.4: [Creation of Project Progress Report]

E.5: [Explanation and Discussion of Project Progress Report]

E.6 [Explanation and Discussion of Project Progress Report]

E.7 [Creation of Project Work Completion Report 2]

E.8 [Creation of Project Completion Report]

E.9 [Explanation and Discussion of Project Completion Report]

E.10 [Hold Project Summary and Recommendation Seminar]

E.11 [Creation of Project Work Completion Report 3]

2.3   Personnel Assignments

   Since the initial plan, slight personnel changes were added, and their achievements are shown in Table 2-2. A summary of the changes are as follows.

（1）   Personnel Changes

Area of Responsibility	Prior to personnel change	After personnel change
GIS Application Training (First Year)	Chiyo Kigasawa	Keiji Yamada
GIS Application Training (Second Year)	Keiji Yamada	Youichi Oyama
Clearinghouse/ Web Operation (First Year)	Yuko Yamaguchi	Takuya Takashou
Clearinghouse/ Web Operation (Second Year)	Takuya Takashou	Lei Peifeng

（2）   Actual Assignment of Personnel

   The assignment of personnel is shown in Table 2-2.

Table 2-2 : Actual Assignment of Personnel

Responsible for	Name	2006	2007	2008	2006 Kenya	2006 Japan	2007 Kenya	2007 Japan	2008 Kenya	2008 Japan	Total Kenya	Total Japan
Work Director/ Map Digitizing	Akira Nishimura	45(1.5) 60(2.0)	65(2.17)	33(1.1)	3.50	2.17	1.10				6.77	
GIS Standardization	Keiji Yamada	75(2.5)	65(2.17) 30(1.0)	30(1.0) 36(1.2)	2.50	3.16	2.20				7.86	
GIS Application Training	Keiji Yamada(2006) Yoichi Oyama	30(1.0)	65(2.17)		1.00	2.17	0.00				3.17	
Metadata/ Network Management	Kazutoshi Masuda	30(1.0)	20(0.67) 55(1.83)		1.00	2.50	0.00				3.50	
Clearing House/ Web Operation	Takuya Takasho(2006) Peifeng Lei	60(2.0)	60(2.0)	36(1.2)	2.00	2.00	1.20				5.20	
					10.00	12.00	4.50				26.50	

2.4 Actual Achievements

2.4.1 Map Digitizing

After a joint meeting with the appointed counterpart, we investigated the implementation details and schedule with counterparts Ms. Asenath Omolo and Mr. Frank Kimoth to carry out the work for "Improving SOK's ability for map digitization".

（1） Detailed Schedule

The detailed schedule of "Improving SOK's ability for map digitization" for each year is as follows(Table **2-3**).

Table 2-3: Detailed schedule for map digitizing

	1st year (2006-2007)					
	2006/10	11	12	2007/1	2	3
Preparation	■					
Study of current conditions		■				
Flowchart, Examination of items for digitization			■			
Creation of specifications				■		
Creation of manual					■	■

	2nd year (2007-2008)					
	2007/9	10	11	12	2008/1	2
Preparation	■					
Revision to Map Digitization Spec. and Manual		■				
A.3 Formation of Digital Map Database		■				
A.4 Establishment of Quality Control Techniques			■			

	3rd year (2008)					
	7	8	9	10	11	12
Preparation			■			
Follow up				███		

（2）　A.1: [Analyzing Current Map Digitization Methods]

1）　Study on Current Conditions of Map Digitization

- a. Examination Method of Study on Current Conditions of Map Digitization

We examined the survey methods with the Counterpart, however they did not have experience in conducting this type of survey. As such, the expert conveyed his knowledge and experience, and it was decided to conduct a survey in the form of questionnaires and interviews. The counterparts submitted questions for the questionnaire and interview with an understanding of this objective.

Diagram 2-1: Investigation of Survey Methods

- b. Survey of the Map Digitization Department

This study was based on a prepared list of questions that targeted map digitization work done at SOK and the section that conducts the work.

The counterpart conducted interviews with the section head or work manager in each section based on the list of questions to grasp the conditions of map digitization. The counterpart prepared a report of the interview results into a Word document file based on notes they had taken during the interview. Also, the questionnaires that had been distributed were collected a few days later.

This study targeted the digitization of maps that SOK has been producing, such as National Base Maps (scale 1: 50,000, 1: 250,000), Thematic Maps (National Parks) and Municipal Base Maps (Topo-Cadastral).

An expert participated in these interviews as an observer, and conducted

supplementary interviews, in an effort to advance the comprehension of current practices.

Diagram 2-2: Interview Process of the Study

- c. Survey of Actual Digitization Practices

    In addition to the interviews with each section head and work manager mentioned above, an interview was conducted with the computer operator in charge of digitizing the maps. This allowed the C/P and expert to confirm his/her understanding of the actual work details.

    This interview identified information that could not be obtained from section heads and managers; for example, the lack of common understanding due to the absence of specifications or manuals.

- d. Evaluation of Current Map Digitization Techniques

    *Plan: The overall project had been formulated, however the details have not been conveyed to the relevant departments. Also, based on that, the detailed plans for each year have not yet been worked out.

    *Procedure: Technicians receive instruction from their superiors, etc., and amongst those staff concerned, uniform digitization procedures are employed.

    *Specifications Document: Irregardless of digitization work projects, specifications documents have not been prepared for products.

    *Manual: Manuals have not been created for digitization work.

    *Quality control: The concept of quality control is watered-down so that it is hard to say there is organized quality control implemented.

- e. Report on Study of Current Condistions of Map Digitization

    The counterpart (C/P) was central to the creation of a report which summarized the evaluation, issues and countermeasures from this survey on current conditions.
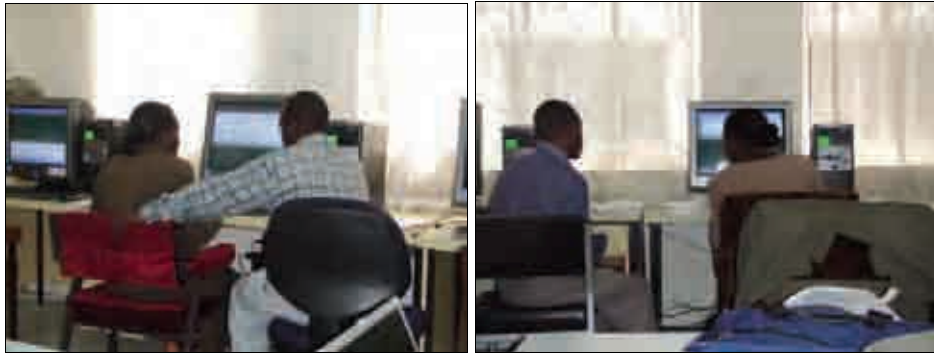
Diagram 2-3: Writing the Report for Current Conditions Survey

- f. Issues in Creating the Map Digitization Specifications Document

    Making use of the period following the status survey when no expert was assigned, we requested that the counterpart in charge of map digitization make a digitization flowchart to identify digitization items and data type.

（3）   A.2: [Creation of Improvement Manual for Map Digitization Techniques]
  1）   Creating the map digitization specifications document

    The Survey on Current Conditions of Map Digitizations revealed that no one was preparing specifications documents for the work items when they digitized maps. At the same time, the map digitization manuals would have to be based on specifications for map digitization. So from this perspective, prior to creating manuals for map digitization, the specifications were prepared for the National Base Map, National Park Thematic Map and Municipal Base Map (Topo-Cadastral), which is targeted for digitization and which SOK is currently implementing on and off. These specification documents were produced using the results of tasks that counterparts completed during the period when no expert was assigned.

- a. Concept behind Creating Map Digitization Specifications Documents

    One of the tasks of this project is the formulation of standards for spatial data infrastructure. Based on the general idea behind standardization, it is recommended to apply the product specification for geographic information, not the process specification. This concept, that the map digitization specifications document is a product specifications document, was kept in mind as we proceeded with the project. However, at this point in time there is no preliminary draft for standardization in Kenya. Also, as the concept of standard specifications is not fully understood, we intend for the specifications document to use the ISO standards and the results of Japanese standarization as reference.

- b. Content of the Map Digitization Specifications Document

   The content for the map digitization specifications document is as follows:

   1. General

   2. Applicable Scope

   3. Identification of Data Products

   4. Contents and Structure of Data

   5. Coordinate Reference System

   6. Time Reference System

   7. Data Quality

   8. Distribution of Products

   9. Metadata

   10. Other

   During this period, we proceeded to produce specifications documents with a focus on "1. General" to "6. Time Reference System". We planned to proceed with the remaining items from "7. Data Quality" as we reach that task. Also, after a draft of standards is updated, those specification documents will be updated by C/P.

- c. Creation of the Map Digitization Specifications Document

   The counterpart had no experience making a specifications document so that the expert team provided a contents page based on standards from both ISO and Japan and showed them an example in sequence. The counterparts then created the specification document which reflected the properties of each area.
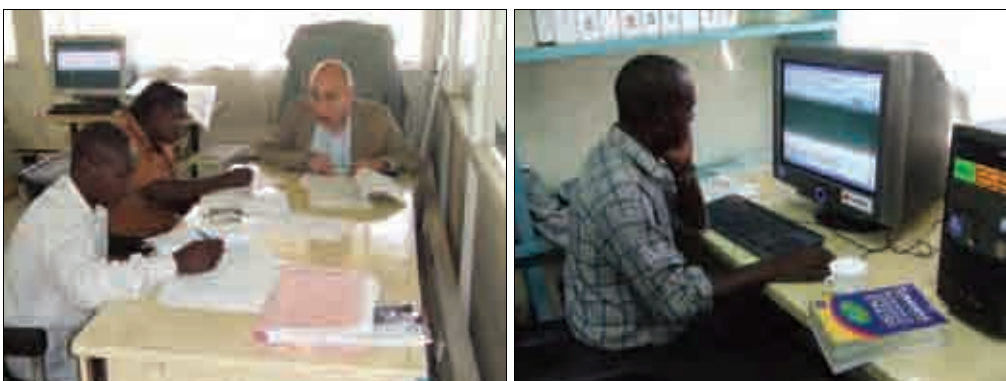

Diagram 2-4: Creating a Specifications Document

- d. Evaluation of the Map Digitization Specifications Documents

We are able to sufficiently evaluate the counterpart on the point that they were able to create a specification document, for which they had no prior experience. However, the resulting document contained a degree of ambiguity and data configuration was not sufficiently comprehensive, so there is plenty of room for improvement. Nonetheless, the specifications document created this time can be used as a trial draft as there will be another opportunity after the standards are established.

2） Creating Map Digitization Manuals

After making the specifications for map digitization, the map digitization manuals were created based on the specifications and a flowchart within the task of the counterparts. As we mentioned above, the manuals were also created according to progress of the project operations.

- a. Concept behind the Creation of Map Digitization Manuals

  The concept behind creating Map Digitization Manuals is as follows.

  ＊A manual is created based on specifications

  ＊A manual is created corresponding with each digitization process (National Base map, Thematic Map, Municipal Base Map Topo-Cadastral)

  ＊A manual is created according to specific software used for map digitization

  ＊A manual is customized for map digitization and created in order to improve productivity.

  ＊A manual is made keeping beginners in mind.

- b. Software Dealt with in the Map Digitization Manuals

  Software either already owned by SOK previously or supplied in the project is used for map digitization. Accordingly, the software to be used for map digitization is as follows.

  ＊Scanning software: WIDE Image

  ＊Image data editing software: Adobe PhotoShop

  ＊Image data vector conversion software: Able Software R2V

  ＊Screen digitization software: MapInfo

- c. Content of the Map Digitization Manual

  The Map Digitization Manuals are composed as follows:

  1. Procedures of Map Digitizing

2. Map Digitizing

2.1 Preparation

2.2 Scanning

2.3 Scanned data editing

2.4 Autovectorization

2.5 Geo-reference

2.6 Screen Digitizing

Items following 2.6 will be added by C/P.

- d. Creating Map Digitization Manuals

Similar to the specifications document, the counterpart had no experience with producing a manual for map digitization. Therefore, the following measures were employed to produce the manuals.

∗The first chapter of the manual (map digitization procedures) is made by the counterpart by adapting and changing a sample provided based on past experiences of the expert so that it is applicable to the contents of each field.

∗The first section of the second chapter of the manual (scanning) is prepared for each process by the counterpart by checking a sample provided by the expert of the work at SOK.

∗The section (following Editing scanned data) in the second chapter of the manual is created by the counterpart by analysing personal experience and with the expert's assistance.

Diagram 2-5: Creating a manual

- e. Evaluation of Map Digitization Manual

The manual for map digitization that was made can be looked at as documentation of the counterpart's current practices In the manual, the obvious items or those of tacit understanding are abbreviated. In that sense, there is a danger that any unknown items are omitted which becomes an inconvenience for beginners.

This point brings to head the questions of what level of detail should be appropriate when producing a manual.

At the same time, keeping that issue in mind, this was the first experience for the counterpart to document this process and it is possible to evaluate any improvements made for future revisions to the manual.

（4） Revision to Map Digitization Specifications and Manual

1） Revision of Map Digitation Specification

Each specification for National Base Maps, Thematic Maps, Municipal Base Maps was reviewed in its entirety. During this review process, the specifications were re-written using the tentative standardization and the manual for making specification products which is based on that, as well as sample specification products as reference. Then, the overall specification was proofread and edited.

The standardization team was lectured on the concept of the application schematic map and application schematic document and how to produce them. Then the specification was re-written accordingly.

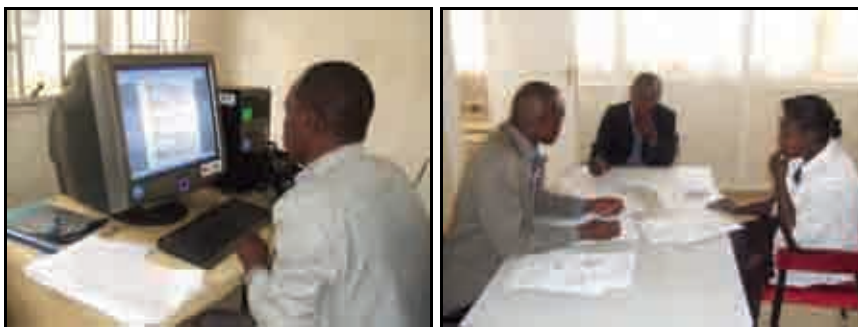Quality evaluation was also added to the specification, which is included later in this document.

Diagram 2-6: Revising the specification document

2） Revision of the Map Digitization Manual

Revisions were made to each map digitization manual (national, thematic, municipal) in accordance with changes made to the specifications. Also, the concept and procedures

of accuracy control for map digitization that should be included in the manuals was explained (see below), and then included in the corresponding manual. This was produced as the second draft of the manual, so to speak.

3） Collecting Information on Secular Changes with RTK-GPS Survey

Sample data of information on the secular changes (e.g. of new roads, schools, churches, vegetation) that had taken place in the model area--the Thika area--for the base map was gathered using the RTK-GPS receiver procured through the project. In particular, this was done by performing reconnaissance of the target area control points, configuring the ground station and then asking residents for information about changes to base the decision of what areas should be targeted before conducting the RTK-GPS survey. The preparation to carry out the survey was appropriately described in the the manual. The procedures for using software to digitize the results (name of survey points, coordinate values) analyzed by the survey department at SOK were also included in the manual.

Diagram 2-7: Collecting Secular Change Information with RTK-GPS

（5） A.3 [Formation of Digital Map Database]

The digital map database was constructed by converting the digitized topographic map database into a relational database. This work requires knowledge of databases and a relatively good understanding of computers, so SOK selected young engineer with knowledge of both as a new counterpart to carry out the task.

1） Installing Relational Database Software

The NSDI5 computer domain was freed up to form a workgroup as a computer for the relational database. The software procured for this purpose-- ArcGIS, Arc Info 9.1, SP2, Arc SDE and Oracle 8i--were installed.

After the software was installed, each user account was set up for each software OS to

prepare an environment where each C/P could use it.

2） Construction of the Relational Database 1

Before constructing the relational database, training was given on the basics to use the software that had been installed.

Technical transfer was carried out for basic usage methods for Arc SDE Post Installation, how to uninstall Oracle 8i and Arc SDE, how to make an Oracle user account for Arc SDE, how to set roles and access rights, setting the parameters of the database and how to create and delete an Oracle database, including modifying the size of the database.

3） Construction of Relational Database 2

After the basic usage skills were learned, and based on those results, the relational database was constructed from the digital topographic map data.

First, space for the Oracle database dedicated to Arc SDE was secured in the computer. After that, the Nairobi 1/2,500 and 1/5,000 scale topographic map data (shape files) that had been earmarked for the relational database and had clear specifications were imported. From this, the Nairobi topographic digital data (1/2,500 and 1/5,000) was all made into the relational database. Also, space was set aside for preparation of the entire National Base Map of Kenya at a scale of 1/50,000 for a later date.

4） Editing the Relational Database

Technical transfer was carried out training the C/P on using Arc MAP to edit the relational database, such as performing revisions, deletion, modification, new entries, etc.
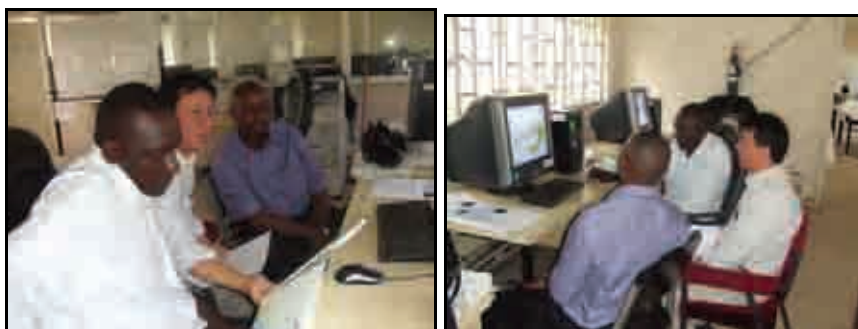

Diagram 2-8: Technology transfer for rerational database construction

5） Other

Training was also conducted for the following items:

- Practicing the display method of 3D data using Arc Scene, composite display of TIN data and image data
- Introduction and practice with Personal Geodatabase (using MS Access)
- Introduction and practice with File Geodatabase (latest from ESRI Arc GIS 9.2)
- Introduction and practice with Coverage data models
- Practice to create topology data and deal with errors

The C/P has produced manuals to outline the content of the technical transfer in cooperation with the expert.

After the above activities, during the period when no expert was assigned, the C/P dealt with a software-related problem and was able to resolve it with support via e-mail. Also, SOK has been requested to provide the digitized data of the 1/50,000 scale National Base Map, which the C/P would, upon receiving it, then render into the relational database.

（6）   A.4 [Establishment of Quality Control Techniques]

Quality control techniques established are those concerning quality control and specifications covered in the manual under quality evaluation.

1）   Quality Control Techniques

A lecture was given on the need and methods of quality control covered in the manual on map digitization. Quality control was covered in the manual as follows:

- Accuracy of printed maps, etc. used for digitization (printed map distortion, clarity)
- Setting parameter values for scanning
- Standards for quality control
- Quality control of digitized feature data

a. Quality control of printed maps

Technical transfer was completed for the following items on methods to control the accuracy of printed maps:

- Measurement and evaluation of scale in 3-directions on printed maps

  Technical transfer was provided on methods to calculate scale for each direction by comparing distance of that for three specified directions on the map between coordinates, and then an approach to evaluating the digitized results.

- Printed map clarity

  The clarity of prints is evaluated examining any dirt or creases that may be present

which could effect digitization.

b. Setting parameter values for scanning

Guidance was provided on filling in a quality control chart for the parameters set for scanning.

c. Standard for quality control

Instruction was given on how to fill in the quality control chart when standardizing scanned data (printed maps, contour lines) by writing in the parameter values used to smooth out standardized residual and contour lines for each control point. Instruction was also provided concerning limited values of quality control for residual.

d. Quality control of digitized feature data

Guidance was given on comparison methods with the original printed maps of digitized topography features and how to record errors in the quality control chart.

2）   Quality Evaluation Methods

In the draft document for standardization based on ISO standards quality evaluation is included in the product specification. SOK has not traditionally thought about quality evaluation in this way (completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy) when carrying out geospatial data production. Therefore, technical transfer was provided to the C/P through lectures on the concepts of ISO-based quality evaluation and appropriate examples based on that concept.

a. Completeness

Instruction was given on completeness, concerning "excess" or "omitted" data in sub-elements when evaluating data quality.

b. Logical Consistency

There are four data quality sub-elements for evaluating locgial consistency, of which instruction was given on "domain consistency" and "format consistency".

c. Positional Accuracy

There are three data quality sub-elements for evaluating positional accuracy, of which instruction was given on "absolute accuracy".

d. Temporal Accuracy

There are three data quality sub-elements when evaluating temporal accuracy, of which instruction was given on "accuracy of time measurement" and "temporal validity".

e. Thematic Accuracy

Instruction was given on thematic accuracy concerning the quality sub-elements "classification correctness", "non-quantitative attribute correctness" and "quantitative attribute accuracy".

The experts also gave instruction on the details of items on quality evaluation in the digitized product specifications of the 1/50,000 base map. Then, using these examples included in the lecture and those prepared by the expert, quality evaluation items were added to each specification.

At this stage, the C/P has been unable to gain sufficient understanding of the quality evaluation methods based on ISO standards. However, these concepts will likely be learned through the standardization team and their related activities.

（7） Follow-up

After the series of tasks aimed at improving capacity of SOK for map digitization, follow-up activities were conducted as outlined below.

2.4.2　GIS Standardization

（1）　Overview

Activities for GIS Standardization were begun with the aim to formulate the Kenyan Geographic Information Standard that will be necessary to build the National Spatial Data Infrastructure (NSDI) and formulate specifications for concrete products. The activities carried out are shown below.

- Implementation Items:

    Organize a C/P Team for standardization and formulate a plan of activity

    B.1.1 [Hold Spatial Data Infrastructure Standards Seminar 1]

    B.1 [Survey of GIS Development and Provision]

    B.2 [Formulation and Disclosure of Spatial Data Infrastructure Standards]

    B.2.1 [Hold Spatial Data Infrastructure Standards Seminar 2]

    B.2.2 [Verification of Spatial Data Infrastructure Standards]

    B.2.3 [Hold Spatial Data Infrastructure Standards Seminar 3]

    B.2.4 [Revision of Spatial Data Infrastructure Standards and Future Planning]

（2）　Organize a C/P Team for GIS standardization and formulate a plan of activity

1）　Organize a C/P Team for Standardization

Two C/Ps were assigned for GIS Standardization activities (Mr. Gota Peter Mbutei, Asst. Director-Geodetic/GIS; and Mr. Oluande B. Agina, Land Surveyor). After the appointment of all of the C/Ps by SOK and the general meeting, the Standardization C/P Team gathered at a kick-off meeting to deepen their understanding of the activity objectives, primary activity details, time period, etc. The two counterparts, being land surveyors, both possessed sufficient knowledge pertaining to surveying and IT techniques, and displayed the necessary attitude to implement external activities. Through this assessment, it can be said that appropriate human resources were commissioned for standarization activities. In addition, all of the C/P members were provided with business cards and an e-mail address since this project would require contacting a number of organizations related to the project for standardization activities and the rest of the activities in the project.

2）　Formulation of an Overall Activities Plan

An administrative meeting was held for the Standardization C/P Team and an overall

plan was formulated for activities over the next two years. The Table of Activities for GIS Standardization between 15 October to 26 December, 2006 is shown inDiagram 2-9.

