Republic of Albania

The State Authority for Geospatial Information

Project on Geospatial Information for Sustainable Land Development in Tirana - Durres Area in the Republic of Albania

Final Report Summary

January 2022

Japan International Cooperation Agency (JICA)

PASCO CORPORATION

KOKUSAI KOGYO CO., LTD.

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JR
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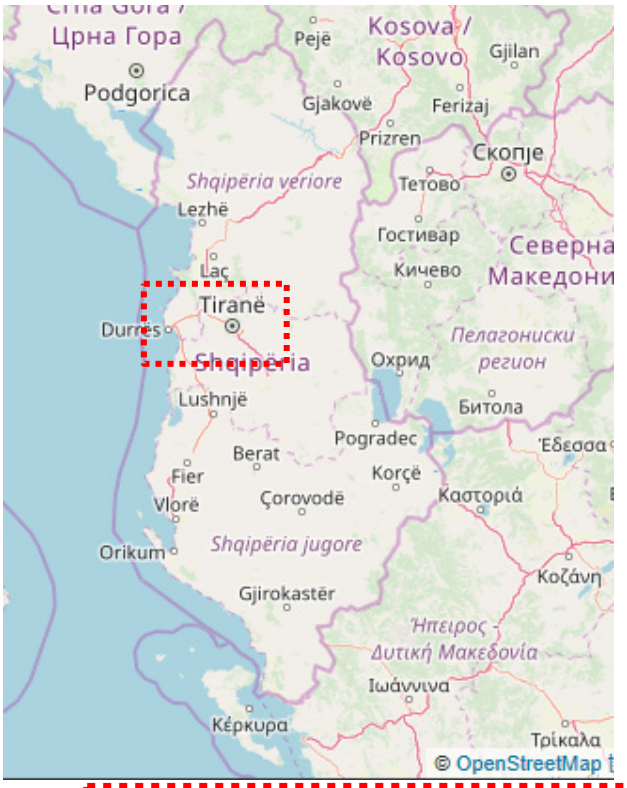
Location of the Project



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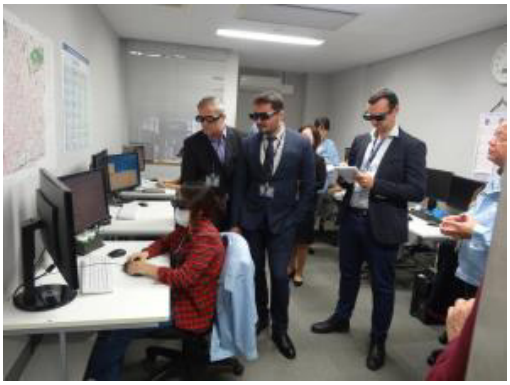

PASCO Okinawa (Training for executives)

	
JICA HQ (Training for engineers)	Mobara City (Training for engineers)
	
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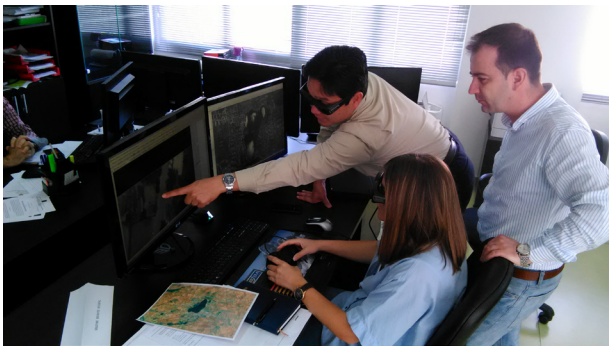
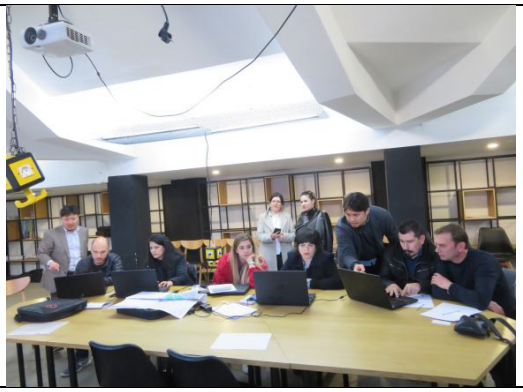
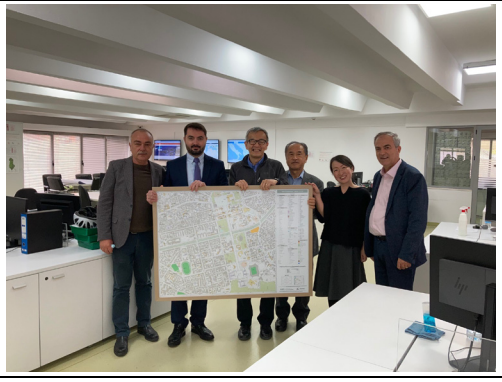
	
Technology transfer	Inspection
	
Training for students	Training for students

	
GIS training for municipalities	GIS training for municipalities
	
JICA Project Final Conference	Regional Conference
	
The 1st JCC	The 2nd JCC
	
The 3rd JCC	Handover of the digital topographic map

Abbreviation List

Abbreviation	Description
ALBPOS	Albania Positioning System
AREC	Agency for Real Estate Cadastral
ASIG	State Authority for Geospatial Information
BIG	Board of Geospatial Information
CORS	Continuously Operating Reference Station
DEM	Digital Elevation Model
DPS	Data Product Specifications
EU	European Union
GCP	Ground Control Point
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
INSPIRE	Infrastructure for Spatial Information in Europe
JICA	Japan International Cooperation Agency
KCA	Kosovo Cadastral Agency
MMS	Mobile Mapping System
OJT	On the Job Training
PDF	Portable Document Format
UAV	Unmanned aerial vehicle
UNVT	United Nations Vector Tile Toolkit
UPS	Uninterruptible Power Supply

1. Summary of the Project

1.1. Outline of the Project

1.1.1. Purposes, Expected Effects, and Target Area of the Project

The Project had the following purposes, expected effects, and target area.

(1) Background to the Project

The city of Tirana, which became the capital of Albania in 1920, is located on a plain, about 20 km inland from the Adriatic Sea. In addition, the city of Durres, which is located to the west of Tirana and faces the Adriatic Sea, is one of the leading port cities in Albania and supports the economy of Albania as a base for imports and exports. Since the surrounding areas of these cities are on the relatively gentle terrain, which makes land development easier, and there is a highway between the two cities for convenient transportation, the population in the Tirana-Durres Region, an area connecting the capital city Tirana to Durres in its suburbs, has been growing sharply in recent years. Especially in the city of Tirana, the population increased from approx. 550,000 in 2011 to approx. 610,000 in 2015 (approx. 22% of the total population of 2.8 million in Albania in the same year)[1], an increase of more than 10% in four years. The National General Plan for Territory was created in 2016 in order to deal with rapid urbanization and disorderly development due to the sharp population growth. In the future, sector-by-sector plans and land management registers must be created to promote infrastructure development based on the Plan. However, the large-scale (1/2,000) digital topographic maps on which they will be based had not been updated since the 1980s.

Meanwhile, the State Authority for Geospatial Information (ASIG) was established to conduct operations related to geospatial information in an integrated manner as part of the national strategies to meet the increasing needs for geospatial information development and prepare for accession to the EU in the future. ASIG had some challenges creating digital topographic maps by itself and conducting the quality control of handling orders for creation of orthophotos, etc. ASIG needed to improve its technical and managerial abilities to create digital topographic maps to ensure efficient development of such maps with adequate quality.

With the background described above, the Project is implemented based on a request made by the Albanian government to the Japanese government in order to develop digital topographic maps of the Tirana -Durres Region and improve the ability to maintain them.

(2) Purposes of the Project

The Project aims at creating 1/2,000 digital topographic maps (about 300 km^2) in the Tirana-Durres Region to enhance ASIG's abilities for photogrammetry and accuracy and quality management to encourage the

[1] Reference: the total population of Albania in 2021 was of 2.84 million and that of the city of Tirana was approx. 910,000 (approx. 32% of the total population.)

utilization of digital topographic maps and thus promote development of social services and infrastructure.

(3) Expected outcome

i. Creation of 1/2,000 digital topographic maps in the Tirana-Durres Region (about 300 km^2; 20 km^2 of which are to be created by ASIG)

ii. Creation of work regulations on technologies for digital topographic mapping

(4) Target area of the Project

Based on consultation with ASIG, the target area of the Project was determined as shown in Figure 1-1.