The Project for Strengthening of Survey of Kenya for GIS Promotion in The Republic of Kenya
GIS Standardization Activities Schedule

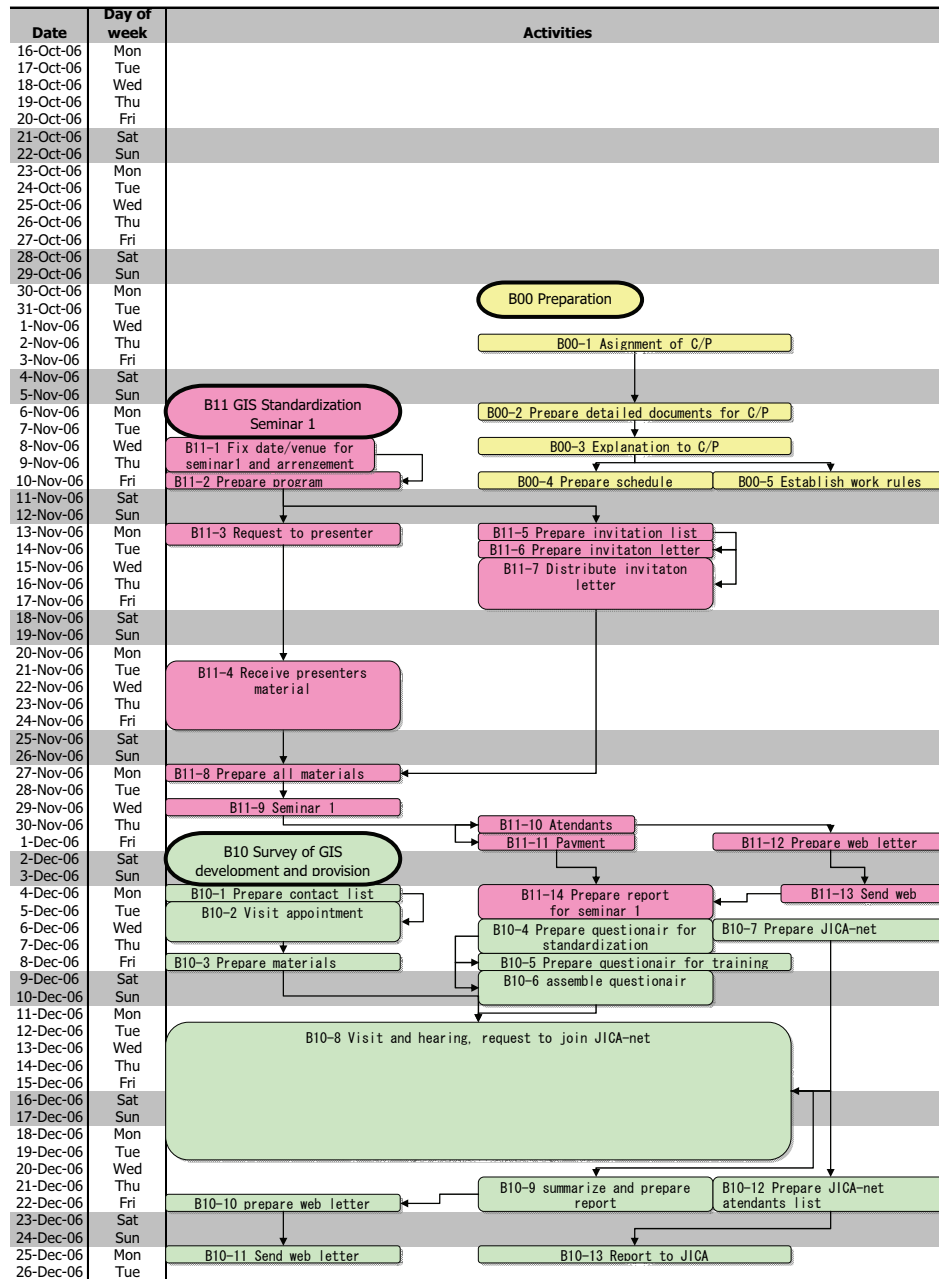| Date	Day of week	Activities
16-Oct-06	Mon	
17-Oct-06	Tue	
18-Oct-06	Wed	
19-Oct-06	Thu	
20-Oct-06	Fri	
21-Oct-06	Sat	
22-Oct-06	Sun	
23-Oct-06	Mon	
24-Oct-06	Tue	
25-Oct-06	Wed	
26-Oct-06	Thu	
27-Oct-06	Fri	
28-Oct-06	Sat	
29-Oct-06	Sun	
30-Oct-06	Mon	B00 Preparation
31-Oct-06	Tue	
1-Nov-06	Wed	
2-Nov-06	Thu	B00-1 Asignment of C/P
3-Nov-06	Fri	
4-Nov-06	Sat	
5-Nov-06	Sun	
6-Nov-06	Mon	B11 GIS Standardization Seminar 1 / B00-2 Prepare detailed documents for C/P
7-Nov-06	Tue	
8-Nov-06	Wed	B11-1 Fix date/venue for seminar1 and arrengement / B00-3 Explanation to C/P
9-Nov-06	Thu	
10-Nov-06	Fri	B11-2 Prepare program / B00-4 Prepare schedule / B00-5 Establish work rules
11-Nov-06	Sat	
12-Nov-06	Sun	
13-Nov-06	Mon	B11-3 Request to presenter / B11-5 Prepare invitation list
14-Nov-06	Tue	B11-6 Prepare invitaton letter
15-Nov-06	Wed	B11-7 Distribute invitaton letter
16-Nov-06	Thu	
17-Nov-06	Fri	
18-Nov-06	Sat	
19-Nov-06	Sun	
20-Nov-06	Mon	
21-Nov-06	Tue	B11-4 Receive presenters material
22-Nov-06	Wed	
23-Nov-06	Thu	
24-Nov-06	Fri	
25-Nov-06	Sat	
26-Nov-06	Sun	
27-Nov-06	Mon	B11-8 Prepare all materials
28-Nov-06	Tue	
29-Nov-06	Wed	B11-9 Seminar 1
30-Nov-06	Thu	B11-10 Atendants
1-Dec-06	Fri	B11-11 Payment / B11-12 Prepare web letter
2-Dec-06	Sat	B10 Survey of GIS development and provision
3-Dec-06	Sun	
4-Dec-06	Mon	B10-1 Prepare contact list / B11-14 Prepare report for seminar 1 / B11-13 Send web
5-Dec-06	Tue	B10-2 Visit appointment
6-Dec-06	Wed	B10-4 Prepare questionair for standardization / B10-7 Prepare JICA-net
7-Dec-06	Thu	
8-Dec-06	Fri	B10-3 Prepare materials / B10-5 Prepare questionair for training
9-Dec-06	Sat	B10-6 assemble questionair
10-Dec-06	Sun	
11-Dec-06	Mon	
12-Dec-06	Tue	B10-8 Visit and hearing, request to join JICA-net
13-Dec-06	Wed	
14-Dec-06	Thu	
15-Dec-06	Fri	
16-Dec-06	Sat	
17-Dec-06	Sun	
18-Dec-06	Mon	
19-Dec-06	Tue	
20-Dec-06	Wed	
21-Dec-06	Thu	B10-9 summarize and prepare report / B10-12 Prepare JICA-net atendants list
22-Dec-06	Fri	B10-10 prepare web letter
23-Dec-06	Sat	
24-Dec-06	Sun	
25-Dec-06	Mon	B10-11 Send web letter / B10-13 Report to JICA
26-Dec-06	Tue	

Diagram 2-9: GIS Standardization Activities Plan (selected)

（3）　B.1.1 [Hold Spatial Data Infrastructure Standards Seminar 1]

  1）　Seminar Objectives

Three seminars are planned in this project as part of the activities for GIS Standardization. The 1st seminar is aimed at promoting the project and a call for collaboration, while the 2nd seminar is for disclosure of the standards. The 3rd Seminar was used to report verification trials of the standards and introduce plans for the future. The design of the 1st seminar, which was held in this period, is shown below.

- Project Overview
- Introduction to examples of the impact of NSDI in Japan
- Introduction to NSDI international activities
- Introduction to NSDI activities in East Africa
- Introduction to NSDI activities in Kenya
- Explanation of project activity plan

  2）　General Overview of Seminar

- Date of Event: 29 November, 2006
- Attendees: 55
- Program: After opening statements by the Ministry of Land Secretary and the JICA Kenya Office Resident Representative, an explanation was provided of the project and GIS standardization program, as well as the GIS Standardization movement. The program is shown in Diagram 2-10.

Kenya National Spatial Data Infrastructure Standards Seminar 1
'Strengthening Capacity and Promoting Geoinformation Sharing in Kenya'

29th November, 2006
0900Hrs – 1540Hrs

Venue: AICAD Conference hall

Time		Topic	Speaker	Organization
Start	End			
09:00	08:30	Registration of participants		
09:30	08:45	Opening Statement	Mr K. MWENGO	PS Ministry of Lands
00:45	08:55	Welcoming Speech	Mr Y. Kano	JICA
09:55	10:25	Project Outline	Mr B. N. Owino	Survey of Kenya
10:25	10:55	Standardization Outline	Mr F. Goto	Survey of Kenya
10:55	11:25	History in Japan	Mr J. SATO	JICA
11:25	11:40	Tea Break		
11:40	12:20	Geo-information Standardization at ISO	Mr S. K. A. Muanza	RECTAS
12:10	12:40	Current status of Standardization Activities in the region	Dr W. Ottichilo	RCMRD
12:40	13:10	Current status of NSDI Standardization in Kenya	Prof. G. C. Mulaku	University of Nairobi
13:10	13:55	Lunch Time		
13:55	14:25	Technical Aspects of KNSDI	Mr K. YAMADA	JICA
14:25	14:55	Schedules regarding standardization	Mr B. A. Olunde	Survey of Kenya
14:55	15:25	Discussion	Mr J. Agatsiva	Dept. of RS & RS
15:25	15:40	Closing Statement	Mr R.Okumu	Ark Consultants

Seminar Co-coordinator: Ms. Pony Gitau
Rapporteurs: Ms. Betty Mulanga; Ms. Rosemary Maeda

Telephone: (020) 8565036
E-mail: knsdi_secretariat@yahoo.com

Diagram 2-10: Program for Spatial Data Infrastructure Standards Seminar 1

3） Program Preparation

Preparations were started about 20 days before the seminar was held, including contacting the speakers, sending invitations to the event, and reserving the hall. A contact list was constructed from resources such as the past NSDI committee, an AICAD short-term expert report, and a study by Professor Mulaku of UON. A total of 100 offices were contacted (incl. multiple contacts within one organization and within SOK, but not including the Japanese side). The contacts were sent invitations primarily via e-mail. 120 participants were anticipated considering the 100 people contacted in addition to C/P and Japanese-side participants. Although there were a number of people who indicated their intention to attend, most invitations received no reply. Similarly, reply rates for the NSDI committee and so on were also low, so we felt a method to confirm the actual attendees would be necessary. Moreover, these preparations were carried out entirely by the C/P. The habit of keeping in frequent contact by e-mail proved beneficial. Meanwhile, as the invitations were sent, preparations were made to set up the hall. Renting the AICAD conference hall, making a banner for the event and deciding the hall

configuration was all carried out during a planning meeting with the AICAD supervisor on 17 November 2007.

Diagram 2-11: Contacting Speakers

4）   Hosting the Seminar

The seminar was held on 29 November 2006 with the help of C/Ps from other project activities who took on various tasks such as drawing up the participants list at registration, writing the Minutes of Meeting (M/M) during the seminar and taking pictures of the event.

The seminar welcomed a total of 55 attendees, well below our expectations. Apparently, another conference held by an international organization on the same day as the seminar it thought to be the reason for the unfortunately low number of participants from international organizations. Nonetheless, the seminar proceedings and reaction from the audience was aligned with our expectations. The emphasis by Permanent Secretary Mr. Mwero that the project was in the hands of SOK left a strong impression. In the Q&A session following the presentation, a number of positive suggestions were offered, and we anticipate that those stakeholders related to the project were able to deepen their understanding of the activities.

Diagram 2-12: Spatial Data Infrastructure Standards Seminar 1

5) Reporting after the event

Following the seminar, a newsletter was produced based on the Minutes of Meeting (M/M) from the event. A selected portion of the newsletter is shown in Diagram 2-13. The newsletter was sent to seminar participants in addition to all of those who received an invitation, according to the contact list. Also, a number of replies were received, allowing for a collection of participant comments. In general, the comments were favorable in regards to the project. We also received comments requesting more advance promotion of activities.

Diagram 2-13: Newsletter No. 1

（4）   B.1 [Survey of GIS Development and Provision]

1）   Study Purpose

The purpose of the study was to collect the content of information (digital and analogue) from organizations currently using GIS to examine and formulate spatial data infrastructure standards (incl. metadata specifications).

2）   Selecting the Survey Organization

We selected the survey organizations that were confirmed to maintain geographic information, or showed a strong probability to actively use GIS. For the selection, we used the report by a short-term expert concerning the use of AICAD facilities, past NSDI committee Minutes of Meeting (M/M), and data from the study by UON Professor Mulaku for reference. The result was a preliminary selection of 41 target institutions for the survey. In addition, 16 of these organizations were selected as those that could be presumed to be storing large amounts of data or those thought to be comparitivly active GIS users. This latter group would be prioritized depending on visits and interview results. The organizations that were identified are listed in Diagram 2-14.

Diagram 2-14: Survey of GIS Development and Provision Target Organizations

3）   Survey Method

The survey was carried out primarily through questionnaires as well as interview visits.

4）   Creation and Transmittal of Questionnaires

The following points were taken into consideration when creating the questionnaire.

- The question items were selected to allow for the spatial data owned by each organization to be arranged into items that should be examined for standardization. For example, dividing the questions for each required data to express the Spatial Referencing System (Coordinate System) in the ISO19000 series format.

- To avoid the organizations from leaving any of the answers blank, feeling they were bothersome to answer, a concerted effort was made to produce questions that could be

given concise answers.

The questionnaire is shown in Diagram 2-15.

Diagram 2-15: Questionnaire for Current Status of GIS Development and Provision

5） Visit and Interview with Target Organizations

Once the questionnaires were sent out, we contacted those organizations that were emphasized and arranged to visit them for an interview. A synopsis of the visits to each organization up until 20 December 2006 is given below.

- University of Nairobi (Prof. Mulaku)

    It was indicated that since most of the existing data was not systematically organized, as most of it is from student research, there was no place on the questionnaire to convey this information. On the other hand, we were provided with many answers concerning the study of GIS data application. In particular, we were able to obtain information concerning resources for lecturers, etc.

Diagram 2-16: Interview survey at UON

- Kenya Police (Mr. Wahome, Crime/Information Section)

    They purchased a set of basic data of Nairobi which is being utilized for crime statistics and analysis. They have also constructed their own database of 4 types of thematic information. There is a GIS room set up with equipment (ArcGIS3 Set), etc., with regular staff. They have issues with personnel education, so a follow-up visit should be made to investigate the GIS training needs of this project.

Diagram 2-17: Interview survey with Kenya Police

- ICRAF (Mr. Nyabenge, GIS Unit）

    They have already constructed a number of data sets, WebGIS, and metadata. Answers were given wherever possible on the questionnaire. Concerning activities related to NSDI, they provided a robust comment that, while they did not have high expectations for previous projects that were unsubstantial, they were looking forward to seeing a concrete plan for even a small pilot model. Also, they have published a number of data sets and suggested linking the websites once the SOK WebGIS is published.

Diagram 2-18: Interview with ICRAF

- FAO (Mr. Hagen, GIS Consultant）

    The questionnaire was returned to us by e-mail. A summary was given of our project, and there was a general welcoming of our project activities. They indicated that without sufficient bugetary allocations for existing data and GIS, it is difficult for them to update the required data used for satellite images. Two comments were received which put emphasis on, 1) updating the secular changes of topographic maps by SOK, and 2) providing information to relevant organizations and receiving feedback. Concerning training, they said they were able to provide resources for lecturers.

Diagram 2-19: FAO interview survey

6） Visits to other organizations

The C/P continued to receive questionnaires and conduct interviews until the end of February 2007, resulting in a total retrieval of 18 questionnaires and interviews with 20 organizations.

7） Producing the Report

We plan to present the report of the completed Survey of GIS Development and Provision at the GIS Standardization Seminar 2 in the context of standardization work.

（5） B.2 [Formulation and Disclosure of Spatial Data Infrastructure Standards]

1） Summary of Activities

In the first fiscal year, a draft was formulated for the Kenya Spatial Data Infrastructure based on B.1 Survey of GIS Development and Provision.

First, Japanese experts were guided by referencing standardized geographic information from the Geographical Survey Institute of Japan, and used three documents to formulate the standards: (1) "KPGIS (Kenya Profile for Geographic Information Standards)" taken from an excerpt of the Kenyan National Standard for geographic information KSISO19100 series and used as a practical standard, (2) the "Manual for Preparation of Spatial Data Product Specification" used for KPGIS tasks, and (3) the "National Spatial Data Infrastructure Scale 1:50,000 Product Specification rev. 1", which is a concrete element of the spatial data infrastructure standard created using the manual.

Afterwards, we consulted and worked with the project C/P to check the technical validity of the basic document structure based on this draft in an attempt to move closer to completing the document.

The next step was hosting the technical committee meeting on 21 June 2007 which primarily invited academic and geospatial information/GIS stakeholders from 5 external organizations that are engaged in creating geospatial information. We received specific comments on the draft concerning the technical aspects of the summary, terms of usage, and so on, in addition to comments and advice for items that should be revised down the line. In the end, we were able to reach a general consensus on the basic composition of the document and procedures to formulate the spatial data infrastructure standard. As a result, we were able to put together a draft document. The activities for the implementation plan concerning B.2 Formulation and Disclosure of Spatial Data Infrastructure Standards, and B.2.1 Hold Spatial Data Infrastructure Standards Seminar 2,

are shown below (Diagram 2-20).

Date	Day of the week	Items		
9-May	Wed			
10-May	Thu			
11-May	Fri			
12-May	Sat			
13-May	Sun			
14-May	Mon			
15-May	Tue			
16-May	Wed			
17-May	Thu			
18-May	Fri			
19-May	Sat			
20-May	Sun			
21-May	Mon	Prepare draft KPGIS document	Purchashing KSISO	
22-May	Tue	Prepare draft KNSDI specification		
23-May	Wed	Prepare draft KPGIS guideline	TC workshop self-learning	
24-May	Thu	Prepare draft KNADI guideline	Mr.Ooluande, Mr. Gota	
25-May	Fri			
26-May	Sat	Mainly Mr. Yamada will prepare,		
27-May	Sun	Mr. Gota, Mr. Oluande will		
28-May	Mon	complete.		
29-May	Tue			
30-May	Wed			
31-May	Thu			
1-Jun	Fri			
2-Jun	Sat			
3-Jun	Sun			
4-Jun	Mon		TC workshop preparation	Seimnor2 preparation
5-Jun	Tue			
6-Jun	Wed			Venue: AICAD
7-Jun	Thu			Guest: Same as 1st seminar
8-Jun	Fri			
9-Jun	Sat			Confirm VIPs schedule first.
10-Jun	Sun			
11-Jun	Mon			
12-Jun	Tue			
13-Jun	Wed			
14-Jun	Thu			
15-Jun	Fri			
16-Jun	Sat			
17-Jun	Sun			
18-Jun	Mon		TC workshop	
19-Jun	Tue		Venue: SoK	
20-Jun	Wed		Lectureler: Mr. Gota, Mr.Oluande,	
21-Jun	Thu		Mr. Yamada	
22-Jun	Fri		Guest: SoK, KISM, RCMRD, UoN	
23-Jun	Sat			
24-Jun	Sun			
25-Jun	Mon	Modify draft KPGIS document		
26-Jun	Tue	Modify draft KNSDI specification		
27-Jun	Wed	Modify draft KPGIS guideline		
28-Jun	Thu	Modify draft KNADI guideline		
29-Jun	Fri			
30-Jun	Sat			
1-Jul	Sun			
2-Jul	Mon			
3-Jul	Tue			
4-Jul	Wed		Seminor2	
5-Jul	Thu			
6-Jul	Fri			
7-Jul	Sat			
8-Jul	Sun			
9-Jul	Mon		News Letter 4	
10-Jul	Tue			
11-Jul	Wed			
12-Jul	Thu			

GIS Standardization 2nd Phase Work Plan (Draft) — 2007/5/17

Diagram 2-20: Formulation and Disclosure of Spatial Data Infrastructure Standards and Seminar 2 Activity Plan

Furthermore, from the time the draft was formulated, we planned that the Expert team would work together to create the draft of the KMP Metadata Profile, which was created from C.5 Formulation of Metadata Specifications, in order to avoid technical inconsistencies.

2） Implementation Procedure

The procedure with which to decide on the draft of the Kenya Spatial Data Infrastructure Standards, we based our plans on obtaining a common consensus on technical validity between the above-mentioned stakeholders. Those procedures are as

follows:

- Analyze the Status Survey of the Previous Year

    Analyze the B.1 Survey of GIS Development and Provision from the 1st fiscal year and come to grasp the technical level demanded by those who will use the Kenya Spatial Data Infrastructure Standards, as well as their interests and needs.

- Producing the Draft

    The Expert Team will produce the draft document.

- Investigations Conducted by the Project Team

    The Expert Team and the Project C/P will review the basic structure and content of the document. Of the two C/Ps, Mr. Oluande B. Agina (Land Surveyor) will act as the primary figure. He exhibits considerable capabilities from the aspect of his technical skill, time-management ability, and strong initiative, and is carrying out the activities proactively.

- Hosting the Technical Committee of GIS and Kenya Geographic Information Experts

    We called upon GIS and geographic information experts to gather for the technical committee meeting and investigated the validity of the document.

3）   Details of Implementation

- Analyze the Survey of GIS Development and Provision from the 1st fiscal year.

    We analyzed the results of the B.1 Survey of GIS Development and Provision, which was conducted by the previous Expert team present in the first year. As a result, we were able to clarify the following conditions and problems:

    1. A great deal of the basic information required by KNSDI is being developed by a small, specified number of data development organizations (i.e. Sock, RCMRD, DRSRS, ILRI, FAO). However, this data can not be used without first obtaining their consent. Also, the actual state of mutual application is largely unknown, even amongst the organizations themselves.

    2. Each organization keeps an inventory of their current data; however this information is rarely communicated to external sources.

    3. Most of the organizations producing and utilizing the data are using mainstream commercial GIS software, with no significant obstacles to technical data conversion.

    4. Most other organizations are not capable of constructing the data themselves.

    5. The quantity and quality of equipment is insufficient, including that of educational institutions.

From these results, we have supposed the following items as prerequisites for composing the draft from the technical aspects considering validity and utilization:

1. The ability to perform "data conversion" that conforms to practical standards without the use of new technical developments or software developments.

2. The ability to concisely write "information necessary for data conversion" (the resulting quality evaluation of the specification/product of the data) without use of special software, etc.

3. The ability to continue to use a variety of GIS software and the current resources made with such software.

- Producing the Draft

   The Expert team produced the draft based on the results of the current conditions survey. As basic technical policy, the following items have been offered for the pragmatic and continuous use of the final document to be released at the beginning of the year.

   1. Use experience gained from standardization activities in Japan as successful examples.

   2. Respect the decisions made in previous KNSDI Workshops (First - Fifth)

   3. Select the items for which technical aspects can be disseminated with current conditions in Kenya.

   4. Select the items for which technical aspects are truly necessary for current conditions in Kenya.

   5. Conformity adequately satisfies international technical standards

   The draft for Spatial Data Infrastructure Standards is the specification product for geographic information material to develop public infrastructure in Kenya. For this, the feature and thematic information, including specifications, are written in detail. We planned and wrote the following points for arrangements to make when choosing product specifications.

   1. Spatial Data Specifications to be used as the practical standard (not a legal standard) A subset covering the standards that will be necessary based on ISO19100

series. In Kenya, 13 standards known as KSISO19100 have been formulated from the ISO19100 series and are currently used. The necessary standards were selected among these standards, extracting the necessary sections without altering their content. The following standards are those that were employed:

KSISO19109 Geographic information - rules for application schema

KSISO19111 Geographic information - spatial referencing by coordinate

KSISO19113 Geographic information - quality principles

KSISO19114 Geographic information - quality evaluation procedures

KSISO19115 Geographic information - metadata

This document offers a framework concerning how to create and utilize geographic information, such as the writing method for product specifications, and method for quality evaluation procedures. The specification material does not contain those particular products.

2. Draft for Spatial Data Infrastructure Standards

This is one of the concrete materials of the NSDI product specification applicable to the Spatial Information Specifications. Geographic information was collected that covers the entire national land area using basic information that could be extracted from the already detailed information provided in 1:50,000 topographic maps. The items that were adopted at previous NSDI committee meetings served as reference for what features and thematic information were employed. We could designate how to use these product specifications together with others (e.g. other data products developed at SOK or existing data at other organizations) as prescribed models.

3. Creating product specifications and using the manual

The data creator made the product specification sheet, and accordingly, the data. Afterwards, when evaluating the quality of the data, a product specifications sheet and user manual was made in order to accurately convey the items for the necessary spatial information specifications and product specification sheet that one creates, with an understanding of how the user will read the product specifications. To this effect, in many cases, what was supplied in this users' manual are the mechanisms to create data and use it according to the standards, even without an in-depth understanding of the spatial information standards.

- Review tasks for the Project Team

    The Project C/P carried out review tasks for the three draft documents prepared by the Expert team for basic composition of the document and to proceed forward to completion. First, the Expert explained to the C/P the findings, document structure and methods of usage that were acquired during standardization activities in Japan. Based on this, revisions were made to the content after close perusal of the documents. We were able to reach a general consensus on the basic structure and content of the document. The main items that were added in revision are listed below:

    1. Basic revisions to English grammar, etc.

    2. Background of the document design added to title page

    3. Made the diagrams bigger and easier to understand

    After these review tasks were completed, the draft document was bound together.
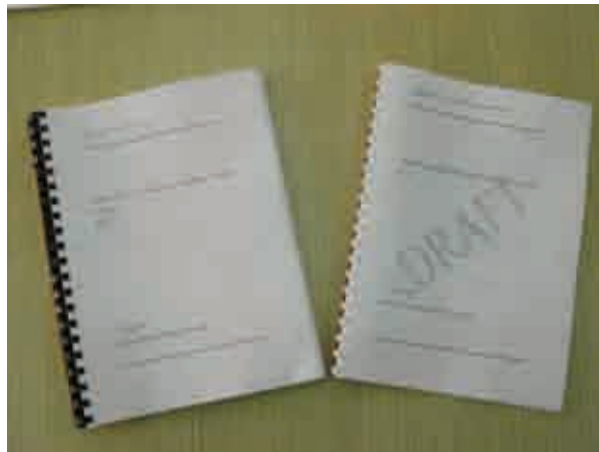
Diagram 2-21: Bound draft after completion

- Holding the Technical Committee Meeting with Geographic Information/GIS Experts

    After reviewing the 3 documents with the C/P, a technical committee meeting of geographic information and GIS experts in Kenya was held to build consensus on the content and final methods contained therein. The pictures below are of the event.

Diagram 2-22: Technical Committee Meeting of GIS Experts

Seven organizations were invited, selected as a prerequisite to the large-scale production of data and their academic authority. The Technical Committee Meeting was called together at the SOK project office on 21 June 2007. Five of those seven organizations agreed to collaborate; the participants are listed below:

University of Nairobi

Jomo Kenyatta University

Department of Resource Survey and Remote Sensing

Central Bureau of Statistics

KISM (Submitted comment on paper)

In the committee meeting, the Expert and C/P gave an explanation of the background, document and selection procedures, followed by a question and answer session. The main topics that were discussed are listed below:

1. General acceptance of the basic structure of the document

2. The necessity to proceed toward completing the document

3. Should add KSISO19101: reference model

4. Necessity to conduct a more detailed review of the feature structure of the spatial data infrastructure standards

5. Should add a more detailed explanation of the background of document selection to the title page

6. In the near future, the standard for KSISO, which will be employed as the practical standard, should be added in sequence.

The result of the Q&A session was general consensus for the project proposal and the draft document was finalized. Afterwards, Professor Mulaku of UON was chosen to report the technical committee proceedings and make an announcement at Seminar-2.

A few problems that were identified at the Technical Committee Meeting will be given attention in the future. These are listed below:

1. Method to Select Organizations

After the selection, which was not disclosed at the discretion of SOK, those organizations that were not invited expressed the opinion that there should have been more organizations participating in the meeting. Concerning this opinion, although we believe the conditions and number selected by the project were valid, several organizations (particularly international organizations) confirmed that, regardless of their fulfillment of requirements for technical level or level of contribution to the GIS community, in reality, they play a proactive role. Nonetheless, efforts will be made in consideration to this item in the future.

2. Technical Level of Participants

Actual experience among organizations that were invited for their technical expertise is varied, and they do not have the know-how of international standards or IT skills for a detailed review. In regards to this, it is necessary to hold a technical workshop which deals with the concept of IT basic technology, such as UML and XML, and quality evaluation, to raise the technical level of the organizations who participate in the technical committee meetings. A study group was planned as a precursor to the first technical committee meeting, however the busy schedule of the targeted organizations made it difficult to request their participation in a meeting that would span over several days. Efforts will be made in consideration to this item in the future.

（6） B.2.1 [Hold Spatial Data Infrastructure Standards Seminar 2]
　1） Aim of holding the seminar

The seminar was held with all geographic information and GIS stakeholders in mind. The draft document was disclosed and we received public comment, which will serve as a road map to revise the draft and design trial testing, for which we intend to gather consensus amongst stakeholders. Furthermore, this seminar was combined with

a seminar that disclosed the draft of metadata.

2） Summary of the seminar

- Date: 4 July 2007
- Location: AICAD, JUJA
- No. of Participants: 79
- Program: Following opening statements by the Permanent Secretary of the Ministry of Lands, and JICA Kenya Office Resident Representative, presentations were given mainly by the C/P. Here is the program.

Diagram 2-23: Spatial Data Infrastructure Standard Seminar-2 Program

3） Holding the seminar

At the outset of the seminar, the importance of the spatial data infrastructure was reiterated in the statements of Mr. Mwero (Permanent Secretary of the Ministry of Lands) and the JICA Representative of the Kenya office. Afterwards, the following list is of the topics mainly presented by the C/P during the seminar.

- Project progress report

- Explain the background of geographic information standardization
- Give a review of the finalized document
- Present an applicable example from the finalized document
- Give a review of the metadata specifications
- Present the setting of the GIS training course
- Report on the technical committee meeting (Professor Mulaku of University of Nairobi)

After the presentations, there was an active Question and Answer session. A summary of the topics of that session are listed below:

- The development of procedures has not been disclosed, nor has the document been authorized. For this reason, comments are being gathered, the seminar included, as the document is still a draft. It was explained that this seminar was part of the development and procedure to build consensus.
- There was an opinion that the software stipulation that was introduced for the 1:50,000 data creation methods of the document application example was inappropriate. On that note, the work specifications of the example followed the product specifications. The data creator is able to use any software that allows him/her to achieve the product specifications. The reply to this comment stated that at that time users are free to decide their work specifications.
- There was a comment that metadata specifications should be reviewed for compliance with existing African standard initiatives, etc., with the Committee on Development Information (CODI). On that note, we plan to make revisions in regard to the comment.

We added the comments and advice we received to that of the technical committee and explained that this would assist in future revisions of the document. We also explained the plan for upcoming activities. A summary is shown below:

- Seminar-2 (same day): Disclosure of the draft document and announcement of Technical Committee resolutions.
- Draft Document Disclosure: This will be made public on the KNSDI website free of charge.
- Revisions: The comments and advice gathered at both the Technical Committee and Seminar-2 will be used for the C/P to implement revisions.
- Trial Testing: The applicability of the revised draft document will be tested on a small-scale as a trial to review the actual capability of technical requirements, such as data creation, preparing product specification sheets, creating metadata, and quality

evaluation.

- Seminar-3 (January 2008): The results from the trial testing will be disclosed to receive public comment and advice.

- Revisions: With the knowledge gained from trial testing and comments and advice from Seminar-3, the C/P will implement revisions.

- Disclosure of Version 1: Educational activities to promote the usage of the finalized standard.

Diagram 2-24: Spatial Data Infrastructure Standardization Seminar-2

4） Providing information after the event

After holding the seminar, the 4th newsletter was published based on the proceedings of the event. Part of the newsletter is shown below. The newsletter was sent not only to those on the contact list who attended, but to all those who were invited.

Diagram 2-25: Newsletter No. 4

（7）　B.2.2 [Examination of Spatial Data Infrastructure Standards]

　1）　Objectives

In B.2 [Formulation and Disclosure of Spatial Data Infrastructure Standards], and B.2.1 [Hold Spatial Data Infrastructure Standards Seminar 2], a trial test was done to digitize 1:50,000 topographic maps which would make up the bulk of KNSDI to confirm that the technical level was appropriate for Kenya and the content was valid. This was then included in the draft document produced through mutual consensus of the stakeholders. The test was carried out to evaluate whether the document was effective in each process of the project, such as creating product specification and data, quality evaluation and so on. The results were taken into consideration for later revisions of the document.

　2）　Implementation

The document produced actually applied to each process of the small digitization project of 1:50,000 topographic maps and investigated the validity of technical level. However, do to unfortunate timing, Mr. Oluande, the C/P involved in the activity up to that point, was unable to return to work because of post-election disturbances in the western part of the country. Instead, Ms. Lucy Chepkosgei was assigned to carry out the primary tasks. Considering the effects of the demonstrative test, the fact that the C/P had

not been involved in the work actually contributed to better testing objectivity. The investigation was divided into the following steps and planned, then carried out between the 4th to the 20th of February 2008.

1. Establish user demand (simulation)

2. Formulate product specification

3. Small scale trial production

4. Quality evaluation of trial product (only the quality sub-elements that allowed complete evaluation were targeted in order to reduce the time needed)

5. Gather information needed for revision of manual for formulating product specification

Special consideration was given during the examination to items concerning data monitoring that used a relatively technically difficult UML diagram and the framework for communication between the author of the document and the author of the data.

3)   Results of Examination

An overview of the examination results is given below. The results were also presented by Ms. Lucy Chepkosgei at the third seminar.

- The basic construction of all documents is valid
- There is no possibility that the standardization done by other organizations will result in incompatibilities. A related possibility is that the push to create product specifications, rather, would indirectly support other standardization efforts.
- There are, however, portions of the document that require revision. Below are the places where a need for revision has been pointed out.

Product Specifications Manual: Experience is needed to use the description of the application schema to understand UML static class diagrams. This suggests that it is not enough to simply use the product specification manual as it would likely produce inaccuracies. As such, finely detailed entries must be added to each section of the manual. Also, it is necessary to provide ample explanation based on the importance of the product specification as a communication tool between data providers and users.

KNSDI Product Specification: The relationship between UML class diagram and implementation was unclear. It is necessary to heavily include UML class diagrams in the notes and reduce implementation problems. Also, according to results of examination, it is unlikely that the quality evaluation procedures would become widespread unless

they are simplified.

Diagram 2-26: Ms. Chepkosgei examining the document
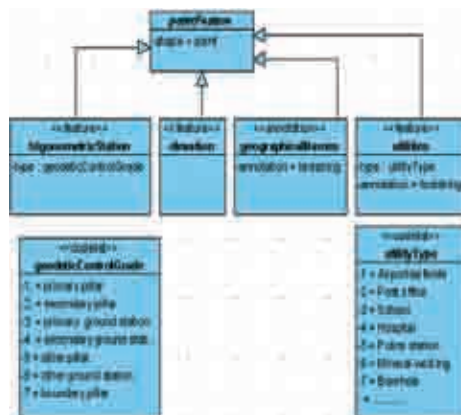
Diagram 2-27: An example of data modeling using a UML class diagram
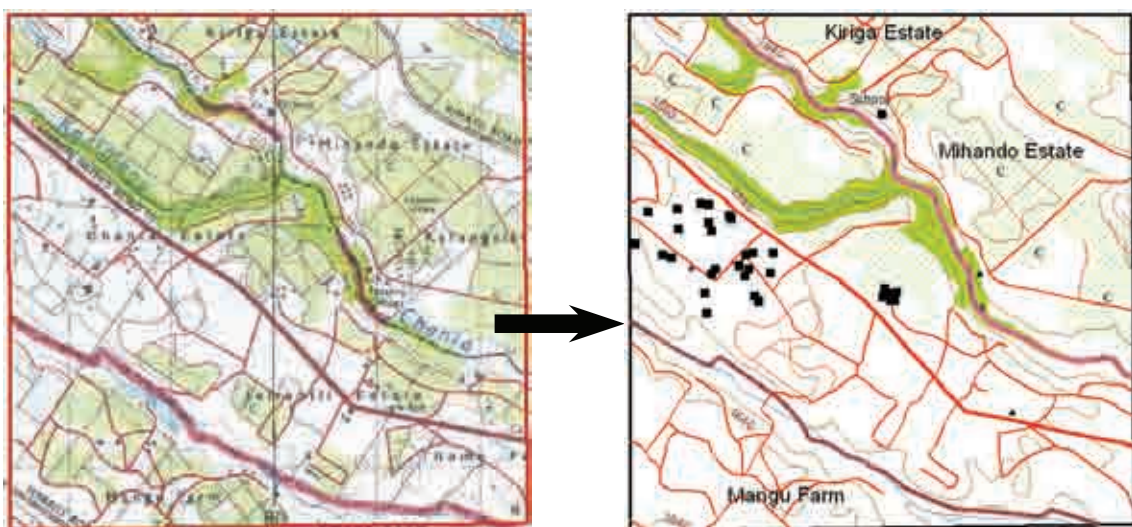
Diagram 2-28: The result of digitization according to the specification

（8）   B.2.3 [Hold Spatial Data Infrastructure Standards Seminar 3]

1）   Aim of holding the seminar

This was the third seminar of the three planned as part of the standardization activities in this project. The Kenyan experts and stakeholders came to general agreement on the standardization document, so the aim for this event was to proceed towards completion of an applicable document and carry out awareness-raising activities. This also served as an opportunity for other projects to give presentations on the progress of their activities that were closely related to standardization.

The third seminar was planned to feature reporting on project activities, particularly those related to data sharing, an introduction on practices by external organizations and facilitate overall discussion.

2）   Preparations

Leading up to the third seminar, the C/P had acquired the ability to carry out preparations independently. They handled decisions on who to send invitations to, as well as sending the invitations, requesting lecturers, setting up facility logistics and running the seminar, largely on their own. This demonstrated the autonomy they've achieved during the course of the project. Also, the C/P held a preliminary meeting to discuss the content of presentations by evaluating them and giving advice to those slotted to speak and making significant improvements in the material.

Diagram 2-29: Preliminary Review of Presentation Material

3）   Holding the Seminar

The seminar was held on 21 February 2008. The number of participants was predicted to be much lower than prior seminars, which welcomed between 60-80 people, due to

political unrest at the end of 2007, but the result was the largest turnout thus far with 83 participants (incl. C/P). The impetus for such a turnout is thought to be the change in venue from the AICAD to the Ramada Hotel, which is much closer to Nairobi city center. This should be considered when planning the venue for the final seminar at the end of this project. With the focus of the seminar on data sharing and the release of the SOK clearinghouse, there are higher expectations for SOK to disclose data.

Diagram 2-30: At the Third Seminar

Kenya National Spatial Data Infrastructure Standard Seminar 5
"Application of Standards for Spatial Data Building and Sharing"

Time	Topic	Speaker	Organization
Date:	Thursday 21st February 2008		
Venue:	Hotel La Mada : Off Thika road : Ruaraka		
08.30-09.00	Registration of participants		
09.00-09.15	Opening Statement	Permanent Secretary	Ministry of Lands
09.15-09.30	Statement by JICA Representative	Mr. Yoshiyuki TAKAHASHI	JICA
09.30-09.45	Progress Report on KNSDI Project	Ms. P. Gitemu	SOK
09.45-10.00	Data sharing MoU Agreements	Mr. H.Oganda	AMFRI
10.00-10.15	Experimental Project	Ms Lucy chepkosgei	SOK
10.15-10.30	Meta data creation	Mr. Mwathi	SOK
10.30-11.00	Tea Break		
11.00-11.15	Data sharing KWS experiences	Mr. Odongo	KWS
11.15-11.30	Database Management Data Capture Manual	Mr. Atsyeia/ Kiyotcho/Assuah	SOK
11.30-11.50	Report on GIS Training/ Clearing House Development	Mr. Odhiambo/ Mr. Mutiuri	SOK
11.50-12.10	Geospatial data hunting and dissemination in Academia	Dr. Aachari	JKUAT
12.10-13.00	Discussions	Prof. Mutoko (Chairman)	UON
13.00-14.00	Lunch Break		
14.00-14.20	Data sharing NGO experiences	Ms Lucy Wanjega	CCF
14.20-14.40	Discussions	Prof. Mutoko (Chairman)	UON
14.40-15.00	Resolutions	Prof. Mutoko (Chairman)	UON
15.00-15.10	Closing Statement		ISK

Seminar Coordinator: Mr. Wanjohi

Rapporteurs   Messrs. Mr. Kwarya, Ms. Rosemary Mairer

Diagram 2-31: Seminar Program (tentative)

（9） B.2.4 [Revision of Spatial Data Infrastructure Standards and Future Planning]

Various activities were carried out to assist in completing the spatial data infrastructure standards and related documents produced thus far. A summary and schedule for these activities is given below. Also, since the C/P who had been conducting these activities, Mr. Oluande, was unable to return, Ms. Mildred Akumu was assigned in his place.

- Period: 4th June 2008 ~ 3rd July (Period for field activity was 5th June ~ 1st July)
- Counterpart (who carried out the tasks): Lucy Chepkosgei, Mildred Akumu, Peter Gota
- Content of work: (1) Management and updating the standards documentation records, (2) application of standards, (3) expansion of standards, (4) future planning

GIS Standardization 4nd Phase Work Plan (Draft)			2008/6/4
Date	**Day of the**	**Items**	
4-Jun	Wed	–	
5-Jun	Thu	–	
6-Jun	Fri	JICA meeting	
7-Jun	Sat		
8-Jun	Sun		
9-Jun	Mon	Create Document revision manual.	
10-Jun	Tue	Revise draft manual for specification.	
11-Jun	Wed	Revise draft KNSDI specification.	
12-Jun	Thu		
13-Jun	Fri		
14-Jun	Sat		
15-Jun	Sun		
16-Jun	Mon	Investigate present state of digitized	Action plan discussion meeting
17-Jun	Tue	1:50,000 map and collect them.	
18-Jun	Wed	Define steps necessary to convert	
19-Jun	Thu	1:50,000 to KNSDI specs.	
20-Jun	Fri		
21-Jun	Sat		
22-Jun	Sun		
23-Jun	Mon	Try out data conversion.	
24-Jun	Tue		
25-Jun	Wed		
26-Jun	Thu		Propose project planning.
27-Jun	Fri		Prepare report of activities.
28-Jun	Sat		
29-Jun	Sun		
30-Jun	Mon		
1-Jul	Tue	Report to JICA	
2-Jul	Wed	–	
3-Jul	Thu	–	

Diagram 2-32: Activity schedule

Diagram 2-33: Standardization Schedule meeting Diagram

Diagram 2-34: The Counterpart at work

1） Managing and updating the records of standards documentation

In order to share the details of document revision and accurate information, a record

must be kept of the revisions made to the specification document and product standard. To do so, a manual outlining document management was made to record any future revisions of the three documents made this year: (1) KPGIS ver.1 (Kenyan Profile for Geographic Information Standards), (2) the KNSDI product specification and (3) the product specification manual. Revisions were also made to the document based on the result of the standards trial test conducted last year.

- Document History Management Manual

    This manual was made listing the items needed to ensure unified methods of document history management. The document for each standard required the following items to be included:

    ➢ Writing the title (page)
    ➢ Writing headers and footers on each page of the document
    ➢ Writing the history log page
    ➢ Explanation of revision procedures

- Updating documents

    The three documents related to the standardization activities were revised according to the examination of the spatial data standards and abovementioned manual. Changes were made mainly to ease the process of filling in application schema for the product specification manual. The other documents created in the project (e.g. draft document for metadata standard) will be updated later.

2） Application of the standard

The three documents (KPGIS ver.1: Kenyan Profile for Geographic Information Standards ver.1, KNSDI product specification and product specification manual), were examined for their application to SOK data and work to be carried out in the future.

The SOK would ideally create all map information in accordance with this standard, but at present the products are not (nor have been) created to comply with the standard. As an initial step towards applying the standard, the SOK converted the past 1:50,000 topographic map digital data to the KSDI product specification and attempted to lay down the work procedures for creating some KNSDI for 1:50,000 topographic map data that will be created in the future.

- Collecting data from within the SOK

    Analysis must be done (data format, 2D, 3D, data type, attribute info, etc) when converting data; this includes data made in accordance with product specifications, but especially data that is not. It is also likely that there are various cases in which

procedures will be needed for existent 1:50,000 topographic map data produced within the department. Data for approximately 20% of the national land has been collected, although much of it is incomplete and does not contain all of the necessary information.

- Analysis of existing data

    The existing data is not in compliance with 1:50,000 product specifications. Required analysis (data format, 2D, 3D, data type, attribute information) was carried out when the data was converted. Also, we came to understand certain trends in the data quality (e.g. geometric errors, homogeneity of thematic information). The following is a summary of the results.

    ➢ Most of the data is made in Tab format with the GIS software, MapInfo.

    ➢ Most data was 2D, including that which should include elevation information such as contour lines and control points.

    ➢ Even images that are ideally acquired as closed area contain numerous problems with

    ➢ Thematic attribute data is difficult to reuse due to that lack of much of the data required, as well as inconsistent field names and definitions.

    ➢ A number of geometric errors had not been corrected, such as required line segments that had not been joined, etc.

    ➢ Thematic attributes had been defined on page sheets in various ways (or not defined at all), so that data between different map sheets would not be homogeneous.

    ➢ These results made it apparent that existing data did not follow the specifications or work instructions given below, deeply impressing the need for product specifications and instructions (manuals).

- Standardization of data conversion procedures

    From the data analysis results, a flowchart was made to establish procedures for a variety of data conversion (including data made using the specifications). The flowchart shows when to judge the pros and cons of reusing data or when to add missing information, and how the data will satisfy the requirements for KNSDI specification after it is converted.

- Trial data conversion

    Using the flowchart, a trial for data conversion was done. The results show that much of the data could not be re-used, as expected, and only a portion (contour lines, rivers) were correctly converted.

- Reporting the trial project

  A report on the application of the proposed standard was made summarizing the results of the trial. To share the results, the report was presented at the project C/P's weekly meeting.

  Each issue pertaining to guidelines and policy must be resolved before KNSDI can be published; however, the procedures that will make it possible to accumulate data until that time have been clarified. A fixed goal has been established for creating KNSDI data that will operate together with the digitization of the 1:50,000 topographic maps to come.

3）   Expanding the draft standard

To expand the draft standard means increasing the applicable standards documents. At present, KPGIS has adopted the minimum requirement of six (one conceptual model and five technical standards) to match actual information in Kenya from the more than 40 geographic information-related ISO (or KSISO) standards.

In conclusion, as a result of a review meeting with the C/P, no additional standards documents will be added in this activity period.

Out of all the geographic information, at present, the draft standard has been employed partially for only one specification and will need the specification to be further developed to improve data conversion and sharing capability. Similarly, the results from last year's trial test and this period's standards application trial shows that the current usage of geographic information at SOK and within Kenya, including the minimal specifications made in this project, have not reached an adequate level.

The C/P was given assistance to investigate whether it would be realistic to expand the specifications in this activity period, but it was deemed unrealistic to make additions at this point in time. In the action plan, it was concluded that the standards should be expanded as needed while taking note of specification applicability in SOK.

2.4.3　　　GIS Application Training

（1）　　Summary

The objective of this endeavor was to strengthen the ability of SOK to run training programs for the application of GIS. A summary follows below.

- Period for field activities: 16 February – 14 March 2007
- Implementation items:

    C.1 [Advance preparation of Study of GIS Data Application]

    Organization of GIS application C/P Team and formulation of activities plan

    C.1 [Study of GIS Data Application]

    C.2 [Implementation of Training for GIS Users]

（2）　　C.1 [Advance preparation of Study of GIS Data Application]

The C.1 [Study of GIS Data Application] overlapped the target organizations and that of the study of existing data for GIS Standardization activities. Also, it was judged that the study period for which to send and retrieve questionnaires and make visits was short, planning to send questions in advance of the actual field study and produce the questionnaire together with that of the B.1 Survey of GIS Development and Provision. A draft was drawn up by the Japanese expert, and as the start of activities approached, the C/P checked and added to it. The points that were taken into consideration when making the questionnaire are written below. The questionnaire was sent primarily by e-mail in the early part of December 2006. The questionnaires that were produced are shown in Diagram 2-35.

&. Available training on Geo-spatial-information in your organization
- Please answer the following questions.
- The questions are grouped into 2 parts, questions in case you (your organization) as a trainee or a trainer.
- Please modify the table as needed to fill in your answers thoroughly.

Gr.	No	Question	Description	Answer
As a Trainee	1	Training theme	Training topics you (your organization) needs (e.g. Basic GIS theory and operation, GIS application in agriculture / marketing / utility management, WebGIS, programming for GIS, GIS Database management, Open Source GIS software)	
	2	Number	Number of expected participants	
	3	Software	Specify software you want to use in the training (e.g. ArcView, ArcInfo, ArcIMS, ArcSDE, Spatial Analysis, 3D Analysis, topobase, GRASS)	
	4	Data	Specify any data format you want to adopt in the practical GIS training (e.g. ArcView Shape, ArcInfo Coverage, MapInfo Tab, DXF, DWG)	
	5	Cost	Acceptable cost for participation	
	6	Duration	Expected duration of a training course	
As a Trainer	7	Training theme	Training topics you (your organization) can teach as a trainer (e.g. Basic GIS theory and operation, GIS application in agriculture / marketing / utility management, WebGIS, programming for GIS, GIS Database management, Open Source GIS software)	
	8	Number	Number of available resource persons from your organization	
	9	Software	Specify any software you want to use in the practical GIS training (e.g. ArcView, ArcInfo, ArcIMS, ArcSDE, Spatial Analysis, 3D Analysis, MapInfo, GRASS)	
	10	Data	Specify any data format you want to adopt in the practical GIS training (e.g. ArcView Shape, ArcInfo Coverage, MapInfo Tab, DXF, DWG)	
	11	Fee	Acceptable gratuity fee for conducting a training	
	12	Duration	Acceptable duration of a training course	

Diagram 2-35: Study of GIS Data Application Questionnaire

（3）　Organizing the GIS Application Training C/P Team and formulating an activities plan for the GIS Application Training

Two C/Ps were assigned for the task of GIS Application Training (Ms. Polly Gitimu <Senoir Asst. Director-Mapping>, and Mr. Odhiambo. Joel K. Akumu <Land Surveyor>). The C/P assignments were made at the start of the project, and the kick-off meeting for GIS Application Training was held just before activities commenced. The aim of the kick-off meeting was the common understanding of the content of primary tasks, implementation period and objectives. The activities diagram is shown in Diagram 2-37. Evaluation of the personnel and their ability to conduct the activities was positive as both C/Ps are land surveyors by trade and had sufficient knowledge of the technical aspects of surveying, in addition to the right attitude for which to engage in external activities, thanks to their overseas study experiences.

Diagram 2-36: GIS Application Training Kick-off Meeting

GIS Training Team Activities Diagram

21-Feb-07

19-Feb-07	Mon	
20-Feb-07	Tue	
21-Feb-07	Wed	
22-Feb-07	Thu	
23-Feb-07	Fri	
24-Feb-07	Sat	
25-Feb-07	Sun	
26-Feb-07	Mon	
27-Feb-07	Tue	
28-Feb-07	Wed	
01-Mar-07	Thu	
02-Mar-07	Fri	
03-Mar-07	Sat	
04-Mar-07	Sun	
05-Mar-07	Mon	
06-Mar-07	Tue	
07-Mar-07	Wed	
08-Mar-07	Thu	
09-Mar-07	Fri	
10-Mar-07	Sat	
11-Mar-07	Sun	
12-Mar-07	Mon	
13-Mar-07	Tue	
14-Mar-07	Wed	

Activities already carried out

Prepared questionnaire 7

Distributing questionnaire 8

Collecting questionnaire 9

Output 3: Result of questionnaire 10

Draft idea of items of hearing 11

Hearing 12

Analysis of Study methods

Documentation overall activities 1

Team meeting 1: Kick off meeting 2

Team meeting 2: Re-Grasp points on the study3

Team meeting 3: Re-consider items of study 5

Output 1: Strategic points on the study 4

Output 2: Items of study 6

Template of Comparison between point and result 14

Comparison between points and results 15

Output 5: Comparison between points and results 16

Template of Analysis of methods for the study 17

Team meeting 3: Review study methods

Team meeting 4: Problems and user needs 18

Output 4: Result of hearing 13

Output 6: Analysis of methods for the study 19

Team meeting 4: Problems and user needs 20

Analyzing problems and user needs in detail 22

Template of Outline of Analyzing problems and user needs in detail 21

Output 7: Documentation analysis of study 23

Plan draft training course 24

Template of Outline of training course 25

Team meeting 5: Plan training course

Output 8: Outline of training course 27

Plan actual course schedule 28

Confirmation to the related organizations 29

Documentation a want ad. 30

Output 9: Advertisement 31

Call for Participation 32

※Team meetings aim matters to discussion, others aim shareable work.
※Compile Output 1-9to be complete report.

Diagram 2-37: Plan of Activities for GIS Application Study

（4）　C.1 [Study of GIS data applications]

1）　Study Purpose

When setting up and running the GIS training program at SOK, the study aimed to understand the conditions of current training courses and the needs of trainees. The following points were also considered during the study:

- Two points were considered when planning the training; the needs of the trainees and the necessary resources that could be provided.

- Consideration of the partnership with University of Nairobi, "training, curriculum, research and dissemination" as they are the institution responsible for the Education WG. of NSDI

- Make use of the basic information from the survey results of B.1 Survey of GIS Development and Provision.

- A questionnaire was prepared and sent to the target organizations prior to the main activities. Any insufficiencies in the questionnaire in terms of the study objective were covered in the interviews, and also to bear this in mind to improve future study methods.

2）　Study Key Points

Preceding the execution of the main study activities in the field, such as the interview study, we examined the main points of the study with the C/P for what information should be gathered and what items should be analyzed. The results are summarized below:

- What is at the root of obstacles to introduce new GIS? (for potential users)
- What field(s) of application are in demand? (for existing users)
- What know-how is essential for its utilization? (for existing users)
- What are the essential technical issues and know-how priorities?
- What are user interests and concerns?

3）　Study items

Based on the points of the study, we examined the items that should be included in the questionnaire and interviews. Because the questionnaire was sent out preceeding the start of the field study, here we made additions to the study during the interviews for any questionnaire items that were unsatisfactory. This is summarized below.

- Information about both the trainees and those who would provide resources for the training.

- What training they would like to receive (for those receiving training)

- The number of staff who wish to participate (for those receiving training)
- Preferred software (for those receiving training)
- The desired participation cost and period (for those receiving training)
- A theme that can be implemented in the training (for resource providers)
- Number of lecturers to be sent (for resource providers)
- Software that can be used (for resource providers)
- Required fees (for resource providers)
- Length of current training courses (for resource providers)

Also, the areas on the questionnaire that required more information are listed below. During the interviews, key information about these points, and questions about possible resource allocations, was collected.

- Concerns about GIS as an individual or organization.
- Applicable fields related to tasks where GIS could be applied.
- What are the obstacles to introducing or expanding GIS?
- What are the priorities concerning GIS usage (human resources, equipment, budget, data)

4) Selecting Targeted Organizations for the Study

The selection of targeted organizations targeted for the study were divided into two groups of those to whom questionnaires were distributed and those with whom we conducted interviews, and then examined to select a study organization.

As in B.1, the questionnaire would be sent to 41 organizations. In order to gather a wide range of various data, a large selection was made of those organizations we were able to contact from the participants list of the KNSDI Workshop, the AICAD short-term expert report for facility applications, as well as the report of existing study data from Professor Mulaku of University of Nairobi (UON).

Meanwhile, 10 target organizations to be interviewed were selected that are implementing some sort of training program and had existing GIS users. We planned to collect detailed, concrete information related to the possibility of resource provision and any relevant conditions.

5) Results of the questionnaire survey

After collecting the questionnaires, the answers were separated and compiled into a table, shown in Table 2-4

Table 2-4: Collective results of study on the application of GIS data

Training Needs		
Training theme	None	ICRAF
	Programming for GIS, Database Management, Open source GIS software, Web GIS	SOK (GIS)
	Basic GIS Application in Environment, Data management	NEMA
	Basic GIS for data manipulation to prepare Navigational maps and Charts	KCAA
	RSc and MSc	KPLC
	CAD, Basic GIS theory & operation, GIS application in utility management, GIS application in marketing	Nrb Water
	Basic GIS theory & operation, GIS application in marketing, GIS application in utility management, Database Management, Open source GIS software, Web GIS	NHC
	Web GIS, Programming for GIS, Open source GIS software	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Number	N/A	ICRAF
	10	SOK (GIS)
	2	NEMA
	10	KCAA
	4	KPLC
	20	Nrb Water
	5	NHC
	15	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Software	N/A	ICRAF
	ArcGIS ver9.2 (12 Licenses), ArcSHE	SOK (GIS)
	ArcView and 3D	NEMA
	ArcView, Mapinfo, Microstation	KCAA
	ArcGIS and gTerrasint, ArcView, ArcInfo, ILWIS, IDRISI	KPLC
	AutoCAD, ArcGIS, Terrosia, Oracle, IBMS, ArcView	Nrb Water
	ArcView and 3D Spatial Analyst	NHC
	ArcIMS, ArcGIS	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Data	N/A	ICRAF
	Shape files, Mapinfo Tables	SOK (GIS)
	ArcView	NEMA

	Mapinfo Tab, JPEG, Other Data based formats	KCAA
	N/A	KPLC
	DXF, DWG, Shape ttr Arcview, ArcInfo coverage	Nrb Water
	ArcView shape	NHC
	ArcView shape	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Cost	N/A	ICRAF
	varies	SOK (GIS)
	US$1000	NEMA
	Should be as per existing market rates	KCAA
	N/A	KPLC
	KSh. 000	Nrb Water
	KSh. 40000	NHC
	Minimal	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Duration	N/A	ICRAF
	varies	SOK (GIS)
	4 Weeks	NEMA
	2-4 Weeks	KCAA
	N/A	KPLC
	3 months (part time)	Nrb Water
	2months on rotational basis	NHC
	At least one week	ILRI
	N/A	FAO (UN)
	N/A	Oskar Services
Capacity as a centre		
Training theme	GIS application in Agroforestry, Agriculture, Forestry and environment	ICRAF
	N/A	SOK (GIS)
	None	NEMA
	Digital cartography (for map/chart preparation ICAO Standards), Conventional Cartography	KCAA
	N/A	KPLC
	N/A	Nrb Water
	N/A	NHC
	Basic GIS theory & operation, GIS application	ILRI

	Land cover classification System/ African Land cover mapping methods Geovis	FAO (UN)
	Basic GIS theory & operation, Advanced GIS Theory, Spatial analysis, model building, Geoprocessing, Scripting, Building database, mobile GIS, Server GIS, Web mapping, programming for GIS, database management	Oskar Services
Number of resource persons	2	ICRAF
	N/A	SOK (GIS)
	None	NEMA
	2	KCAA
	N/A	KPLC
	N/A	Nrb Water
	N/A	NHC
	13	ILRI
	10	FAO (UN)
	8 (of which 4 are ESRI Authorised Instructors)	Oskar Services
Software	ArcGIS, Spatial Analyst, 3D Analyst and Image Analyst	ICRAF
	N/A	SOK (GIS)
	N/A	NEMA
	Microstation, Mapinfo, ARINC A424	KCAA
	N/A	KPLC
	N/A	Nrb Water
	N/A	NHC
	ArcView, ArcGIS	ILRI
	Geovis, LCCS	FAO (UN)
	ArcGIS (ArcView, ArcInfo & ArcEditor), ArcIMS, ArcPad, ArcGIS Server, ArcGIS Spatial Analyst, ArcGIS 3D analyst, ArcGIS Network analyst	Oskar Services
Data	Arc Info coverage, shapefile, other relevant Image based formats	ICRAF
	N/A	SOK (GIS)
	N/A	NEMA
	N/A	KCAA
	N/A	KPLC
	N/A	Nrb Water
	ArcView Shape	NHC
	Shapefile	ILRI
	Shapefile	FAO (UN)
	ArcView Shapefile, ArcInfo coverage, ArcGIS Geodatabase file format, CAD DXF &DWG	Oskar Services

Fee	USD 50 per person per day for one week GIS application	ICRAF
	N/A	SOK (GIS)
	N/A	NEMA
	KSh. 66000	KCAA
	N/A	KPLC
	N/A	Nrb Water
	N/A	NHC
	US$50	ILRI
	N/A we require full cost coverage and an official request from the requesting agency	FAO (UN)
	Each course US$ 450 -US$750 per person, a large class gets 30% discount	Oskar Services
Duration	Timeweeks to already have basic GIS theory and operation	ICRAF
	N/A	SOK (GIS)
	N/A	NEMA
	6 weeks	KCAA
	N/A	KPLC
	N/A	Nrb Water
	N/A	NHC
	At least one week	ILRI
	1-2 Weeks	FAO (UN)
	3-5 full days	Oskar Services

A summary of the survey results for trainees is shown below:

- They possess the minimum software and equipment requirements, yet many do not use them effectively.
- There is constant demand for basic GIS training.
- There is no apparent demand for constructing WebGIS and programming in comparitively highly technical areas.
- There is high demand for usage of GIS in applicable areas directly tied to an organization's activities, however there is a lack of necessary technology or information, so there is potential demand for training.
- Many organizations use ArcGIS or ArcView (ESRI), so there is little problem to exchange data between organizations.
- In organizations where full-scale use of GIS has not been implemented, there has not been a rational plan for the development of personel or equipment needs, (due to the lack of formulating a systematic and substantial usage of GIS).
- The majority of training participation is carried out with the support of donor organizations. Also, because of this, the training periods are relatively long, one-month events.

In addition, the following is a summary of survey results from a study of those potential providors of training resources.

- Both public and internal training sessions are held frequently at a number of organizations.
- Basic training for ArcGIS or ArcView (ESRI), for example, spatial analysis techniques or data modeling, is common.
- Training for public institutions is tailor-made, yet rarely held on a periodic basis. (excluding KISM/the University of Nairobi)

6） Results of interview survey

The interview survey was carried out for eight of the planned 10 organizations. The results of the interview survey are summarized below(Table 2-5).

Table 2-5: Summary of Interview Survey Results

Org. Name	Summary of Interview Results
ICRAF (International Centre for Research in Agro forestry)	In cooperation with ILRI (International Livestock Research Institute), they conduct training related to the field of GIS data development. They are able to provide a variety of custom-made training for ArcGIS. ILRI is replete with facilities equipment and capable of providing training for upwards of 20 people at a time.
CBS (Central Bureau of Statistics)	CBS primarily digitizes topographic maps, and also performs analysis of a variety of statistical information in the form of thematic information. Their collection of basic information, such as topographic maps, is a problem. There are 15 GIS engineers. According to their response, they would have difficulty providing personel due to their busy season.
NCC (Nairobi City Council Physical Planning)	They participated in a technical transfer as a C/P under the previous JICA project (2002-2003), where they benefited in GIS fundamentals and GIS related to city planning. Since then, there has been little progress in GIS usage, and it would be difficult for them to provide resources.
UON (Department of Surveying, University of Nairobi)	Capable of general training for ArcGIS, IDRIZI, ILVIS, and ERDAS, and able to provide 3 lecturers and 2 assistants. The usage of equipment and facilities would be somewhat limited from September due to the new school year.
RCMRD (Regional Centre for Mapping of Resources for Development)	They implement GIS training and application most positively and all-inclusively. They are well-versed in ArcGIS and ERDAS training. They have no training experience related to WebGIS, programing, or open source. They have ample equipment and facilities, and are able to accommodate about 40 individuals at a time.
MoL (Ministry of Lands, Physical Planning)	We surveyed their Physical Planning GIS Lab. The facilities are small and not conducive to use for training. One staff member is knowledgeable with city planning GIS, and we have confirmed the possibility of him serving as the lecturer for a course in that field.
KLPC (Kenya Power and Lightning Company)	Under the management of a Spanish company, they have constructed an independent database of electrical transmission and supply lines. They have built a system to access data via an internet environment and continually update data with RDB, and are seen to have a high level of technical expertise. Due to the proprietial nature of the software, however, it would be difficult to use it as is. A course on facility systems in the applied area of GIS is feasible.
KISM (Kenya Institute of Survey and Mapping)	They regularly offer an ArcGIS subject, and there are 9 lecturers. Also, in the lab, they have 8 ArcGIS units. It is feasible to use their lab and lecturers to provide basic ArcGIS training. Without an internet environment, their lecturers have few opportunities to deal

| | with open-source information so that they are slightly estranged with technical trends. |

7）   Analysis of survey methods

In this study, we were able to analyse not only the results but also the methodology. We have clarified any problems or points for improvements related to the methods of this study with the aim of applying lessons learned to any future studies of a similar nature. The areas where problems were identified are raised below. Also, an analysis of the results has been prepared in a report.

- When comparing the results from the questionnaire with those from the interviews, ascertaining the accurate information was difficult.
- There were cases where the contact person at an organization selected at for the interview was inaccurate, and the answers were inadequate.
- There were a large number of cases where the scope of the question was too broad, resulting in imprecise answers or no answer at all.
- There was little prior information on the target organizations, so the necessity to confirm the role of the organizations during the interviews was inefficient.
- Most of the returned questionnaire lacked replies related to cost.

Therefore, the following items given are improvement plan techniques to be used as reference material in the future.

- Increase the proportion of interviews conducted.
- Be thorough with e-mail to the reception office and multiple contact persons at each organization.
- Establish a preliminary research stage to grasp basic understanding of organizations via their internet web pages wherever possible.
- Revise the questionnaire (without increasing the overall number of questions) to include specifics with yes-no questions or easily answerable questions.
- At the conclusion of training, distribute the questionnaires and conduct follow-up surveys to understand time series variation.
- It is better not to individualize questions asking for information pertaining to cost. This item should be discussed at the point in time when resources are offered on the basis of an objective, third-party view.

8）   Issues and training needs

We publicized the final report of the survey results in the project newsletter. In this part, listed below are the issues and training needs for the application of GIS that were

clarified through analysis of the survey results.

The following items presented are in reference to issues and training needs of potential users.

- Purchase and upkeep of costly software licesnes

    A large number of organizations have not fully implemented GIS into their work or expanded GIS usage due to the inability to purchsae costly software or for reasons of maintenance. Despite this situation, there is hardly any utilization of nor expectation voiced for open source software.

    Should information and training pertaining to open source software be provided, it would be possible to construct thematic information and conduct basic analysis for GIS irregardless of an organization's scope and size or GIS budget allocation.

- Data problems

    We are uncertain how to commence work applications in the absence of usable data. If it is possible to provide data that can be used free of charge, it is possible to conduct macro analysis which targets the national land area of Kenya immediately.

    Training for acquisition methods of various spatial data and image data that can be downloaded from the internet would be extremely useful, but there has been no systematic protocol for this up to the present.

Also, the following items presented are in reference to issues and training needs of existing users.

- Full-fledged usage of GIS in applicable fields of work has not progressed. For this, it seems effective to share successful cases of organizations that have utilized GIS on a full-scale in their operations.
- There is hardly any drive toward data sharing via WebGIS or a clearinghouse. While, technically speaking, it is not very difficult, the fact that there are few pioneers in the domain means that no one has jump-started the efforts. Hands-on training will be essential.
- Programming skills for constructing facilities management GIS are insufficient. Since there is no training for GIS programing, it will be necessary to have a systematic learning course.

9） Content of training course

A draft of the content for the GIS training course, based on the survey reports, was

formulated taking into consideration the points the follow.

- Selecting topics where it is possible to define the course achievement objectives.
- Adopting course content that can be related to project activities, (digital map database, standardization of geographical information, clearinghouse, disclosure of Nairobi sample maps on the Web, etc.).
- There are a number of constraints, such being unable to arrange for a lecturer despite needs, however, as there is a buffer period of about six months until training planned for October 2007, it is feasible for SOK itself to cultivate lecturers for new training fields.

The draft schedules for one-week training for potential users in Table 2-6 and existing users in Table 2-7 are as follows.

Table 2-6: One-week training for potential users

Course Title		GIS Training course with free Software and Data for immediate use
Day	Subject	Description
1	Open source GIS	Introductory lecture on GIS, introduction to Quantum GIS
2	Quantum GIS Data capture	Fundamentals of handling various data
3	Quantum GIS Advanced Techniques	Hands-on training for complex functions of Quantum GIS
4	Free data utilization	Lecture on a variety of cost-free spatial data and hands-on training
5	GIS utilization	Lecture on the utilization of GIS in applied fields

Table 2-7: One-Week training for existing users

Course Title		GIS Training for optimal utilization of GIS software
Day	Subject	Description
1	Arc GIS Extensions	Hands-on training by ArcGIS Spatial analyst, and 3D analyst
2	Open Source GIS / Free Data Utilization	Hands-on training to introduce Quantum GIS, and ILWIS, as well as a lecture on cost-free spatial data
3	Data Sharing	Lecture on standardization, and the spatial reference system
4	GIS applications	Lecture on facilities, environmental assessment, marketing, and census applications for GIS
5	Databases techniques for GIS	Hands-on training to use the GIS database with an ODBC connection

10） Formulating the implementation schedule

We will establish the initial stages of the training and reserve facility usage and hosting the lecturers. Below is the implementation schedule as anticipated.

- Participants: 20 people per course from the organizations in the GIS data application study
- Duration: 5 days
- Number of courses: Two courses for existing users, and two courses for potential users.

Table 2-8: Schedule for One-week training for potential users

Day	Subject	No. of particip ants	Training period	Lecturer commissioning organization	Location
1	Open source GIS	20	15th Oct 2007 22nd Oct 2007	KISM/SoK	KISM
2	Quantum GIS Data capture	20	16th Oct 2007 23rd Oct 2007	KISM/SoK	KISM
3	Quantum GIS Advanced Techniques	20	17th Oct 2007 24th Oct 2007	KISM/SoK	KISM
4	Free data utilization	20	18th Oct 2007 25th Oct 2007	KISM/SoK	KISM
5	GIS utilization	20	19th Oct 2007 26th Oct 2007	KISM/SoK	KISM

Table 2-9: Schedule for One-week training for existing users

Day	Subject	No. of particip ants	Training period	Lectuerer commissioning organization	Location
1	Arc GIS Extensions	20	29th Oct 2007 6th Nov 2007	RCMRD, UON	RCMRD
2	Open Source GIS / Free Data Utilization	20	30th Oct 2007 7th Nov 2007	KISM/SoK, KARI (Kenya Agricultural Research Institute)	RCMRD
3	Data Sharing	20	31st Oct 2007 8th Nov 2007	KISM/SoK	RCMRD
4	GIS applications	20	1st Nov 2007 9th Nov 2007	KPLC, ICRAF	RCMRD
5	Databases techniques for GIS	20	2nd Nov 2007 10th Nov 2007	RCMRD	RCMRD

11） Preparation for implementation of the training

Preparation was carried out for the implementation of the training. The items that

should be resolved and prepared when implementing training are listed below. Preparations were carried out from mid-March 2007.

- Lecturer commissioning: Make a request, including preparation of materials.
- Secure the classroom: At educational institutions, it will often overlap with the start of the new school term, so it is necessary to make reservations early.
- Secure equipment and materials: Check the number of PCs and software licenses.
- Create, distribute and publicize application information for training participants: Utilizing the SOK website and newsletter.

Also, the following points will be given consideration when making future plans.

- At the present moment it is not possible to finalize the training period for the course. However, we are able to make preliminary plans particularly on condition of the facility reservations and dispatch of lecturers. Based on those conditions, it may be necessary to modify the training period, location or lecturer.
- A great deal of preparation will be necessary to secure the equipment and space for the training due to the great number of stakeholders, such as lecturers and trainees that are involved. From this, a management table will be made to assist the process, and facilitate common understanding between the expert and the C/P supervising the training schedule and implementation to take sure-footed and timely actions.
- During periods where there is no expert for GIS Application Training on hand, continual preparatory work will be done by the C/P supervising the training schedule and implementation by cooperating with other experts or via e-mail exchange.

（5）　C.2 [Implementation of Training for GIS Users]
　1）　Overview

The training was planned and carried out based on the basic plan formulated in the first year.

Training was devised for both potential users and existing users, so that each group was provided with two courses, or four in total. Each course lasted five days, from Monday to Friday. The schedule was as follows:

- Potential Users' Training Course
      1st: 2007.10.15 Mon – 2007.10.19 Fri, 20 participants

      2nd: 2007.10.22 Mon – 2007.10.26 Fri, 20 participants

- Existing Users' Training Course

1st: 2007.10.29 Mon – 2007.11.2 Fri, 20 participants

2nd: 2007.11.5 Mon – 2007.11.9 Fri, 20 participants

SOK staff made preparations and executed the training course with assistance and advice by the JICA experts. The process for preparations and a review of comprehensive efforts after the training is given below.

GIS training carried out at SOK was planned with the aim of understanding the conditions of current training and the research needs of users, keeping in mind the desire to improve future survey methods.

2） Training preparations and the implementation process

The planning stage included decisions on the training schedule, curriculum, software (GIS), instructors, research location, recruitment and distribution of teaching materials. The process or result of each item is given.

- Schedule

    Each time, considerations were given to the schedule and how many people could be accommodated as well as instructors' schedules, and the two courses were held (four courses in total) as 5-day intensive training. The courses were deliberately scheduled to avoid any holidays.

    Preparations must be executed promptly as it affects the overall schedule. In this case, the schedule, curriculum and software to be used were decided first, and then plans were made together with instructors on arranging the meeting place and materials.

- Curriculum

    The potential users and existing users have various levels of knowledge in various fields, so the curriculum for either course starts with arranging the basic GIS know-how, then introducing more concrete materials (GIS software) before gradually moving into more applicable disciplines. Also, practical examples were provided, avoiding any one specific area of expertise by selecting general examples that may be applied to a number of fields. The curriculum (syllabus) for these courses is included as a separate output. When deciding on the curriculum, the items to be taught were included in detail after the primary decision of selecting the GIS software had been made.

- Software used

    The software employed for the training was the open source Quantum GIS. In recent years, there have been different software releases, but open source software

was selected to aid in the continuity of project activities, facilitating the use of GIS amongst participants and the organizations they represent, and effective achievement of project goals despite a limited budget. This software was adopted during the first year study, and may be downloaded from the homepage.

Although the trainees were instructed how to download the software, it was installed in all of the PCs prior to training to save time, and avoid any networking troubles, so Quantum GIS could be started immediately. The software was also distributed to participants on CD-R so they could easily use it after the training as well.

- Instructors

    The training instructors were experts in related fields invited from related organizations in Kenya, starting with SOK, as well as RCMRD, JKUAT, and so on. SOK staff played a central role when selecting instructors, and gave consideration to forming personal connections for future training activities. The instructors and their affiliation and field are given below (in order of appearance).

    Mr. Geofrey Gichuru/JKUAT, (both courses), Basic Concepts of GIS, GPS Exercises

    Ms. Lucy Cecilia Warugu Mburu/JKUAT, (both), Operating Quantum GIS

    Mr. Bernard Sharon Majani, (both), Operating Quantum GIS

    Mr. Mickie Maurice Omondi/KPLC, (both), Intro to GIS applied

    Mr. Samuel Ng'ang'a/RCMRD, (existing users), ArcGIS, Database management

    Mr. Charles M.K. Mwangi/SOK, (existing), Intro to ILWIS and operation

    Mr. Meshack Osindo Nyabenge/ECRAF, (existing), Intro to GIS applied

    Mr. Christopher Muturi Tatua/SOK, (existing), Comparative examination of GIS

    (cf. SOK managing staff: Mr. Joel Odhiambo Akumu, Mr. Joseph Mwaura Karanja)

    The instructors were selected once the schedule and curriculum was determined, and then the managing staff made preliminary contact. One week prior to the course, the materials to be used had been prepared (by the instructor), training program confirmed, and contracts made with the instructors, etc. The training course got off to a smooth start thanks to diligent efforts by SOK staff to contact the instructors beforehand and their faithful cooperation.

- Location of training

    The location for the training was decided taking into consideration a number of

factors, such as the schedule, capacity for participants in the lecture rooms, ability to use calculators, transportation service, food/refreshment service, the safety of the area and overall cost, and ultimately settled on AICAD near JKUAT. The facility for AICAD (African Institute for Capacity Development) offered a number of provisions, as described below.

Diagram 2-38: A lab at AICAD and the building itself

➢ Possible to use the facility continuously throughout the entire day.
➢ Seating in the lecture room for a maximum of 32 participants.
➢ A desktop PC at each seat with connection to shared server and Internet.
➢ Shuttle service with capacity for 30 offered both morning and evening (fee-based)
➢ Lunch service and refreshments mid-morning and afternoon (fee-based)
➢ Located on the northeast outskirts of Nairobi, facing Thika Road, along which SOK is also located. Excellent surroundings, located within the grounds of JKUAT (Jomo Kenyatta University for Agriculture and Technology).
➢ Usage fee commiserate with the initially budgeted funds.

Once AICAD had been selected, the facility was examined more closely to check the condition of the classroom. This was to confirm the number of PCs, connectivity to the server and Internet, and use of the projector, etc. At that time, the GIS software was also installed on the PCs. It was apparent that there would be no problems holding the training at this location.

The lunch and refreshment service was organized, along with the shuttle service. The bus would depart from a prescribed location in Nairobi at 7:10am each day and the return leg would depart AICAD at 5:00pm. The bus' 30-person capacity ensured that all of the participants, including lecturers, could be accommodated in one trip.

- Recruitment

    Organizations that were visited during the first year survey were directly informed about the training, as well as placing an ad in the Daily Nation newspaper one month before to advertise the event. SOK itself created and arranged the ad to be placed. The training was also announced on the KNSDI Website and SDI Africa Newsletter.

- Teaching materials

    The lecturers prepared their own materials (mainly using PowerPoint). Nevertheless, SOK was in charge of installing the GIS software—Quantum GIS—and preparing the take-home program on CD-R.

- Distributed materials

    For all of the seminars thus far, the following materials were distributed to participants on the first day of the meeting:

    ➢ CD-R loaded with Quantum GIS software
    ➢ CD-RW to be loaded with the PPT materials used in the seminar (data added on the last day)
    ➢ Quantum GIS manual (printed and bound)
    ➢ Set of writing utensils (pencil, eraser, ball-point pen, legal pad)
    ➢ Special folder (to store writing utensils)
    ➢ Shoulder bag (imprinted with name of seminar, used to store above materials)

- Participant questionnaire

    In order to obtain evaluation on the seminar, all participants were given a questionnaire. This was distributed the morning of the last day (Friday), and they were asked to return it by the end of the afternoon. The format of the questionnaire was based on that used in Japan, including the lecture content, schedule, distributed materials, services, and so on. This feedback will serve as important data for future training.

    The questionnaire was returned by 80% of the 80 participants, providing valuable data to be analyzed and used for future seminars.

- Issuance of Course Certificate

    At the end of each course, each participant with qualifying attendance was issued a course certificate signed by SOK and JICA.

Diagram 2-39 ： Participants from the Potential and Existing Users' Courses

3） Post-Seminar overview

After the four weeks of the seminars were completed, a review of the preparation stage and conditions during implementation were carried out, as well as an overview of the training seminar based on the questionnaire replies (see results summarized as attached). As a result, this will become reference information for future seminars. Also, a report on the seminar was given by SOK in the KNSDI Newsletter.

- Promotion

    To recruit participants, advertisements were put in general publications and on the website, but the insert in the Daily Nation paper produced the largest impact. A number of applicants, mostly potential users, responded to the Daily Nation ad. This made it apparent the value of placing an ad in a general publication, not only to popularize use of GIS in multiple fields, but also to arouse the interest of potential demand. To most applicants, this type of opportunity was practically unheard of, as there are few training seminars of the sort in this region.

    For existing users, most of them applied upon seeing advertisement via the KNSDI Website, SDI Africa Newsletter, or at the KNSDI Seminar. This showed the effectiveness of advertisement through related organizations.

- Training period

    Participants indicated an overall favorable response concerning the content of the training, although a large number of them indicated the desire for a longer seminar. Concrete proposals were offered, such as two weeks, rather than one (5 days). This showed that, on the whole, participants were satisfied with the content of the seminar, but reveals the need to more closely review an appropriate length for the seminar, including fees, lecturers and facility provisions. Also, many respondents indicated that April and August were ideal times to hold the training.

- Using open source GIS

    A significant aspect of the training was the use of open source GIS. This was highly evaluated by many of the participants. Open source software is becoming more common in recent years, and friendly competition seems to have improved the quality, with functions that prove to be highly satisfactory. At the same time, it is hoped that this software continues to be improved and updated. Amongst existing users, their ability to compare between this and propriety software, such as ArcGIS, has prompted them to point out some incompatible functions. Even so, on the whole, there is higher value in using the free software. These participants have potential to be pioneers in spreading the use of open source GIS in Kenya.

- Content of the training

    There were many who voiced their desire to see more importance placed on practical training using actual samples and case studies, rather than lectures on theory. This is in line with a trend often expressed by participants of such training seminars, and upon reflection, there was not strict coordination of the lecturers' roles, and each of them started their lecture explaining the fundamentals of GIS. As a result, a large portion of the training involved basic theory. As such, this is an issue of clarifying the role of each lecturer in more detail. Using this experience, a more detailed syllabus was produced which can be used to plan in the future and will likely assist in making significant improvements.

- Distributed materials and training venue

    The distributed materials, training venue, participation fee, services (such as shuttle service) and so on were all highly evaluated. Among the feedback received, there was a common request that the data used in the lectures (e.g. PowerPoint) be distributed before the seminar. Given the effect this has on the readiness of lecturers as well as the attitude of participants, it no doubt requires close examination. Also, it is essential to set the participation fee low to widely attract potential users, so it is vital to continue to examine facility usage, training period, preparation and so on.

- Training course

    This round of training catered equally to both potential and existing users, but in fact application was overwhelmingly greater for the potential users' course. For future courses, consideration should be given to spreading GIS to a wider range of potential users, presenting higher level skills to existing users, or both. It will be necessary to have a clear vision when continuing with these activities and balance the needs of these two groups as well as those of Kenya overall.

2.4.4   Examination of Metadata Specifications/ Network Management

（1）   C.3 [Examination of Metadata Specifications]

  1）   Examination of metadata specifications (draft)

In this project, to prepare for the construction of a clearinghouse, the metadata specifications that will act as the foundation were examined. The metadata of every country is composed of a selection of approximately 50 core metadata items and conditional factors, based on the international standards of ISO19115 (Geographic Information - Metadata), (Diagram 2-40).

ISO19115
Comprehensive Metadata
(about 400 items)

JMP2.0
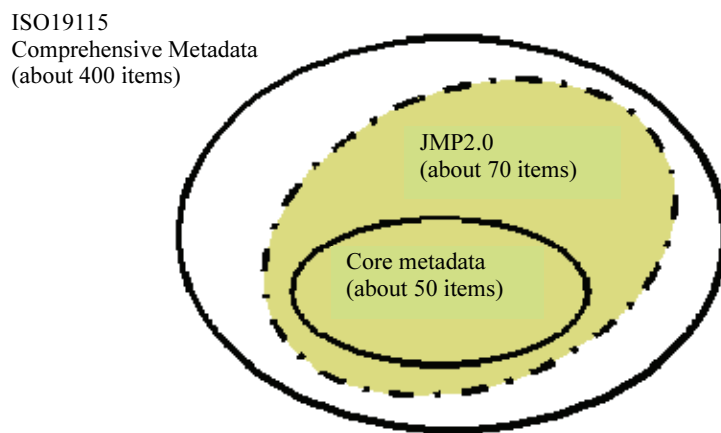(about 70 items)

Core metadata
(about 50 items)

Diagram 2-40: Core metadata

Also, in Kenya, KSISO19115 has been prepared based on ISO19115. Accordingly, to construct the clearinghouse for this project, we had to at least cover the international standard core metadata (approx. 50 items). Furthermore, in this project, we planned to prepare the metadata on ISO criteria, basically using the ArcCatalogue metadata editor that is the application in the ArcGIS product, and then construct the clearinghouse using ArcIMS. Consequently, the metadata specifications generated with ArcCatalogue was examined in comparisson with ISO criteria and using and XML file, carried out with the counterpart. (Diagram 2-41).

Diagram 2-41: Comparison of metadata generated with ArcCatalogue and ISO criteria

Furthermore, a comparisson chart was made in order to find any redundant XML file tags constructed by both parties (Diagram 2-42).

COMPARISON OF METADATA TAG-NAMES AS USED IN JMP20 AND ARC CATALOG METADATA PROFILES

NO.	JMP20	ArcCatalog
1.	`<title>xxxx</title>`	`<title Sync="TRUE">37-EG-78-1ADMIN-VER11</title>`

2.	`<date>2002-12-01</date>`	`<CreaDate>20070130</CreaDate>`
		`<CreaTime>10361300</CreaTime>`
		`<SyncDate>20070306</SyncDate>`
		`<SyncTime>09582000</SyncTime>`
		`<ModDate>20070306</ModDate>`
		`<ModTime>09582000</ModTime>`
		`<pubdate>March 2005</pubdate>`
		`<begdate>February 2003.</begdate>`
		`<endtime>November 2003</endtime>`

3.	`<dateType>002</dateType>`	None
4.	`<organisationName>xxxx</organisationName>`	`<cntorg>Survey of Kenya</cntorg>`
5.	`<voice>029-864-1111</voice>`	`<cntvoice>0208566020</cntvoice>`
6.	`<facsimile>xxxx</facsimile>`	`<cntfax>0208566020</cntfax>`
7.	`<deliveryPoint>xxxx</deliveryPoint>`	None
8.	`<city>xxxx</city>`	`<city>REQUIRED: The city of the address.</city>`
9.	`<administrativeArea>xxxx</administrativeArea>`	`<state>REQUIRED: The state or province of the address.</state>`
10.	`<postalCode>305-0811</postalCode>`	`<postal>REQUIRED: The ZIP or other postal code of the address.</postal>`
11.	`<country>jpn</country>`	None
12.	`<electronicMailAddress>vector@gsi.go.jp</electronicMailAddress>`	`<cntemail>sok@gt.go.ke</cntemail>`
13.	`<linkage>http://www.gsi.go.jp/GSI/CONTACT/metadatahtml</linkage>`	`<linkage Sync="TRUE">file://\\NGOMO\D$\metadata and network\37-eg-78-1\37-EG-78-1ADMIN-VER11.dxf</linkage>`

Diagram 2-42: Comparisson of ArcCatalogue & JMP2.0 XML file

As can be seen in the table, the tag names differ for JMP2.0 XML files (ISO19115 standard) and those for ArcCatalog, and it also becomes obvious that ArcCatalogue contains tags that are not applicable to JMP2.0. From this point, we planned to examine the tag name conversion method and adding to or editing tag names to comply with ISO19115, to decide final metadata specifications.

2） Metadata maintained by other organizations

RCMRD is an international organization that conducts research, development, and training pertaining to GIS and remote sensing. They also operate a commercial clearinghouse developed by OSS (see image below, www.rcmrd.org/geonetwork/). The information registered on this clearinghouse is mostly thematic maps with hardly any information pertaining to topographic maps. Consequently, in the future, development of metadata pertaining to topographic maps for the clearinghouse at SOK would be ideal so as to avoid any overlap with that of RCMRD.
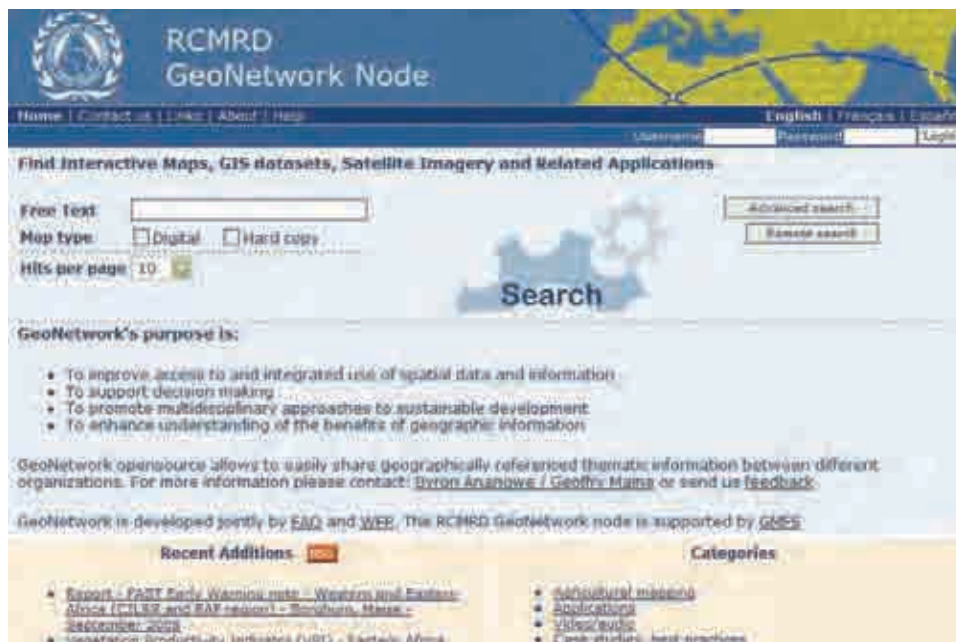

Diagram 2-43: RCMRD clearinghouse

（2） C.3 [Network Management (Information and Communication System Infrastructure Development and Management)]

The development of an infrastructure for an information and communication technology system (hereafter, ICT system) required to acomplish KNSDI was carried out with counterparts, Mr. Henry Ngomo and Mr. John Mwairo. However, it is not realistic to develop every object of the ICT infrastructure seperately, such as the network, server, and client machines, so that without limiting the object of activity with the network, the ICT infrastructure was developed as a whole. After building the ICT infrastructure, we will continually implement improvements and operation management. Moreover, the organization of developing and managing the ICT infrastructure is tied in to activities in other fields, (see "1. Organizational Alignment of ICT Infrastructure Development" below), so that the tasks are carried out in close connection with Mr. Peter Gota, Mr. Christopher Muturi and Ms. Betty Mulianga.

1） Organizational Alignment of ICT Infrastructure Development

The construction of KNSDI requires 3 component elements:

Establishing policy and a legal framework for spatial data preparation and dissemination,

Development of ICT infrastructure for spatial data preparation and dissemination,

Preparation of spatial data content (metadata and digital maps).

The component elements of each are described below.

- Establishing policy and a legal framework for spatial data preparation and dissemination

    Concerning the dissemination of spatial data to users, it should be to establish policies and standards, and a legal framework if necessary, for provision methods and content. Precisely, the things to be examined and regulated would be, to give some examples, the type of information (of the spatial data maintained by SOK), how (the policies and methods to manage the means to distribute spatial data, the authorship rights, publishing rights), and what users will be targeted when distributing data.

- Development of ICT infrastructure for spatial data preparation and dissemination

    The management of the clearinghouse and data processing, information communication techniques will be planned, introduced and managed.

- Preparation of spatial data content (metadata and digital maps）

    The spatial data content (metadata and digital maps) that would be stored via the clearinghouse and availability to users will be prepared.

The following achievements were made which apply to "development of an ICT infrastructure for the processing and dissemination of spatial data":

- Design and operation of the servers
- Design and operation of the network systems (LAN/WAN)
- Integration of client and printer settings into the system

From the viewpoint of "Establishing policy and a legal framework for spatial data preparation and dissemination", the items below will need to be considered to move forward with activities.

- Information communication system standards

    Carry out operation management, securing resources, and designing the project ICT infrastructure while making adjustments with relevant organizations according to the ICT standard of higher institutions such as the national government and the Ministry of Land.

- Spatial data management policy

    Examine the specifications and operation management of the ICT infrastructure while ensuring compliance with the dissemination method and spatial data content offered to users according to policy (i.e. legal framework).

- Uniform criteria for spatial data

    The specifications for spatial data content (metadata and digital maps) handled by the ICT infrastructure developed and operated in this project, will be checked for compliance with the uniform standard spatial data of Kenya.

    Also, looking at the component elements of "preparing spatial data content (metadata and digital maps)", it is necessary to develop and operate the ICT infrastructure while keeping in mind the demands put forth by the users of the ICT system for preparing spatial data content.

    The above discussion on the components to develop an ICT infrastructure from the overall viewpoint to construct KNSDI, along with related items of concern, is summariezed below in Diagram 2-44.
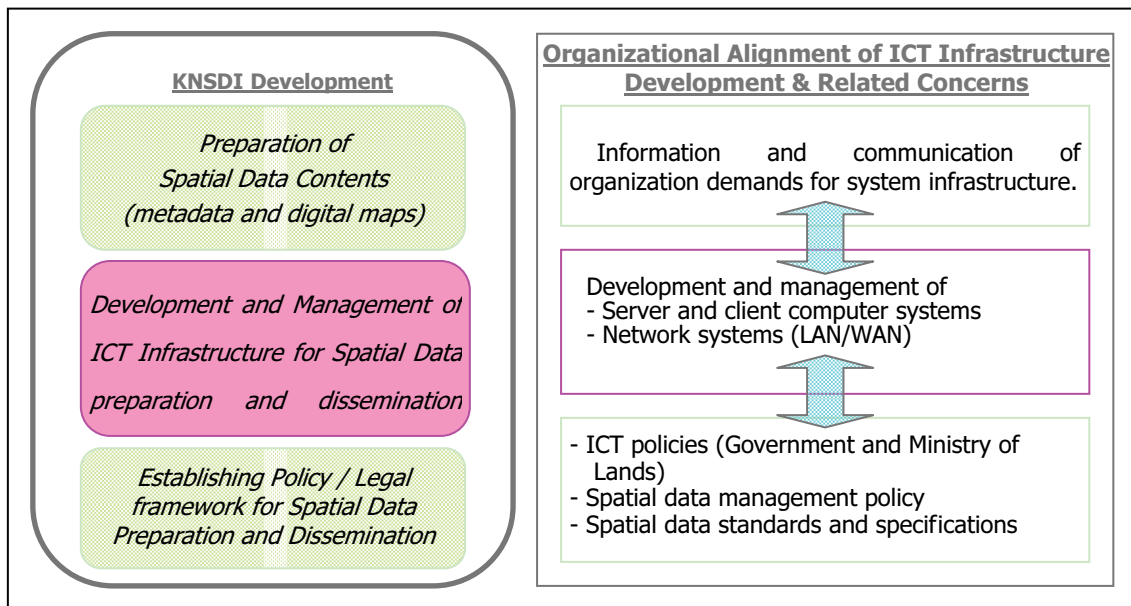
Diagram 2-44: Organizational Alignment of ICT infrastructure development & related concerns

2） Developing the ICT infrastructure

The server, network system (LAN/WAN), client and printer setup was integrated into the system as the counterpart was given technical instruction. When this activity was carried out, ample time was given so that, in addition to explaining essential application tasks and information communication techniques, the counterpart themselves completed the operations. It is also necessary to understand the technically advanced details of developing the ICT system. As a supplement, these fundamentals were explained as well.

Prior to developing the ICT infrastructure, we gathered information and held discussions with relevant organizations to help examine and design a realistic formula. For this aspect, importance was put on the main activities of the counterparts as much as possible so that they would be able to continuously engage in this activity.

- a. Gather Information

Disseminating information through the internet will be achieved by selecting an internet connection service (i.e. line service) that can be used. The internet connection services (or line services) that are offered vary depending on the country, so we investigated what was available in Kenya. An interview with AICAD and RCMRD, who both distribute information over the internet, was conducted to assess the situation there (particularly the Internet connectivity environment, and how they transmit large volumes of data). As the result of these interviews, we also came to the realization that Access Kenya, a dominant ISP (internet service provider) with a high

number of clients, would be a highly possible option when SOK comes to require a connection for the Internet and operation of it's own independent server. We visited Access Kenya and discussed with them their offerings for internet connection services (and line service), as well as server housing service.

- b. Discussion and alignment with relevant organizations

     The ICT system that will be developed for this project should be designed in accordance with the system standards of the Kenyan government and the Ministry of Land. As mentioned above, information was gathered previously when it became apparent that SOK would need to operate its own server and internet connection. This would minimize the impact on the schedule for project objectives when the discussion and alignment with relevant organizations is prolonged.

     As is conventional procedure, we investigated the ICT standards and holding discussions with those relevant organizations in order to examine and design a realistic method for ICT infrastructure. According to results of discussions with the Ministry of Lands ICT department and the Treasury ICT department, which manages the system for the national government, we appropriate server resources (disk space) to disclose Web content and the knsdi.go.ke domain name for the project. Mr. Peter Gota led the discussion and arrangements with relevant organizations, with advisory from the project expert.

- c. Building a server

     The following functions were allocated for each of the three servers (materials supplied by JICA) in the design and construction. The OS (operating system) was not preinstalled on any of the servers, so the OS was installed and configured. All of the servers were set up with the Windows2003Server OS. Each server is explained below.

     Web server: Spatial data is transmitted out as demanded by http service. They were set up using open software, Apache, Java and Tomcat as middleware.

     GIS server: Automatically generates data according to distribution formats based on spatial data and their storage management. The OS was installed and configured. Also, the ArcGIS Server was installed and configured, and licenses managed for ArcGIS clients. From here, we will introduce Oracle, ArcIMS, ArcSDE and construct the GIS server.

     Operation management server: This server acts for the administration of user accounts, the domain and DNS (domain name server), and printer server. These actions were designed and realized by setting up the designs in the OS,

Windows2003Server.

- d. Building a Network System (LAN/WAN)

    A network system (LAN/WAN）was designed and built. In detail, the following was accomplished:

    ➢ Network segmentation design
    ➢ IP address assignment
    ➢ Domain design
    ➢ Network equipment configuration and physical connection design
    ➢ Network equipment setup
    ➢ Network equipment placement and wiring, and connection to host

    The network equipment which was established and set up is made up of 2 routers and 4 switching hubs (equipment supplied by JICA) as well as the ADSL router.

    The conventional structure is to set up the network system, a component of the ICT infrastructure, according to the network architechture and network policy of higher institutions such as the Kenyan national government and the Ministry of Land. However, due to schedule constraints for project activities, an independent network system was to be developed and configured within the scope of the project system, and in the future when it is connected to other departments and government organizations, the setting details will be reviewed and reconfigured. Considerations have been made for the network system configuration so that the connectivity is pliable and any adjustments that have to be made will be minimized.

    The internet connection environment was achieved using an ADSL line at SOK provided by Telkom Kenya. However, the slow line speed is insufficient to place the Web server at SOK and disseminate spatial data this way at 512kbps (downstream)/128kbps (upstream), speeds which are not guaranteed but only the theoretical maximum. From now, a realistic method for transmitting large volumes of data must be investigated and implemented as necessary.

- e. Integration of client and printer settings into the system

    Prior to developing the server and network system, the 2 clients and 2 printers (equipment provided by JICA) were made operable with the minimal required settings. Once the server and network system was set up, the set up and configuration of the clients and printers were altered accordingly. Below are the details of the modifications that were made.

    ➢ Changed the TCP/IP settings

> ➢   Changed the domain setting
> ➢   Changed the user account settings
> ➢   Changed the shared printer settings
> ➢   Changed the network wiring and connections

A report on the study conducted on current conditions containing the evaluations, issues and countermeasures was prepared mainly by the counterpart.
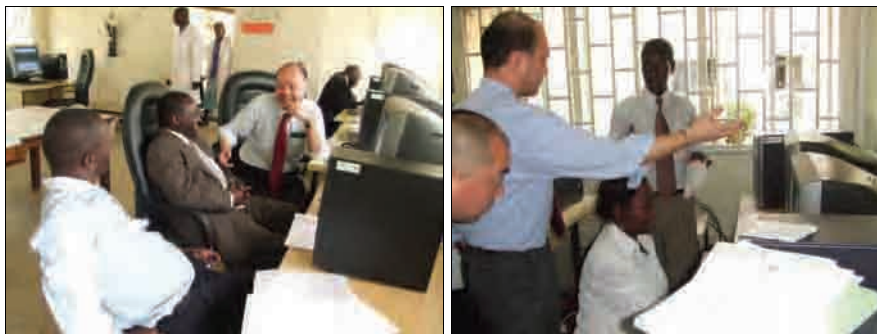

Diagram 2-45: Developing the ICT infrastructure

3）ICT infrastructure operation management

After developing the ICT infrastructure, we are continually managing operations and making improvements. The layout and settings have been documented and managed so that they can be referenced immediately. If there are any layout or setting changes, we will lead in the revision of the documents. The following documents have been produced.

- Network configuration
- Server configuration
- Server configuration sheet
- Client configuration sheet
- Router configuration sheet
- Switching hub configuration sheet
- User Account Administrtion sheet

From now, a procedure manual will be produced of the routine work within administration operations.

4）The achievements, activity evaluation and feedback of each Counterpart

We had Mr. Henry Ngomo, Mr. John Mwairo and Ms. Betty Mulianga fill out a questionnaire for self-evaluation of the project activities and also conducted individual interviews with them. The questions on the questionnaire are shown below; the questions refer not to the overall project but to the counterpart individually.

- Project activities and acomplishments
- Skills that were improved through project activities
- The role of the Japanese expert in skill development
- Future project activity plans
- Skills to be improved through future project activities
- Ideas and comments for project improvement

The results of the interview and questionnaire answers revealed no disparity in recognition or viewpoint between the counterparts and experts. Including the two members we were unable to interview or receive a questionnaire from, Mr. Peter Gota and Mr. Christopher Muturi, the skill development achieved by the five counterparts through their proactive efforts to develop the ICT infrastructure and conduct operation management tasks was highly commendable. In particular, Mr. Henry Ngomo and Mr. John Mwairo made substantive improvements related to ICT system techniques through project activities, and we anticipate their further improvement as the project continues.

（3）　C.5 [Formulation of Metadata Specifications (draft)]

1）　Background

Nowadays, various geographic data are produced by various organizations. Also searching services or data distribution through clearinghouse (Search service based on metadata for geographic data) has become available. In the project, we planed to build a clearinghouse using ArcGIS and ArcIMS to open SOK's geographic source to the public.

On the other hand, Metadata information such as the responsible person, coordinate reference system, data quality must be ready when we build the clearinghouse. Therefore, it's required that the metadata contains at least what GIS needs for search with consistent description rules.

With this in mind, we have designed the Kenyan Metadata Profile (hereafter, KMP1.0) draft document in accordance with KSISO19115 (Geographic information: Metadata) to build common rules of metadata profiles based on studies we have done in the project.

2）　Characteristics of the metadata profile

The characteristics of the metadata profile are described below, Also, the relation between comprehensive metadata and KMP1.0 is shown in Diagram 2-46.

- Based on KSISO19115

- Constructed of only core metadata (22 data sets)
- Constructed of 7 metadata elements
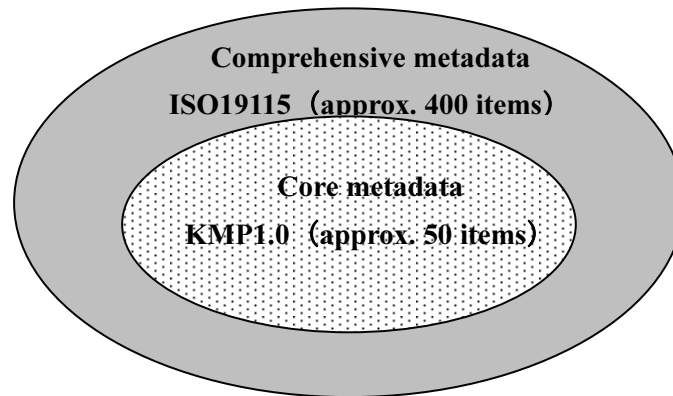- Necessary to add metadata elements in the future

Diagram 2-46: Relationship between Comprehensive metadata (KSISO19115) and KMP1.0

3）   Metadata profile specifications (draft)

The draft document of KMP1.0 specification consists of 7 chapters and 2 annexes. Described below are the core metadata, metadata package, UML modeling and data dictionary used for KMP1.0.

- Chapter 1: About KMP1.0
- Chapter 2: Core metadata
- Chapter 3: Metadata package
- Chapter 4: UML data modeling
- Chapter 5: Data dictionary
- Chapter 6: Code list
- Chapter 7: External reference elements
- Annex 1: Comparison between core metadata for KSISO1911 and core metadata for ArcGIS
- Annex 2: Sample XML data file of KMP1.0

1. Core metadata

Core metadata is defined as the minimum required metadata for any of community. KMP1.0 designed in the project contains the core metadata and structures 22 datasets, for instance, citation, responsible party, data quality information, data distribution information, and reference system information. Core metadata elements are listed in the table below Table 2-10.

Table 2-10: List of core metadata sets

Dataset title (M) (MD_Metadata > MD_DataIdentification.citation > CI_Citation.title)	**Spatial representation type (O)** (MD_Metadata > MD_Dataidentification.spatialRepresentationType)
Dataset reference data (M) (MD_Metadata > MD_DataIdentification.citation > CI_Citation.date)	**Reference system (O)** (MD_Metadata > MD_ReferenceSystem)
Dataset responsible party (O) (MD_Metadata > MD_DataIdentification.pointOfContact > CI_ResponsibleParty)	**Lineage (O)** (MD_Metadata > DQ_DataQuality > LI_Lineage)
Geographic location of the dataset (by four coordinates or by geographic identifier) (C) (MD_Metadata > MD_DataIdentification.extent > EX_Extent > EX_GeographicExtent >EX_GeographicBoundingBOX or > EX_GeographicDescription)	**On-line resource (O)** (MD_Metadata > MD_Distribution > MD_DigitalTransferOption.onLine > CI_OnlineResource)
Dataset language (M) (MD_Metadata > MD_DataIdentification.language)	**Metadata file identifier (O)** (MD_Metadata.fileIdentifier)
Dataset character set (C) (MD_Metadata > MD_Dataidentification.characterSet)	**Metadata standard name (O)** (MD_Metadata.metadataStandardName)
Dataset topic category (M) (MD_Metadata > MD_DataIdentification.topicCategory)	**Metadata standard version (O)** (MD_Metadata.metadataStandardVersion)
Spatial resolution of the dataset (O) (MD_Metadata > MD_DataIdentification.spatialResolution > MD_Resolution.equivalentScale or MD_Resolution.distance)	**Metadata language (C)** (MD_Metadata.language)
Abstract describing the dataset (M) (MD_Metadata > MD_DataIdentification.abstract)	**Metadata character set (C)** (MD_Metadata.characterSet)
Distribution format (O) (MD_Metadata > MD_Distribution > MD_Format.name and MD_Format.version)	**Metadata point of contact (M)** (MD_Metadata.contact > CI_ReponsibleParty)
Additional extent information for the dataset (vertical and temporal) (O) (MD_Metadata > MD_DataIdentification.extent > EX_Extent > EX_TemporalExtent or EX_VerticalExtent	**Metadata data stamp (M)** (MD_Metadata.dataStamp)

2. Metadata Package

The metadata packages in KMP1.0 are shown in Diagram 2-47 below. This metadata packages are fundamentally based on JMP2.0 (Japan Metadata Profile 2.0), and consists of 7 large metadata entities. The metadata entities are as follows:

- Metadata entity set information
- Identification information
- Data quality information
- Reference system information
- Distribution information
- Extent information
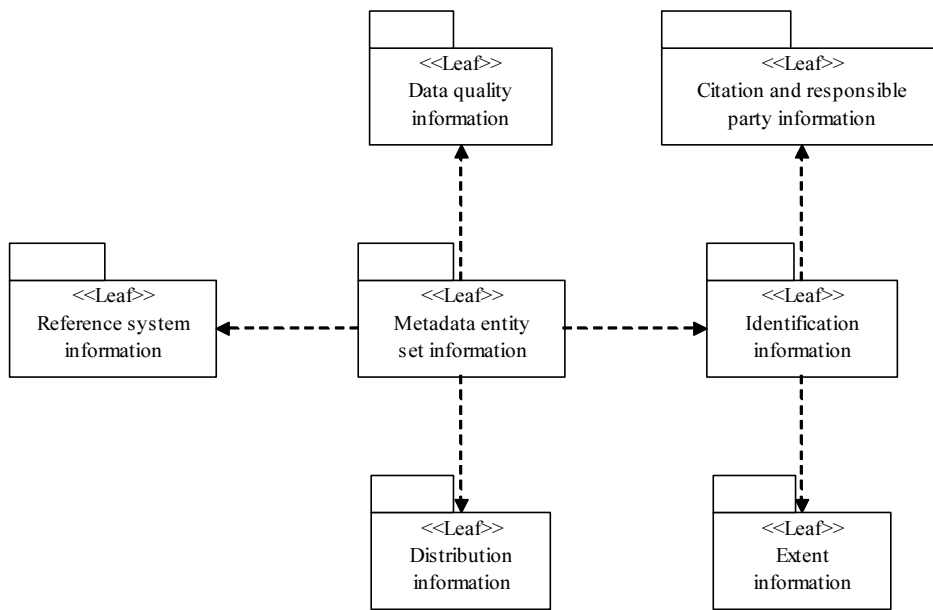- Citation and responsible party information

Diagram 2-47: Metadata package in KMP1.0

3. UML Data Modeling

Each metadata element and entity on KMP1.0 is described using UML (Unified Modeling Language) in Chapter 4. UML class model of distribution information is shown in Diagram 2-48.
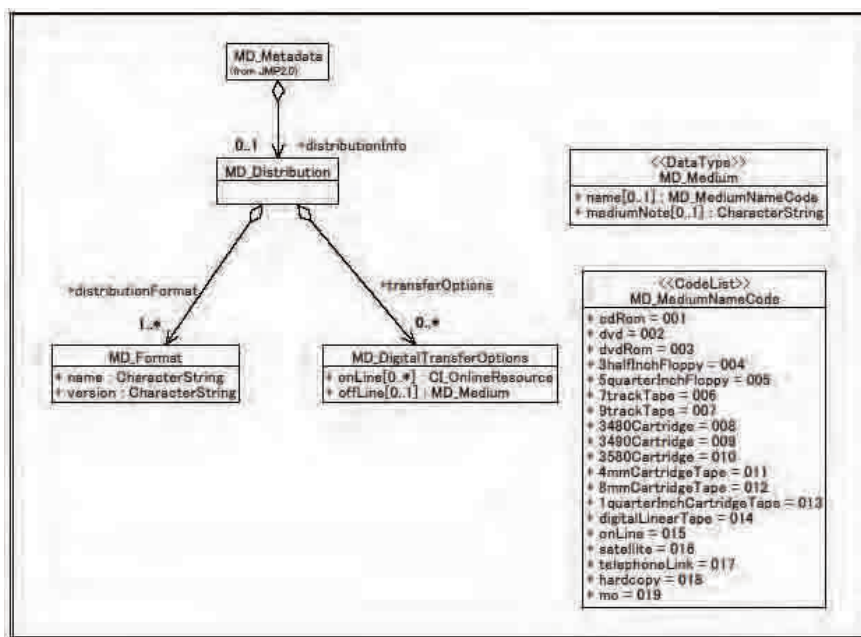

Diagram 2-48: UML graph of distribution information

4. Data dictionary

The data dictionary is described in Chapter 5 of the KMP1.0. The data dictionary in this KMP1.0 includes Name/Role, Definition, Requirement/Condition, Multiplicity, Data type and domain of validity for each metadata element and entity (see draft document of KMP1.0 specification).

（4）   C.6 [Metadata Specifications Seminar]

The draft document of KMP1.0 based on KSISO19115 was completed. The document was introduced to the public at Seminar 2 (4 July 2007 at AICAD). There was one recommendation offered at the seminar concerning these specifications, given below:

- Suggestion

KMP1.0 should contain keyword information to make it a suitable base for using the clearinghouse search function.

Given this recommendation and the importance of keywords for metadata, the C/P will add keyword information in the revision of KMP1.0.

Other comments and recommendations received through e-mail or the KNSDI website shall be considered, with metadata content supported by ArcGIS for actual implementation.

（5）   C.7 [Metadata Development and Disclosure]

1）   Review of metadata development methods

Metadata will be developed based on the metadata specifications (draft) that have been developed and using the editor included in ArcCatalog, on of the applications within ArcGIS provided by JICA.

2）   Metadata devlopment

In this project, the metadata will be developed for 1:2,500 and 1:5,000 topographic maps created in a previous project using the metadata editor included in ArcCatalog. Metadata will also be created for other topographic map data at SOK.

3）   Metadata disclosure

The metadata that is developed will be disclosed via the clearinghouse developed using ArcIMS installed on the SOK Web server. The KNSDI webpage features a link to the clearinghouse so that it is possible to access it from the KNSDI website.

2.4.5　　　Operating the Clearinghouse/Web

（1）　　C.4 [Web Operation/ Nairobi Sample Map Disclosure]

　1）　　Investigation of Nairobi Sample Map disclosure and a realistic method for project information transmission

The Nairobi sample maps (hereafter, "sample maps") and project information were to be disclosed and transmitted to the Internet through the Web server. Two avenues were persented here as methods to achieve this:

- To use Internet connectivity and Web server that is established in the project.
- Use the Web server already in operation to disclose content (sample maps and project information)

It was decided that after a study of the ICT system standards of higher institutions and discussions and coordination with those organizations that operate them (the Treasury and Ministry of Lands ICT Department), the contents created during the project would be disclosed using the Web server managed by the Treasury. For now, as a trial, the disclosure and transmission of data to the Internet through this Web server was limited to sample maps and project information.

2） Creation of Web content (for the disclosure of Nairobi sample maps and transmitting project information)

One of the tasks in this project is disclosure of Nairobi sample maps. For this, a Web site was to be launched for the project where disclosure of sample maps and transmission of project information can be done.

For these tasks, Web content (drafts) were created through OJT along with the appointed counterpart for the transmission of project information and disclosure of sample maps. The counterpart, in this case, was verified to have already acquired the techniques to create, update and modify Web content. The counterpart is updating Web content independently, although at irregular intervals.
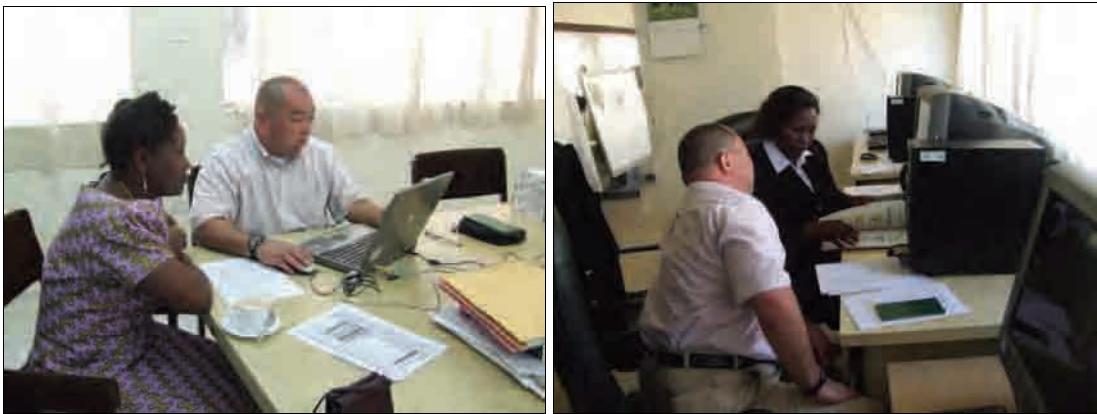

Diagram 2-49: Technological guidance to construct Web content

In this project, the contents that the counterpart created with the technological guidance of the expert are the following:

- Project summary
- The newsletter created in the project
- Printable 1: 2,500 and 1: 5,000 topographic maps
- Sample images from the GIS topographic map database
- GIS topographic map database specifications

Below, in Diagram 2-50 and Diagram 2-51 the created content (sample maps) is shown.
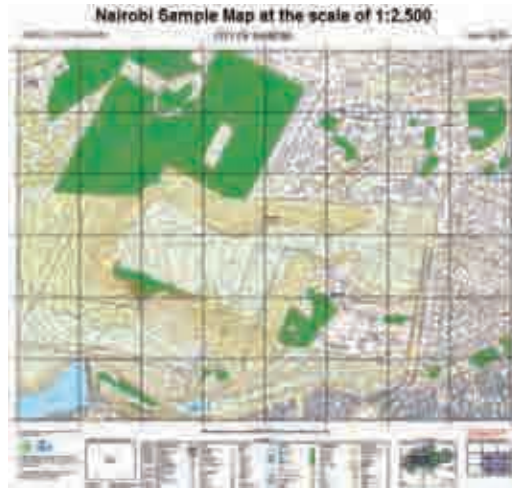

Diagram 2-50: Printout of 1: 2,500 scale topographic map

Diagram 2-51: GIS topographic map data (public administrations)

（2）　C.8 [Clearinghouse Construction and Disclosure]
　1）　Constructing the clearinghouse
　•　Various environments when construction the clearinghouse

The hardware used to construct the clearinghouse at SOK was a server computer (including server OS) that was provided in the project, and the software was ArcGIS and ArcIMS. Also, the newest product in the ArcGIS series, GPT (GIS Portal Toolkit) was used to serve as the core of the clearinghouse. GPT was not provided by the project, but was distributed at a clearinghouse training course targeting East African countries hosted by UNEP.

On the other hand, SOK still uses ADSL (512kbps/128kbps) to connect to the Internet. Also, due to restrictions set by the provider's connection service, it has not been possible to obtain a fixed global IP address. Furthermore, the domain name has not been acquired.

- Constructing the clearinghouse

    Construction of the clearinghouse was started based on the environment described above.

    There were a number of choices to be made when constructing the clearinghouse. One choice was to utilize the WWW server at the Ministry of Finance used to disclose sample maps of Nairobi. However, after giving consideration to the plan to improve the Internet environment in SOK and the activities plan using the Internet. It was ultimately decided to construct the clearinghouse within SOK.

    The above hardware and software was added to use Dynamic service when constructing the clearinghouse. It was decided to use the GPT distributed in a UNEP training course because it is compatible with ArcGIS products and had better functionality than other ready-made clearinghouse software available.

- Overview of the clearinghouse

    The basic appearance of the clearinghouse at SOK was the GPT default, with the addition of a map of Kenya, the KNSDI title and Kenyan flag to the banner. Also, KNSDI's copyright was added to the footer (Diagram 2-52).
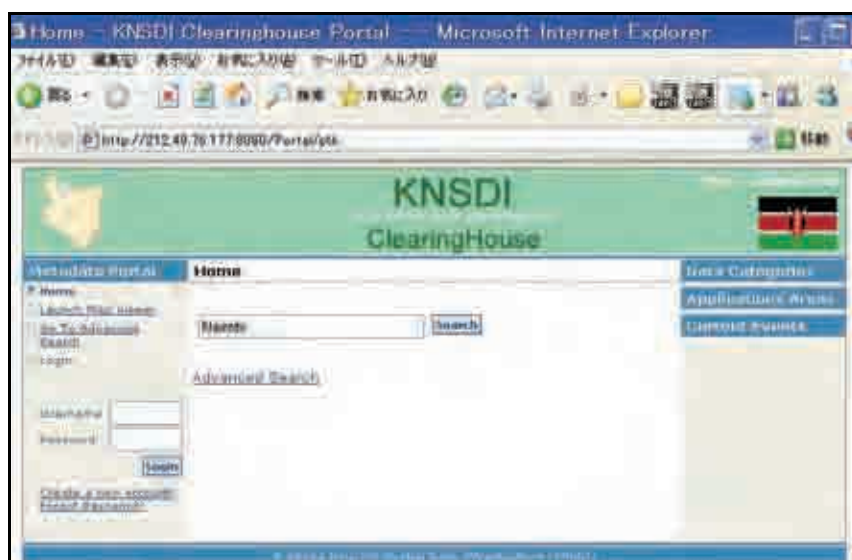

Diagram 2-52：Clearinghouse portal

Currently the major functions offered by the SOK clearinghouse are using metadata of geographic information to search, display, promulgate, review, permit, update, revise, etc.

The clearinghouse can be accessed directly through the following IP address:

http://212.49.76.177:8080/Portal/

- Functions of the clearinghouse

    The functions of the clearinghouse constructed at SOK are as follows.

    The homepage shown below can be accessed by entering the above IP address into the IE (Internet Explorer) or Firefox browser. A registered user can then enter their user name and password to login. Visitors who are not registered can enter a keyword into the search textbox and the next page will display the results of the search. If the data matching the keyword is contained in the clearinghouse, all of the corresponding results will be summarized on 1 page or a series of pages. (Diagram 2-53)

Diagram 2-53: Example Search

The metadata is summarized in text and alongside a thumbnail image of the content is displayed. For those who want to check the details of the metadata, there is a View Detail button provided. Clicking this button will display the details.

When displaying the data detail, the metadata in accordance with ISO standards will be displayed with a number of main items and their sub items.

> Content Citation

> Content Description

> Time Period of Content

> Content Status

> Spatial Domain

> Access and Usage Information

After checking the details, one may want to investigate the acquisition method, etc. To do so, the data detail page features a button View All Metadata that, when clicked, displays all metadata including the contact, data format, cost and so on, which can then be downloaded.

2) Disclosing the clearinghouse

- Clearinghouse announced at seminar

The SOK clearinghouse was announced along with an introductory presentation on its construction, data and functions at the Spatial Infrastructure Standards Seminar 3 held on 21 February 2008 attended by government and other related organizations.

- Clearinghouse publicity

The publicity plan for the clearinghouse set forth to promote active use of the SOK clearinghouse by users beyond those that had participated in the seminars, including users outside of Kenya. To realize this plan, a link to the SOK clearinghouse on internationally well-known geographic information sites was arranged. Presently, SOK is listed as a data publisher on one of the most well-known geographic information sites in the world, the Geography Network, along with other leading geographic data publishers such as EPA, ESRI, NASA, SPOT, USGS, UNEP and so on. When users anywhere in the world access the Geography Network, they will see SOK listed as a data publisher with a link to access the clearinghouse.
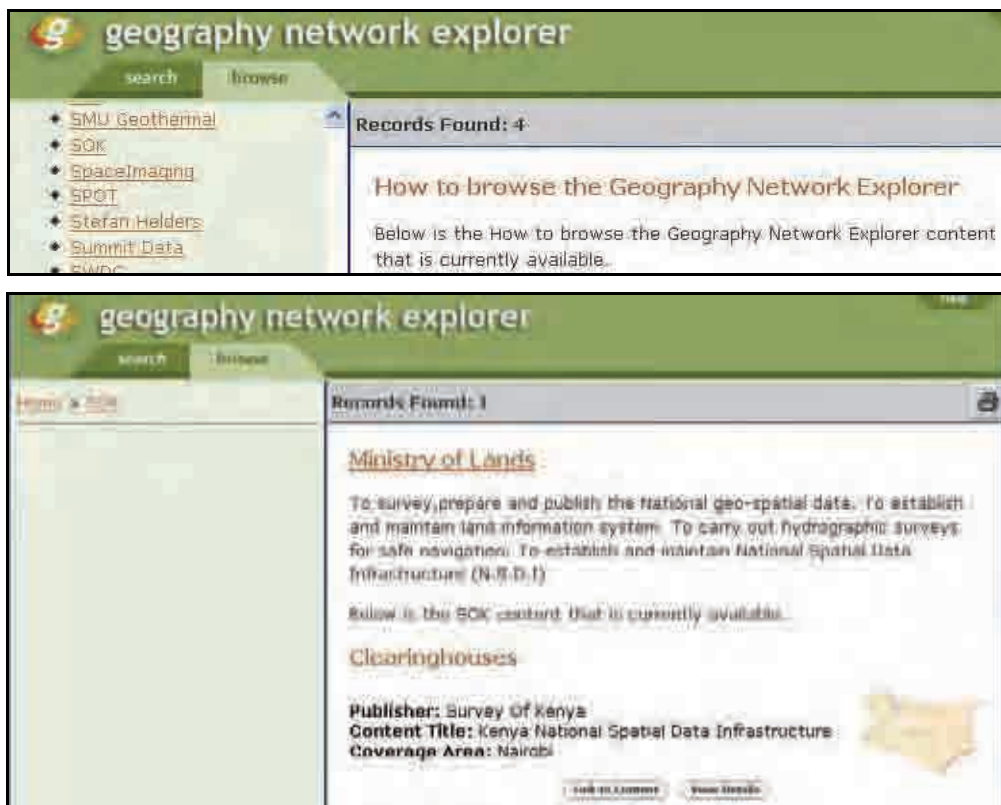
Diagram 2-54: Geography Network

3） Future tasks

- Improvement of Internet connectivity

At present, the SOK clearinghouse is connected through the Internet using ADSL (518kbps/128kbps). This environment is limited to performing metadata searches, and does not allow actual download of topographic maps. Accordingly, one issue is to establish connectivity that will allow the download of large data files.

The server that handles the Internet connection has been vulnerable to hackers since it was constructed. One attack took place during the construction of the clearinghouse by a hacker using the handle "SpiderMAN", and although no major damage was done, the banner to the clearinghouse was temporarily down. A free program, Disinfector, was downloaded from the Internet to avoid minor attacks, but it will be necessary to establish proper countermeasures to prevent damage from a truly malicious attack or virus.

- Acquisition of Internet domain name

To access the SOK clearinghouse presently requires that one input the IP address to

the portal site. For users, this method is considered inconvenient and plans are to obtain a user-friendly domain name to easily access the site. This will help to expand users of the SOK clearinghouse beyond the seminar participants and should result in widespread use of the geographic information developed and constructed at SOK. Therefore, acquisition of a domain name will not only aid in access to the clearinghouse but also serve as an effective step in utilizing the search map. Furthermore, a domain name must be acquired at an early stage to improve the functionality of the SOK clearinghouse.

- Enriching clearinghouse data storage, such as metadata

As mentioned above, the SOK clearinghouse presently has digital topographic maps of Nairobi uploaded. However, there is other geographic information stored at SOK. The widespread use of geographic information would require that metadata be created for SOK information and then update the clearinghouse, and in addition, store digital geographic information on the clearinghouse and proceed to make it publicly available.

Also, as long as SOK controls storage permission, parties other than SOK could use the clearinghouse to store geographic information metadata, making the clearinghouse functional as a platform for Kenyan national GIS data.

- Intensification of clearinghouse publicity

Due to a number of restrictions, the primary objective has been for the SOK clearinghouse to disclose metadata owned by SOK. In order to achieve this, site usage must be improved by linking the clearinghouse to well-known site handling geographic information and intensifying publicity. Furthermore, methods to raise access to the clearinghouse must be improved.

2.4.6 　　Other tasks (Reporting and Discussion)

（1）　E.1 [Creation of Inception Report]

The inception report (English ver.) was created after collecting materials and data in Japan and examining the basic policy, methods, items and their content, implementation system, schedule and so on, related to the project activities and based on the proposal. The inception report was approved by JICA and then prepared to provide this to JICA and the counterpart in Kenya.

（2）　E.2 [Organization of JCC]

In order to organize the JCC based on the items agreed upon in the Record of Discussion (R/D), candidates for the JCC were selected and SOK was asked to contact the related organizations. As a result, JCC was ultimately formed from the following organizations.

- Kenyan side

  Permanent Secretary, Ministry of Lands

  Director, External Resources Department, Ministry of Finance

  Project Manager (SOK)

  Deputy Project Manager (SOK)

  Principal, KISM

  Director, Central Bureau of Statistic

  Director, Department of Resource Survey and Remote Sensing

- Observers on the Kenyan side

  Director General, Regional Centre for Mapping of Resources for Development

- Japanese side

  JICA Kenya Office Resident Representative

  Experts

- Observers on the Japanese side

  Japanese Embassy Representative

The Permanent Secretary, Ministry of Lands was selected as the JCC.

（3）　E.3 [Explanation and Discussion of Inception Report]

The Inception Report was explained and discussed on 31 October 2006 at the lecture　room

in KISM.

At the meeting, explanation was given along with a Q&A on the tasks and content written in the inception report (such as, how will project-related guidance be provided to each SOK department, if the Nairobi municipal maps will be disclosed on the Internet, how to handle abuse of data copyright, and how to go about obtaining geographic data), appointment of counterpart and members of JCC as well as days to hold JCC. Also, the office provisions needed (Internet, desks, chairs, power supply, etc) was revisited. Finally, a report was given on the status of equipment supply.

The draft version of the inception report was ultimately recognized as written in the M/M.

The following participants attended this meeting:

- Kenyan Side:
  Surveys of Kenya, Ministry of Lands

  Mr. J. K. MATHENGE   Ag. Director of Surveys

  Mr. E. M. MURAGE   Ag. Deputy Director of Surveys

  Mr. B. N. OWINO   Senior Assistant Director of Surveys (Geodetic and GIS)

  Mr. J.G. HALAKE   Senior Assistant Director of Surveys (Hydrographic Surveys)

  Mr. Z. KANUNU   Ag. Senior Assistant Director of Surveys (Cadastral)

  Ms. P. W. GITIMU Ag. Senior Assistant Director of Surveys (Mapping)

  Mr. P.M. GOTA   Ag. Assistant Director of Surveys (Geodetic and GIS)

  Mr. C.T. MUTURI Chief Photogrammetrist (Air Survey)

  (KISM)

  Mr. B. KUMUNGA Principal, Kenya Institute of Surveying and Mapping

- Japanese Side:
  Mr. J. SATO   Chief Advisor of JICA Consultants Team

  Mr. A. NISHIMURA   JICA Consultants Team, Surveyor

  Mr. K. YAMADA   JICA Consultants Team, Photogrammetrist

  (JICA Kenya Office)

  Mr. M. ISHIZUKA   Assistant Resident Representative

  Ms. A. OLUBENDI Programme Officer

（4）　E.4 [Creation of Project Work Completion Report 1]

At the end of the first fiscal year, a project work completion report summarizing achievements concerning the work schedule, personnel and activities implemented, etc., was produced and submitted to JICA.

（5）　E.5 [Creation of Project Progress Report]

A project progress report was produced summarizing the achievements concerning the work schedule, personnel, activities implemented, evaluation of project progress and so on up to September 2007, and this was submitted to JICA and the C/P in Kenya.

（6）　E.6 [Explanation and Discussion of Project Progress Report]

The project progress report was explained and discussed at the KISM meeting room on 17 October 2007. Approximately 20 minutes was given to explanation with major emphasis put on the process of activities and the results. However, discussion was less about these things and involved much Q&A about problems with Internet connectivity and future items, such as: When can we improve the Internet environment at SOK? What are plans at JICA using the results after the project is completed? Once the website is opened, isn't it necessary to know how many people are connecting to the site in order to conduct monitoring and evaluation? Is there a plan to review the geographic data standards and digitization manual that were developed? Lastly, the draft of the progress report was approved.

The following participants were in attendance for the explanation and discussion.

- Kenyan Side:

    Mr. E. M. MURAGE　　　Project Manager, Director of Surveys, Ministry of Lands

    Mrs. P. W. GITIMU Deputy Project Manager, Ag. Senior Assistant Director of Surveys (Mapping), SOK

    Mr. B. N. OWINO Senior Assistant Director of Surveys (Hydrographic Surveys), SOK

    Mr. F. N. MASAKU　　　Ag. Senior Assistant Director of Surveys (Adjudication), SOK

    Mr. Z. T. KANUNU　　　Ag. Senior Assistant Director of Surveys (Cadastral), SOK

Mr. P.M. GOTA   Ag. Assistant Director of Surveys (Geodetic and GIS), SOK

Mr. B. M. KUMUNGA   Principal, Kenya Institute of Surveying and Mapping

- Japanese Side:
  Mr. J. SATO   Chief Advisor of JICA Experts Team

  Mr. A. NISHIMURA   JICA Experts Team

  Mr. K. MASUDA   JICA Experts Team

  Mr. W. CHE   JICA Experts Team

  (JICA Kenya Office)

  Mr. T. NAKAZAWA   Assistant Resident Representative

  Mr. S. N. Mogere   Monitoring & Evaluation Advisor

（7）　E.7 [Creation of Project Work Completion Report 2]

At the end of the second fiscal year, the second project work completion report was produced summarizing achievements concerning the work schedule, personnel and activities implemented, etc., and submitted to JICA.

（8）　E.8 [Creation of Project Completion Report]

The achievements concerning the work schedule, personnel, activities implemented, evaluation of project progress, issues and recommendations and so on up to September 2008, and at the same time, the project completion report was produced including the activities planned to take place after September, and this was submitted to JICA and the C/P in Kenya.

（9）　E.9 [Explanation and Discussion of Project Completion Report]

A presentation on the project completion report was made and explained to the C/P. The details of the results were discussed and accepted.

（10）　E.10 [Hold Project Summary and Recommendation Seminar]

The C/P made preparations and held a comprehensive seminar for project completion on 30 September 2008 which introduced activities planned for after the project.

（11） E.11 [Creation of Project Work Completion Report 3]

At the end of the third fisical year, the third project worl completion report was produced summarizing achievements concerning the work schedule, personnel and activities implemented, etc, and submitted to JICA.

2.4.7   Follow-up

（1）   D.1 [Follow-up]

Follow-up was conducted for each activity keeping in mind independent development   after project completion.

1）   Follow-up on Map Digitizing

- Preparation of specifications and manual to conduct pilot project
- Release the specifications and manual to related departments
- Objectives and methods to implement pilot project

2）   Follow-up on Spatial Data Infrastructure Standards

Information was organized on when the specifications in the KPGIS document within the Spatial Data Infrastructure Standards should be expanded and adopting suitable specifications therein.

3）   Follow-up on GIS Training

Preparation work was organized concerning necessary tasks to hold regular training courses each year such as budget measures and arranging lecturers.

4）   Follow-up on Metadata Network Management

The storage of the metadata developed for 1:2,500 and 1:5,000 Nairobi municipal maps into the clearinghouse was confirmed. Also, a plan was formulated for creating metadata for the 1:50,000 map that will be produced.

5）   Follow-up on Clearinghouse/Web Operation

The plan of modifications to configuration of the Web server were made for the new wireless Internet connection.

2.4.8 Comprehensive Seminar at Project Completion

A comprehensive seminar was held at AICAD on 30th September 2008.

（1） Outline

- Seminar title: Roll Out of Kenya National Spatial Data Infrastructure (KNSDI)
- Date: 30th September 2008
- Venue: AICAD Assembly hall
- Number of participants: 152

（2） Preparation

Following topics were taken care.

Encourage C/P ownership

Experts only gave piece of advice for C/P created plan to keep ownership. Preparation has been carried successfully based on knowhow through experienced three seminars.

Contents to be covered

Last three seminars held in the project had been focused to GIS standardization. However, this seminar should cover report of all project activities, presentation and discussion involving stakeholders, moreover KNSDI policy common understanding as a project final seminar. See program on Diagram 2-55.

Kenya National Spatial Data Infrastructure Seminar IV
"Roll out of Kenya National Spatial Data Infrastructure (KNSDI)"

Date: Tuesday 30th September 2008
Venue: AICAD Conference Hall

TIME	TOPIC	SPEAKER	ORGANIZATION
08.30-09.00	*Registration of participants*		
SESSION I: CHAIR – MR. WANYOIKE			
09.00-09.15	Welcome Statement by Director of Surveys	Mr. Murage	SOK
09.15-09.30	Opening Speech Permanent Secretary	Ms. Angote	Ministry of Lands
09.30-09.45	Statement by JICA Representative	Mr. Takahashi	JICA
09.45-10.00	Report by JICA Advisor	Mr. Sato	JICA
10.00-10.30	Roll out plan for KNSDI Project	Ms. P. Gitimu	SOK
10.30-10.45	*Tea Break*		
SESSION II : CHAIR – DR. MUSYOKA			
10.45-11.00	Geospatial Standards and applications	Ms. Lucy	SOK
11.00-11.15	International Geospatial Standards: Kenyan Position		KEBS
11.15-11.30	Application of Geospatial		Moi University
11.30-11.45	Clearing House Development and Metadata	Mr. Muturi	SOK
11.45-12.00	Clearinghouse: Stakeholder's perspective	Mr. Mtaroni	RCMRD
12.00-12.15	Mau Initiative framework towards SDI	Mr. Julius Muchemi	MauSDI
12.15-12.45	*Questions & Answers*	*participants*	SOK
12.45-13.00	*Exhibition*	*KNSDI Secretariat*	SOK
13.00-14.00	*Lunch Break*		
SESSION III (WAY FORWARD): CHAIR – Professor Mulaku Panelists: Dr. Musiega, Mr. Wanyoike, Dr. Musyoka, Dr. Farah			
14.00-14.15	Adoption of KNSDI Policy Document	Prof. Mulaku	UON
14.15-14.45	Discussion on KNSDI Rollout and the way forward	Prof. Mulaku	UON
14.45-15.00	Resolutions	Prof. Mulaku	UON
15.00-15.10	Closing Statement	Dr. Farah	RCMRD

Seminar Coordinator   Mr. Peter M. Gota

Rapporteurs   Ms. Chepkosgei, Mr. Mwania, Mr. Raymod

Diagram 2-55: Seminar program

Have more stakeholders

Following matters were carried out considering to have more stakeholders (especially government sectors) that was pointed out at termination evaluation result which was implemented May 2008t.

Utilization of JICA long term expert connections that chief advisor has: Requested attendance of the seminar to Ministry of Roads, Ministry of Nairobi Metropolitan Development.

➤ Recruitment of participant by advertizing in newspapers: 2days advert on major newspapers were used by the reason of good experience through GIS training course in October 2007.

Diagram 2-56: Advert on the newspaper

- Exhibition

Expert advised that exhibition can be giving easier understanding of the project outputs to participants than presentation. So C/P have prepared a series of results related to the spatial data infrastructure from data production to data search and provision in the clearinghouse to exhibit on pc.

1)   The seminar

Number of participants was exceeded nearly twice of past seminars including those participants by good preparation. Some participants came from other regions like Moi university of Eldored, Nakuru-city. Following topics were heighted in the seminar.

Set up technical committee for the KNSDI policy work out

Expectation to SOK to take initiative of KNSDI construction

Observation of project outputs on the exhibition

Diagram 2-57: Exhibition

Diagram 2-58: Comprehensive Seminar

2.5   Special Items

2.5.1   Project Implementation Structure

The project work up to mid-year was executed as established in the implementation structure shown below.

（1）   Expert side

The experts team is composed as follows to conduct the project work.

1）   Conposition of the Experts Team

The experts team structure was as follows.

Responsible for:	Name
Chief Advisor	Jun Sato
Work Director/ Map Digitizing	Akira Nishimura
GIS Standardization	Keiji Yamada
GIS Application Training	Keiji Yamada=>Youichi Oyama
Metadata/ Network Management	Kazutoshi Masuda
Clearinghouse/ Web Operation	Takuya Takasho=> Peifeng Lei

2）   Organizational Operation of Expert Team

The expert team held meetings as needed in an effort to bring mutual understanding and maintain a consensus for the smooth operation of the project work and to achieve the project outputs. Also, close communications were kept with SOK and the NSDI committee and such. In particular, impromptu meetings were held with the down-to-earth SOK project supervisors to regularly exchange opinions or in immediate response to a particular issue.

3）   Other

As mentioned above, there was a modification in the composition of the expert team from the initial plan.

（2） Composition of the Counterpart Organization side

The structural composition of the counterpart organization side was based on what was agreed upon in the R/D, and the details were decided through discussion with SOK.

1） Composition of the Counterpart Side

Based on discussions with SOK and proposal by the expert, two counterparts were assigned for the project manager, deputy project manager and each field. However, due to internal reassignments, there were the following transitions for project responsibilities.

Responsible for	Counterpart Name
Project Manager	Mr. J. K. Mathenge (Director of SOK ~ 7/31/2007) Mr. E. M. Murage (Director of SOK 8/1/2007~)
Deputy Project Manager	Mr. B. N. Owino (31/ 10/2006 ～5/1/2007) Mr. Halake(5/1/2007～7/31/2007) Ms. Polly Gitmu (8/1/2007~)
Map Digitizing	Ms. Asenath Omolo Mr. Frank Kimotho Mr. Atsiele Atsibilwa Raymond (9/2007～) Mr. AKUMU, Mildred A. K. (9/2007 ～ 12/2007) (in charge of relational database construction)
GIS Standardization	Mr. Bernard Olwande （～2008/1） Ms. CHEPKOCHEI, Lucy Chepkosgei Mr. Peter Gota
GIS Application Training	Mr. Joel Odhiambo Ms. Polly Gitimu (~7/31/2007) Mr. Joseph M. Karanja (8/1/2007~)
Metadata/ Network Management	Mr. John Mwairo Mr. Henry Ngomo (~7/31/2007) Mr. Mutuku M. Kennedy (8/1/2007~)
Clearinghouse/ Web Operation	Mr. Christopher Muturi Ms. Betty Mulianga (~7/31/2007) Mr. Mutuku M. Mwania (8/1/2007~)

2） Organizational Operation of the Counterpart Side

The counterpart side organizational operation was conducted under the supervision of the deputy project manager, who was in charge of the substantial project work.

In addition, the deputy project manager made periodic site inspections and compiled reports on the progress and result of work of the person in charge of each area, which created a lot of tension in the air.

（3）　Project Management

Regular meetings were held (Friday of each week) between the experts and the C/P from May 2007. At these meetings, the C/P responsible for each area provided a report on current progress and future plans, as well as any problems or issues at that time, which was then discussed among participants. Based on the results of the project, the C/P carried out activity planning on its own, such as discussions, planning and implementation as well as reporting.

2.5.2   JCC Administration

（1）   Forming JCC

SOK made a request to relevant organizations with the aim to form JCC based on items agreed upon in the R/D to select JCC committee candidates. As a result, the JCC was formed according to the following composition:

- Kenyan side

    Permanent Secretary, Ministry of Lands

    Director, External Resources Department, Ministry of Finance

    Project Manager (SOK)

    Deputy Project Manager (SOK)

    Principal, KISM

    Director, Central Bureau of Statistic

    Director, Department of Resource Survey and Remote Sensing

- Observers on behalf of Kenya

    Director General, Regional Centre for Mapping of Resources for Development

- Japanese side

    JICA Kenya Office Resident Representative

    Expert Team

- Observers on behalf of Japan

    Japanese Embassy representative

In addition, the Permanent Secretary of Ministry of Lands has assumed the position of JCC chairman.

（2）   JCC Administration

The following items, given mention in the R/D, were designated at JCC.

- Examination and approval of the project work content planned for each fiscal year
- Review of the overall progress and the result of the project work executed in each fiscal year.
- Review and exchange of opinions for any major occurances in the project work

Also, at the request of SOK to the JCC chairman, the JCC committee was called to order.

1） First JCC

The First JCC was held on 24 November 2006 in the boardroom of ARDHI HOUSE by the summons of the JCC chairman.

- Kenyan side participants

    Mr. K. Mwero: Permanent Secretary, Ministry of Lands

    Mr. A. A. O. Mondoh: Director, Administration, Ministry of Lands

    Mr. J. K. Mathenge: Project Manager; Director of Surveys, SOK

    Mr. B. M. Kumunga: Principal, Kenya Institute of Surveying and Mapping

    Mr. B. N. Owino: Deputy Project Manager, Sr. Assistant Director, SOK

    Mr. S.E. Onsare Ondari: For Director, Central Bureau of Statistics

    Mr. Kanyiri: Senior Assistant Secretary, Ministry of Lands

- Japanese side participants

    Mr. J. Sato: Chief Advisor of JICA Experts Team

    Mr. A. Nishimura: JICA Experts Team, Surveyor

    Mr. K. Yamada: JICA Experts Team, Photogrammetrist

    Mr. K. Tokuhashi: Deputy Resident Representative   JICA Kenya Office

    Mr. M. Ishizuka: Assistant Resident Representative   JICA Kenya Office

    The agenda for this meeting was as follows:

- Explanation, Discussion and Approval of Inception Report
- Other Items

During the explanation and discussion of the Inception Report, while the expert team explained the contents of the project work, simultaneously, the expert team gave advice to emphasize SOK's active role in the project, and their capacity development. The Inception Report was approved.

The SOK speakers then presented an overview of the equipment and materials to be used in project work, the condition of their maintenance and management, and the conditions of internet connectivity.

Also, plans to carry out the disclosure of Nairobi topographic maps and how that would be done was discussed.

Lastly, with such a short project period of two years, both parties agreed to cooperate closely to complete the project.

2） Second JCC

The Second JCC was held on 10 March 2007 in the boardroom of ARDHI HOUSE by the summons of the JCC chairman.

- Kenyan side participants

    Mr. Ooko: Deputy Permanent Secretary, Ministry of Lands

    Mr. J.K. Mathenge: Project Manager; Director of Surveys, SOK

    Mr. B.M. Kumunga: Principal, Kenya Institute of Surveying and Mapping

    Mr. J.G. Halake: Deputy Project Manager, Sr. Assistant Director, SOK

- Japanese side participants

    Mr. J. Sato: Chief Advisor of JICA Experts Team

    Mr. A. Nishimura: JICA Experts Team, Surveyor

    Mr. K. Yamada: JICA Experts Team, Photogrammetrist

    Mr. K. Masuda: JICA Experts Team, IT Engineer

    Mr. T. Takasho: JICA Experts Team, IT Engineer

    Mr. K. Tokuhashi: Deputy Resident Representative JICA Kenya Office

    Mr. T. Kanenawa: Assistant Resident Representative JICA Kenya Office

    The agenda of the meeting was as follows:

- Opening Speech

    Opening speeches for the meeeting were given by the chairman and the JICA Kenya Office Resident Representative (read by the deputy resident representative as proxy).

- Explanation of Project Work Progress up to March 2007

    The expert team gave an overview of the work details and the results concerning each work area (map digitizing, standardization, GIS training, metadata/network management and clearinghouse/Web operation). And finally, looking at these details and results, as well as the result of the monitoring meeting (mentioned below), the modifications proposed for the contents of the PDM were affirmed.

- SOK Response to Project Work

    SOK gave a positive report of the achievements corresponding to the project, particularly, the appointment of C/P, preparation of an office environment and Internet environment, and acquisition the domain name and such for the homepage.

- Discussion of Spatial Data Dissemination

  The expert team put forth discussion on how to broaden plans for the disclosure of Nairobi topographic maps and future disclosure of various geographical data. It was the first time to discuss these issues so an explanation of the basic concept was given. There was uniform recognition of the need to continue the discussion on data dissemination (the policy, methodology, associated legal development, etc.).

- Overview of Project Work from May 2007

  The expert team gave an overview of project activities from May 2007, using a detailed project chart and man-month chart.

- Other

  Agreement was reached concerning the frequency of JCC meetings to be held until March 2008. So far there has been one, with another tentatively planned for sometime around October.

3） The Third JCC

  The Third JCC was held on 27 November 2007 in the boardroom of ARDHI HOUSE by the summons of the JCC chairman.

- Kenya side participants

  Mr. K. MWERO:　　Permanent Secretary, Ministry of Lands

  Mr. E. M. MRAGE:Project Manager: Director of Surveys, SOK

  Mr. B. M. KUMUNGA:　　Principal, Kenya Institute of Surveying and Mapping

  Ms. P. GITIMU:　　Deputy Project Manager, Ag. Senior Assistant Director, SOK

  Mr. W. ABUTO:　　Senior Assistant Director of Surveys (Administration), SOK

  Mr. Z. T. KANUNU:　　Ag. Senior Assistant Director of Surveys (Cadastral), SOK

  Mr. P. M. GOTA:　　Ag. Assistant Director of Surveys (Geodetic & GIS), SOK

  Ms. E. A. ODHIAMBO:　　For Director General, National Bureau of Statistics

- Japan side participants

  Mr. J. SATO:　　　　Chief Advisor of JICA Consultants Team

  Mr. A. NISHIMURA:　　JICA Experts Team, Surveyor

  Mr. K. OYAMA:　　　　JICA Experts Team, Photogrammetrist

  Mr. Y. TAKAHASHI:　　Resident Representative, JICA Kenya Office

Mr. T. NAKAZAWA: Assistant Resident Representative, JICA Kenya Office

The issues discussed at the meeting were as follows:

- Opening statement
- Explanation, Discussion and Approval of Project Progress Report
    The Experts explained each activity and the progress of the project. In doing so, major emphasis was put on methods that helped in evaluating the progress and those results. Q&A session was held on the report. A summary follows.

- Issues in measuring the evaluation indicators
- Concept of C/P engaging in tasks when no expert is assigned
- How will GIS be promoted in Kenya?
    Following the Q&A, the draft of the report was approved.

    Meanwhile, there was also discussion on the method to disseminate GIS and spatial data infrastructure in Kenya.

- Explanation of NSDI Dissemination Activities in Japan
    The experts explained the state of activities concerning NSDI in Japan.

4)   The Fourth JCC

The Fourth JCC was held on 26 September 2008 in the boardroom of ARDHI HOUSE by the summons of the JCC chairman.

- Kenya side participants

Mr. E. M. MURAGE Project Manager, Director of Surveys, Ministry of Lands

Mr. J. G. HALAKE   Deputy Director of Surveys, Ministry of Lands

Mr. P.M. GOTA   Assistant Director of Surveys (Adjudication), SOK

Mr. A. M. YUSUF   Ag. Assistant Director of Surveys (Hydrographic), SOK

Mr. G. W. MWANGI Economist, Ministry of Lands

Mr. C. T. MUTURI   Chief Photogrammetrist, SOK

Mr. B. M. KUMUNGA   Principal, Kenya Institute of Surveying and Mapping

- Japan side participants

（JICA Kenya Office）

Mr., K. KAWAZUMI Deputy Resident Representative

Mr. T. NAKAZAWA Assistant Resident Representative

Mr. S. N. Mogere   Monitoring & Evaluation Advisor

 （JICA Expert team）

Mr. J. SATO   Chief Advisor of JICA Consultants Team

Mr. A. NISHIMURA JICA Experts Team, Surveyor

Mr. K. YAMADA   JICA Experts Team, Photogrammetrist

Dr. P. LEI   JICA Experts Team, GIS expert

The issues discussed at the meeting were as follows:

- Explanation of Project completion report and its approval.

The experts explained the outline of the result if project and also explained in details. In the detailed explanation, the issues and the recommendations after project were focused on and the action plan that was prepared bt the C/P was explained.

In the discussion, there were a lot of acknowledgements and finally the draft final report was apprived.

2.5.3　　Cooperation with the NSDI Committee and Relevant Organizations

（1）　The NSDI Committee cooperation with the project

　1）　Summary of the NSDI committee

　　The NSDI committee consists of a broad range of organizations related to geographical data, such as central government agencies, local government, NGOs, international organizations and private companies, with the purpose of joint ownership of geographic information and problem solving. Furthermore, SOK defined the placement of the NSDI executive office in the schema. The committee activities so far have been 6 workshops that have been held since 2001, and the four working groups (WG) which are standardization, preparation of the legal system, human resource development and dissemination, are operated. In this project, it was necessary to back up these past activities and support their advancement. Furthermore, the NSDI committee does not continually perform activities but is called to order when necessary so that, to ensure cooperation with the NSDI committee in the project, it would be necessary to actively approach an NSDI WG.

　2）　Cooperation with the Standardization WG

　　As for the activity of GIS Standardization of this project, we intended to formulate domestic standards of geographical information and developed product specifications for spatial data infrastructure which would conform to domestic standards. When making these decisions, the technical validity of the standard was necessary, and it was understood that reaching a consensus among users is of utmost importance. The actual work to formulate this will be carried out by the TC (Technical Committee) organization located at the SOK secretariat office. Members from the NSDI committee Standardization WG are included as chief members of the TC.

　　The GIS Standardization group gave an ample explanation of the project's GIS standardization activities to KEBS, and has made preparations to obtain support at the Standardization TC meeting in 2007. Also, in the First GIS Standardization Seminar, the many remaining members of the NSDI committee were invited, which set forth the position that great importance was given to the consensus of stakeholders in the project. We plan to continue the active involvement of NSDI committee members in the future.

　3）　Cooperation with the Human Resource Development WG

　　The NSDI committee Human Resource Development WG is centered around international organizations and educational institutions, represented by Professor Mulaku of the University of Nairobi (UON). In addition, in the training course of GIS and remote sensing that have tied together Japan and Kenya using JICA-Net, Professor

Mulaku acted as a facilitator at training courses related and fully understood these JICA activities. From the beginning of project activities for GIS application training, we visited UON and gave a summary of our activities, and furthermore, requested the provision of resources, such as a lecturer for the training. We planed to continue making timely visits to Professor Mulaku to help him understand how these activities are proceeding.

（2） Cooperation with Relevant Organizations
  1） The clearinghouse

At present, international organizations such as RCMRD, ILRI and FAO, which use GIS and remote sensing, have already developed and utilize a clearinghouse. While one of the objectives of this project is to develop a clearinghouse, the other clearinghouses and their relationship will be analyzed, and it will be necessary to continue to cooperate with these organizations to ensure there is no data overlap when the clearinghouse is constructed. Especially, it is desireable for SOK to place importance on developing metadata for topographic maps, which is not included in other clearinghouses.

  2） Cooperation with the JICA-Net Training Course

JICA periodically held JICA-Net training courses, which target technical engineers of countries such as Kenya using video meeting equipment, which was carried out in March 2007. For this, Professor Murai, an emeritus professor of the University of Tokyo, gave lectures regarding GIS and remote sensing. In Kenya, the course received praise from the Kenyan side for its contribution to the betterment of technical engineers' fundamental technical knowledge in related areas who participated as trainees, including the SOK staff.

The curriculum for GIS training planned in this project is focused mainly on practical skills. Accordingly, it is not possible to spend time on fundamental and academic technical aspects. In this project, the academic training in the JICA-Net course and the practical training in this project would aim for synergy and cover the training needs of different engineers such as project workers, and project manageers. Based on the results of our study on user needs regarding GIS training, we proposed a training course management plan with a new JICA-Net for 2007 fiscal year.

2.5.4   Construction of Environment of Internet Connectivity

（1）   Current situation of the Internet Connectivity

SOK has set up its computer and network system with a connection to the Internet utilizing ADSL service provided by Telkom Kenya. The specification and cost of the ADSL service are indicated below:

- Speed (theoretical value): 512kb (downstream)/128kbps (upstream)
- Initial Cost: KSH 3,274
- Monthly Cost: KSH 35,914

Budget allocations have been made at SOK for ADSL costs.

The Internet connection was used for initial installation and updating the Operating System for the server and client computers to establish the infrastructure for the project Information and Communications System. In addition, the counterpart receives instruction on exploring technical information via the Internet.

On the other hand, the current Internet connection is not satisfactory for the transmission of spatial data for the Web server installed at SOK because of the low speed of 512kbps (downstream)/128kbps (upstream), which are the maximum theoretical speeds and not assured for actual performance. It will be necessary to investigate methods to distribute large data files and take the required steps to realize this capability.

（2）   Distributing large volumes of data via the Internet

1）   Problems with the current environment of the Internet connectivity.

In the project, the aim is to provide spatial data content (metadata and digital maps) via the Internet, however, it will be difficult to realize that goal with the current envrionment of Internet connectivity because of the two reasons given below:

- The access line to the Internet is narrow-band

    Especially, the upstream speed is as low as 128kbps. It is generally understood that it is not feasible to disseminate web content through such an access line. Moreover, the fact that the spatial data expected to be transmitted is relatively large makes the possibility of actualizing this goal very small.

- The Internet access is provided as "best-effort" service

    ADSL services are provided as a "best-effort" package with specifications of theoretical maximum speeds. Under the current environment, the maximum speeds of 128kbps (upstream) and 512kbps (downstream) are theoretical and their actual speed is much lower. In fact, the instability of the current Internet connectivity has resulted

in inaccessibility to the Internet many times throughout a day. It is not realistic to disseminate web content to the Internet utilizing this kind of access line.

2） Moving forward

A wireless dedicated line was provided for Internet connectivity in the Kenyan government budget at the end of June 2008. In comparison to the ADSL used thus far, connectivity will be much more stable. The bandwidth of this line is the same as before, 512kbps (downstream)/128kbps (upstream), but has enhanced the line in response to the needs of SOK.

2.5.5 Kenyan sense of project ownership

It was highlighted how SOK, which only has former experience with development projects, would perceive the project and the sort of response that would be elicited.

SOK's active role based on a sense of ownership was repeatedly emphasized as an indispensable part of the project when the Inception Report was explained and discussed in the first stage of the project, and we felt that this point was understood at that time.

（1） SOK's sense of ownership as an organization

In order for the project tasks to progress smoothly, SOK took action as an organization to lay the groundwork and improve workspace conditions (such as establishing offices, equipping them with materials and undertaking office improvements), looking toward plans for the future, and considered these tasks as part of their own operations. In particular, this includes efforts to secure and improve office space in the initial stage, post-project plans to enlarge offices, and the maintenance of equipment that has been supplied (such as constructing a shed to house the generator for power failures, and updating the circuitry to switch over the power supply). In addition, their designs to accelerate IT in the SOK offices by drawing up plans and acquiring a budget to commence these tasks, and their improvement of work conditions for the project, made it apparent that SOK's sense of ownership was in agreement with project advancement.

（2） Work force sense of ownership

The expert team requested two members from each field for a total of 10 counterparts for the execution of project work. According to this request, SOK provided 10 members which included staff from their management team. These 10 members included those that were reassigned for this appointment, so it was felt that SOK had a sense of ownership for the workforce behind the project. On the other hand, there have been repeated personnel transfers, and despite the fact that this C/P substitution is caused by external factors, it possibly becomes

an anxiety of obstacle to the continuity of activities and the aspect of self-development, and a deeper understanding towards project activities was desired.

（3）   Counterpart sense of ownership

Those counterparts which actually participated in project work, as aforementioned, consisted of both general staff and management. For some of these members, there was a question as to the minimum requirements in regard to their technical ability to perform the work, but the overall drive to move the project forward was positive and rich in spirit. In that sense, it was felt that counterparts had a sense of ownership for the project.

2.5.6   Monitoring meeting

A monitoring meeting was held to evaluate the stage of completion for the tasks of the project.

（1）   Holding the monitoring meeting

The monitoring meeting was held on 8 March 2007 with the C/P and expert team to evaluate the project stage of completion.

（2）   Monitoring meeting agenda

The agenda for the monitoring meeting was as follows.

1）   Project stage of completion

- Reaffirming the project objectives and outcomes
- Achievements made by the Kenyan side and Japanese side
- Achievements of each C/P group's activities
- The degree of achievement for each outcome based on activity results

2）   Monitoring each item of the PDM

- Monitoring of input achievement
- Monitoring of activity achievements
- Monitoring of outcome achievements
- Other

3）   Discussion of future project work details

- Problems identified through monitoring
- Countermeasures to identified problems
- PDM revision and changes based on problems identified and countermeasures

（3）　　Minutes of Meeting (M/M) for monitoring meeting

　1）　　Project stage of completion

After reaffirming the project objectives and outcomes based on the PDM, input achievements were reported on behalf of both Kenya and Japan. Also, the current progress of the activities and outcomes was reported by the C/P.

　2）　　Monitoring each item of the PDM

The discussion was carried out whether the above-mentioned report has problems or not. Since it was the first monitoring meeting together with the expert and the C/P, there was some difficulty in grasping the substance of the reports and extracting the problematic issues. To stay aware of the actual conditions (activities and results), detailed monitoring was performed using expert logs and C/P reports to their superiors. The recognition of problematic issues by the expert team played a central role.

　3）　　Discussion of future project work details

As described in the 2nd Chapter, the transition of project work was generally favorable. However, due to the delay of some equipment supply and poor IT infrastructure, a portion of the project work was carried over to the next period. Future measures were designated in response to these issues which were commonly recognized by both the C/P and the consulting team.

Furthermore, as monitoring was conducted, discrepencies arose in portions of the PDM (such as the expression and indicators of activity contents). In response, the expert proposed corrections, which were then accepted by the C/P side.

2.5.7　　The Newsletter and other Publications

（1）　Newsletter Publication

A newsletter was issued in order to widely publicize the progress of the project and intermediate results. A newsletter was published to mark any large event or turning point in the project.

The first issue was published in December 2006, centering on the events of the Spatial Infrastructure Standards Seminar 1 that had recently been held.

The second issue, a special volume on the disclosure of Nairobi maps on the Web, was published in March 2007.

The third issue, marking the completion of the first fiscal year work, including the progress and outcomes, was issued in March 2007.

The fourth issue was published after the Spatial Data Infrastructure Standards Seminar 2

(jointly with the Metadata Seminar), introducing the seminar report as well as the published draft document.

The newsletters have benn published 7times in total by end of theproject.

The newsletters were published on printer paper and posted on the pilot homepage which explains project work.

（2）　Publication of the Leaflet Announcing the Establishment of the Pilot Homepage

A leaflet included in the second newsletter informed relevant organizations and the general public of the establishment of the pilot homepage (above) and its contents.

This leaflet announced the news of establishing the home page and the ability to peruse digital maps of Nairobi (topographic maps, GIS data, etc.) on the home page. In addition, a summary of work operations at SOK, which hosts the home page, was included.

Chapter 3 Evaluation of Project Degree of Progress
3.1 External Conditions

3.1.1 Setting External Conditions according to the PDM

The external conditions contained in the PDM ver.1 are as shown below.

- External conditions of the activities

  The Kenyan side secures a suitable budget.

  A sufficient number of counterparts are secured.

  Cooperation with relevant organizations.

- External conditions of achievements

  The SOK employees that receive training through the project will continue at the workplace.

- External conditions of the project objectives

  Relevant organizations actively promote the application of GIS.

- Upper objectives

  Increase demand for GIS applications.

  Increased popularization of GIS hardware and software.

  Sustaining the government national land data application policy

  Preparation of systems to construct NSDI.

3.1.2 Perceiving the external conditions

The external conditions for activities and achievements are ascertained in the project team monitoring meeting and the 2nd JCC meeting to confirm that they are not obstacles to project implementation.

3.2   Measureing Evaluation Indicators

3.2.1   Output 1: SOK's capacity on reliable map digitization is improved for GIS promotion

The indicator used to evaluate Output 1 progress is as follows, from the first verified PDM.

- Indicator 1-1: Productivity of map digitization will be improved.

This indicator is acquired by means of the "Project Document".

The work implemented in the first year was the study on current conditions, compilation of the specifications and producing a map digitization manual. To apply the manual to practical work and measure productivity after the production of the manual was not achieved. Therefore, the indicator for Output 1 was not achieved by the end of the first year.

On the other hand, as we have mentioned, there are other indicators such as the level of attainment seen in the report on present conditions, map digitizing specifications and map digitizing manual, which were completed by the end of the first year which are seen as valid indicators of the degree of progress for Output 1. Furthermore, considering the above conditions and as was written in the section on the monitoring meeting, we proposed a review and revision of the output indicator, with which the C/P and JCC agreed. As a result, 2 more indicators have been added.

- Indicator 1-2: Map digitization specification will be prepared
- Indicator 1-3: Map digitization manual will be prepared

The indicators were revised and the evaluation indicator was measured from the second year as follows.

With the documentation of map digitization specifications and manual nearly complete, the additional 2 indicators have been largely fulfilled. The specifications and manual are suitable for immediate use. Nevertheless, SOK is now implementing the map digitization project and only now conducting in-house training, so the specifications and manual are not being applied. Thus, the indicator for improvement of the production of map digitization can not be measured yet. However, the C/P was able to plan and hold the in-house course in March 2008 and the staff in charge of map digitization able to provide instruction on what has been learned thus far and the specifications and manual. This is the basis to achieve indicator 1-1 Productivity of map digitization will be improved, and although indirect, provides means evaluate this highly.

3.2.2   Output 2: Spatial data infrastructure is standardized

The evaluation indicator used for Output 2 is as follows:

- Specifications for spatial data infrastructure, developed by the project, will be assessed

by the standards working group (WG) of NSDI.

There was overall consensus made in July 2007 among the GIS technical committee and at the Standardization Seminar 2. However, this product has not been developed yet as an application.

3.2.3   Output 3: Resources for GIS dissemination are developed.

The evaluation indicators used for Output 3 are as follows:

- GIS users will be satisfied with the training provided by SOK.
- A clearinghouse will be developed and managed.
- Nairobi city sample maps will be posted on the pilot website.
- Guidelines for geospatial data supply will be published.

（1）   GIS users will be satisfied with the training provided by SOK

The results of the questionnaire survey at the end of GIS training showed an extremely high evaluation by participants of the training content and quality of the curriculum.

（2）   A clearinghouse will be developed and managed

For this indicator, the installation and setting of ArcIMS and preparing the Internet environment in order to utilize the clearinghouse were completed. Also, metadata specifications (draft) were formulated, and using ArcCatalog, the metadata for 1:2,500 and 1:5,000 topographic maps was prepared. The clearinghouse is currently operational and it is possible to search the metadata prepared thus far. The objective has been achieved in a large part.

（3）   Nairobi city sample maps will be posted on the pilot website

The Web contents for the disclosure of Nairobi city sample maps were prepared in this operation. Also, the URL (knsdi.go.ke) has been obtained for the disclosure of data. The content that has been developed is now disclosed on the Internet via the Ministry of Finance server. This indicator has been achieved.

（4）   Guidelines for geospatial data supply will be published

A draft has been created using the Japanese model of geospatial data publication under the direction of the Chief Advisor, however this has not yet been published.

3.3   Evaluating Achievements from the Viewpoint of Monitoring

3.3.1   Output 1: SOK's capacity on reliable map digitization is improved for GIS promotion

The documentation of the related items needed to improve the map digitization work done at the SOK was largely completed, although it is not ready for actual use. Nevertheless, considering the level of technical difficulty in documentation, it is favorable that the end product is more than half completed.

3.3.2   Output 2: Spatial Data Infrastructure is Standardized

The spatial data infrastructure has been standardized. It is now vital to promote the application of the standard to create products.

3.3.3   Output 3: Resources for GIS dissemination are developed

The indicator for Output 3, as mentioned in 3.2.3, "A clearinghouse will be developed and managed" and "Nairobi city sample maps will be posted online" has been achieved. Nonetheless, if each indicator is isolated, as follows, we can say that the following achievement evaluation has been achieved.

- It is evaluated that the content of work done pertaining to GIS training and the degree of progress according with the plan.
- Understaning the metadata specifications
- Understanding skill and knowledge to prepare metadata used for ArcGIS
- Understaning hardware and software setting skill and knowledge to develop the clearinghouse
- Understanding skill and knowledge to create Web content has been achieved, although due to limitations of the internet communication environment, it is not possible to disclose this from the server at SoK so far. The remedial measures should be considered in the future to improve this point.
- Understanding Internet and networking skills and knowledge in order to disclose Web content online
- Understanding knowledge required for the formulation of spatial data provision guidelines

3.4 PDM Confirmation and Revision

3.4.1 PDM Confirmation and Revision by JCC

（1） PDM Confirmation at JCC

The first meeting of JCC was held on 24 November 2006 in the board room at ARDHI HOUSE, where explanation and discussion of the project work in the inception report took place, along with an introduction to the PDM (Project Design Matrix) which is contained in the report. The first draft of the PDM, which resulted from the explanation and discussion, was verified.

（2） PDM Revision at JCC

During the 2nd meeting of JCC on 9 March 2007 in the board room of ARDHI HOUSE, the progress and results of project work in the first fiscal year were explained and discussed. At the same time, we explained revisions to the PDM, which were made at the monitoring meeting. After that overview, a supplementary discussion was held on the revisions and changes, and the background for those changes were explained in detail.

Revisions and changes were as follows.

- The content of Output 3 was broken down and a detailed description was added.
- Adding indicators for Output 1, 2 and 3, the interim measurement of progress for project work was made possible.
- The process of technology transfer was added to the output examination methods.
- Activity 3 was expressed in more detail.
- The number of experts and work division in the input by the Japanese side were changed by the reality of operations and proposal.

The revisions and changes shown above were affirmed at the JCC meeting.

Chapter 4 Issues and Recommendations
4.1　　　Post project issues

4.1.1　　　Strengthening the capacity of SOK for map digitization

（1）　Trial use of the specifications and manual

It has not been possible to reach the stage in the project where the specifications and manuals that have been produced can be put into practical use. Thus, a pilot activity will be conducted to apply the specifications and manuals. The objective of the pilot activity is to confirm the validity of the specifications and manuals and to obtain the budget projection and production quota for digitization needed to formulate an actual digitization plan. Another crucial issue pertaining to the pilot activity and its results is to select the areas to revise and improve specifications and manuals based on discussion and investigation of these results within SOK.

（2）　Specifications and Manual Revision and Recognition within SOK

The revisions/improvements selected from the above activities will be added and new versions of the specifications and manuals will be prepared. The latest version will then be released within SOK. Afterwards, SOK will recognize these specifications and issue as official document.

Another issue pertaining to the specifications is to clarify the relation in comparison to NSDI digitization items.

（3）　Regular Document Maintenance

Because the manual is aimed at practical use and is written in detail using easily understood language, as software and hardware are updated/upgraded, the manual becomes outdated. It is therefore necessary to formulate a plan wherein the manual is regularly maintained.

On the other hand, it is also necessary to formulate a maintenance plan for the specifications so that they match maintenance performed for geospatial information standards.

4.1.2　　　Formulation of Spatial Data Infrastructure Standards

（1）　Forming more robust agreements

Priority in standardization activities is given to validity of the technology; however, it is vital that sufficient consensus built between stakeholders. Even after project completion, it is obvious that there are some organizations and individuals that have not yet accepted the standards. This requires the SOK to take initiative to adopt these standards and renewed activities for promotion.

（2）　　Producing concrete products

It is not necessary that the technical level of the specifications and the standards they are founded on extremely advanced from an international perspective, but that they should be effective in five years time. The aim is not the specifications and documents themselves, but producing products that are in compliance with them.

4.1.3　　Resources to Disseminate GIS

（1）　Training on GIS Usage

The GIS training course in the project was truly a great success and there is anticipation for regular training courses to be planned in the future. In order for the SOK to secure funding to hold training courses regularly, it is important that they enhance their ability to formulate of regular training courses based on budget plan.

（2）　　Examination of metadata specifications and Disclosure of Nairobi Sample Map

　1）　　Issues regarding construction of the clearinghouse

- Issues regarding metadata development

    The objective to disclose the Web server and clearinghouse has largely been achieved. The issue now is development of metadata. Inventory needs to be taken for the resources held by the SOK (including data and printed map sheets), and investigate the need to disclose each of these. Then, planning for metadata production should be made.

- Issues concerning offering data online

    The clearinghouse offers a data search function, but for SOK to plan on expanding functionality as a one-stop portal site, it will be necessary to properly operate this at SOK under government guidelines for spatial data provision.

4.1.4　　Issues concerning Integrated fields

（1）　Producing spatial data infrastructure

Spatial data infrastructure is the geographic information made up of the (ideally, free) basic feature framework covering the national land of Kenya. The digitization of 1:25,000 topographic map in SOK has included nearly the entire spatial data infrastructure, but because the specification of this digitization in not uniform, it can not be used as-is.

（2）　Providing free (or low-cost) spatial data infrastructure

It is necessary to disclose guidelines for spatial data provision (this was assumed in the project results, but as an organization that deals with data products in the first place). This includes the clarification of the rights and obligations in using the data products. However, essentially, as "infrastructure", spatial data infrastructure should be offered at no charge or remain at a very low cost (comparable to data media), (this does not mean that all SOK map sheets should be provided free).

On the other hand, at SOK, the protection of intellectual property rights is important, and the majority of opinion on the pricing and constraints concerning the use of data products and pricing issues seem to be negative.

4.2   Recommendations

4.2.1   Improvement of SOK's capacity for map digitization

The following recommendations are based on the following situation. In handling any issues when continuing follow-up activities, the digital map specifications and digitization manual were developed as important tools to improve the capacity of SOK to perform map digitization, and these are recognized within the organization. Also, the numerical data of digital map productivity (output quota) can be obtained.

（1）   Revision of existing 1/50,000 topographic map data

The existing 1/50,000 topographic map at SOK has already been partially digitized. However, the data that has been developed is not based on firmly established specifications. Also, this data targets part of terrain and features shown on a sheet of existing maps.

Given these conditions, recommendations are as follows.

- Make an inventory of the digitized data of 1/50,000 topographic map per map sheet. The inventory will include digitization items and their layers, data format, etc.
- Convert digital data of the existing 1/50,000 topographic map to digital data format that conforms to digitization specifications.
- Digitization of topographic data that could not be converted to comply with 1/50,000 topographic map digitization specifications and topographic data that had not yet been digitized.

Depending on the above, the existing 1/50,000 topographic map data can be arranged into digital map data based on 1/50,000 topographic map digitization specifications.

（2）   Digitization of existing 1/50,000 topographic maps

At SOK, there are still a large number of 1/50,000 topographic maps that have not yet been digitized at all. The following recommendations are for that process.

- Specify the map sheets of existing 1/50,000 topographic maps that have not been digitized at all.
- Calculate the total number and total area of undigitized topographic maps.
- Formulate a plan for digitization based on the production efficiency (output quota) obtained from these calculations, the follow-up and other issues. The plan will specify resources needed such as the production schedule, necessary materials, including type and quantity, and personnel needed.

（3）   Updating the existing 1/50,000 topographic map (Revisions of secular

changes)

The first stage of map digitization of 1/50,000 topographic maps in Kenya set out in recommendation (2) is complete. However, the majority of the existing 1:50,000 topographic maps have not been updated with revisions for secular changes. Therefore, the digitized map sheets and features to be updated must be specified and updated.

The following items are to be considered for specifying the geographic information to be updated.

- High priority is given to 1/50,000 topographic map data that corresponds with NSDI feature items.
- High priority is given to map sheets that are used frequently (such as municipal or areas marked for development)

This updated information will be the newest digital geographic information in map sheets and feature units.

（4） Digitization of thematic maps, topo-cadastral maps

In the follow-up and issues, the 1/50,000 topographic map was primarily targeted, but also draft documents for specifications and a digitization manual are being made for thematic maps and topo-cadastral maps. We recommend that these are digitized according to the same procedures and according to the need for these two types of map.

（5） Preserving reliability in digital maps

As said earlier, digital maps are created based on specifications, and these must be revised according to any changes made to standards for geographic information. It is also necessary to update manuals as needed when the software is periodically upgraded. These recommendations are for preparing an organizational system that will ensure that these periodic operations are implemented.

4.2.2   Formulating Spatial Data Infrastructure Standards

（1） Producing spatial data infrastructure

Up to this point, the activities of the mapping digitization group and the GIS standardization group have been integrated (on the premise of publishing guidelines to offer spatial data). We recommend spatial data infrastructure is constructed according to the following technical procedures.

- The 1:50,000 topographic map product specifications made by the map digitizing group are authorized within the department.
- The spatial data infrastructure product specifications made by the GIS standardization group are authorized within the department and among stakeholders.
- The procedures to extract or convert 1:50,000 topographic map product specifications to spatial data infrastructure product specifications is documented.

Spatial data infrastructure is constructed according to these documented procedures.

（2）   Provision of free (or low-cost) spatial data infrastructure

If the digital map is offered through the Internet, it's very hard for the capacity of SOK to charge users for it. Also, it would be difficult for SOK to explain externally the costs for updating data if the spatial data infrastructure was not recognized and used by users. Taking this into consideration, in order to spread spatial data infrastructure practically, publishing guidelines, constructing the clearinghouse and Web operation thus far are combined and the following measures are given consideration.

- The information offered free of charge over the Internet would only be the basic feature framework (e.g. political boundaries, water bodies, traffic). Also, the guidelines for these features (free use of data) are prepared.
- The remaining features of spatial data infrastructure, are offered offline through conventional media such as CD for a fee (low-cost), and guidelines for these features (fee-based use of data) are prepared, (for example, conditions of use the user agrees to confirmation of use).

4.2.3   Preparing resources for GIS dissemination

（1）   Training for GIS usage

In order to hold regular GIS training on an annual basis, a manual should be made that covers all of the steps needed to do so, such as obtaining budgets, requesting instructors, securing a venue and conducting a questionnaire. These items were organized in the follow-up activities, so it is recommended that a document is produced based on this information.

（2）   Operating the clearinghouse

1）   Recommendations for developing metadata

At present, metadata is developed using one of the applications included in the ArcGIS product called ArcCatalog, a metadata editor. However, although the editor is in compliance with ISO19000 series, ArcCatalog uses tags developed independently by

ESRI. Accordingly, it is ideal to develop a metadata editor that can be expanded based on the metadata specifications established in the ISO19000 series and in this project.

2） Recommendations for Clearinghouse and Web operation

In order to provide a stable search function for metadata and offer geographic information, it is necessary to operate and maintain a Web server and a LAN environment within SOK. Accordingly, when rebuilding the LAN environment within SOK, preparations should be made to guarantee that information can be sent from the SOK server assuredly, and that the clearinghouse and KNSDI website can be properly operated.

4.2.4 Formulating an Action Plan

The action plan was formulated during the project progress meeting held generally every Monday in order to encourage the each activity carried out by the C/P thus far to. This is shown in the figure below. This is the results that the C/P was instructed to prepare a concrete plan that they were able to accomplish on their own from a technical stand point without wavering from SOK policies.

The action plan contains the minimum items that the C/P is capable of accomplishing independently and technically. A brief outline is provided below.

- Digitize 1:50,000 topographic map at a pace of 10 sheets per month
- Make a plan for 3 in-house trainings (standardization, map digitizing) per year
- Continuously update the clearinghouse/metadata
- Make an annual plan for GIS training (external)
- Continuously revise and update the standards

Year	2008		2009											
Calendar Month	11	12	1	2	3	4	5	6	7	8	9	10	11
WORKING GROUPS													
STANDARDS													
Updating & improving Standards													
Evaluation of use of Specifications													
In house Training(SoK)													
Datasets Evaluation(KNSDI Stds)													
TRAINING													
Potential/Existing GIS Training													
Newsletter Production													
In house Training(SoK)													
Stake holders Training													
DIGITIZING	Digitizing revised topo sheets						Digitizing existing topo sheets						
1:50,000	13 sheets		10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets	10 sheets
1:100,000													
In house Training(SoK)													
METADATA													
Scale 1:2500													
Scale 1:10000													
Scale 1:50000													
Scale 1:250000													
WEB DESIGN/CLEARING HSE.													
Capacity buildings (Sytm admin.)													
Mirror Server													
Template Distribution													
Metadata Uploading													
DATABASE													
Database Population													
Capacity Building													
Data Population/updating Manual													

Diagram 4-1: Draft Action Plan at the end of the Project

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