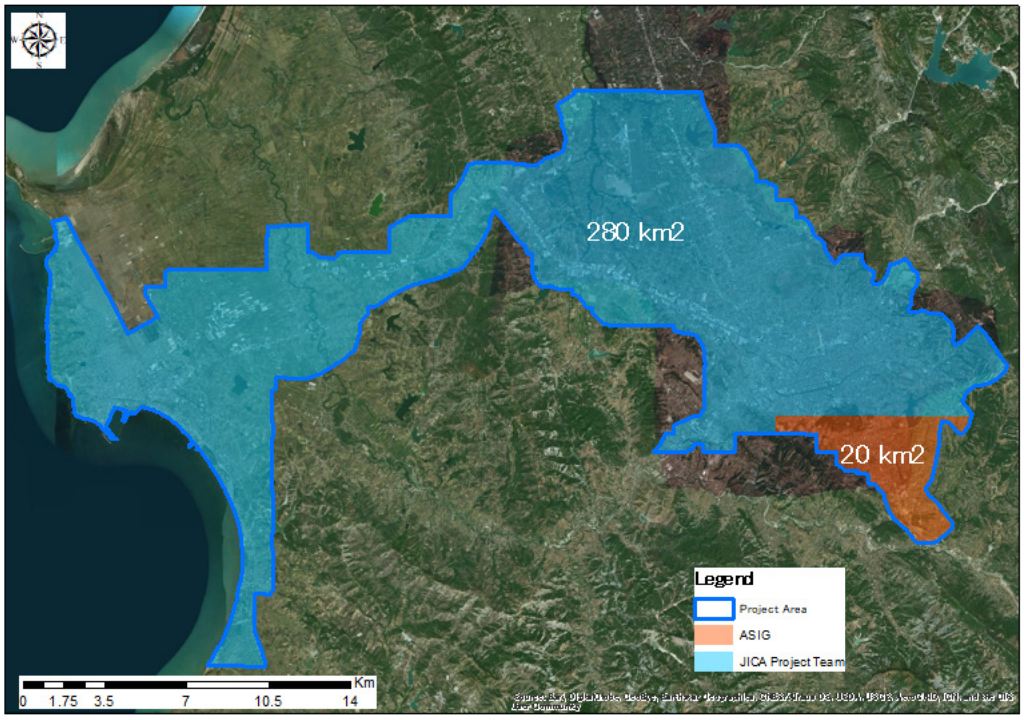


Figure 1-1 Target area of the Project

1.1.2. Outputs

The following table lists the outputs from the Project.

Table 1-1 List of the Outputs of the Project

Item		Quantity	Remarks
(1) Study reports	Inception Report (IC/R)	10 copies in English	Including 7 copies to ASIG
		1 PDF copy	1 copy to ASIG

Item		Quantity	Remarks
	Interim Report (IT/R)	3 copies in English	To JICA
		3 copies of Japanese summary	Ditto
		1 PDF copy	1 copy to ASIG
	Draft Final Report (DF/R)	3 copies in English	To JICA
		3 copies of English summary	Ditto To JICA
		5 copies of Japanese summary	Ditto
		1 PDF copy	1 copy to ASIG
	Final Report (F/R)	10 copies in English	Including 7 copies to ASIG
		10 copies of English summary	Including 7 copies to ASIG
		5 copies of Japanese summary	To JICA
		2 PDF copies	1 copy to ASIG
(2) Outputs of technical cooperation	1) Work regulations for digital topographic mapping and supervision (including manuals for topographic mapping) <u>Guidelines</u> - Geospatial Data Product Specification Creation - Field Verification and Field Compilation - Quality Evaluation of Map Data Manuals - Leveling - Ground Control Point Survey - Photogrammetry - Fieldwork - Data Capturing And Data Editing - Cartography and Generalization - Data Structurization	2 sets in English and Albanian	Including 1 set to ASIG

Item		Quantity	Remarks
	- UN Vector Tile - Survey Operation Manual for Topomap		
	2) Records of holding Regional conference	2 sets	Presentation materials and Videos
(3) Aerial photos and orthophotos	1) Result of GCP survey	1 set	
	2) Digital aerial photos	1 set	1,802 photos, Approx. 388 km^2
	3) Result of aerial triangulation	1 set	
	4) Orthophotos	1 set	1,178 photos
(4) Digital topographic maps	1) Field survey results - Field verification - Field completion	1 set	1 set to ASIG
	2) Digital data files (1) Digital topographic maps (2) GIS database (3) Digital topographic maps in PDF format (4) Data Product Specifications (including map symbols)	 2 sets 2 sets 2 sets 2 sets	 Including 1 set to ASIG Approx. 300 km^2 Including 1 copy to ASIG Approx. 300 km^2 Including 1 set to ASIG 162 Sheets/Files Including 1 set to ASIG
	3) Report on quality control including accuracy control tables	2 sets	Including 1 set to ASIG
(5) Vector tiles of the digital topographic maps produced by using UN Vector Tile Toolkit	UN vector tiles Program of web map site	2 sets	Including 1 set to ASIG Approx. 300 km^2 (10 zoom levels)

1.2. The Changes Made after the Project Started

Since the start of the Project, on the basis of consultation with ASIG and JICA, changes have been made to the following matters in the initial plan.

（1） New aerial photography

At the time of concluding R/D of the Project, ASIG agreed to use the aerial photographs taken in 2015 as the base of the digital topographic maps to be created by the Project. However, it was confirmed that a

considerable amount of changes had occurred over the years since 2015 in the target area of the Project. Therefore, JICA and JICA Project Team (hereinafter called "JPT") judged that the Project needs to cope with the changes. As a result of examining the method (comparison between new aerial photography and on-site survey, etc.) and the costs associated with them, it was decided to implement new aerial photography that is most appropriate in all aspects, including work period, cost, and quality. Due to this, the project duration was extended from 28 months to 37 months and it was decided to withdraw the orthophoto creation work of 1 km^2 using UAV that had been initially planned. The new aerial photography was conducted as described in 3.2.5 and the aerial photos were used for creation of the digital topographic maps as described in 3.2.8.

The 1st amendment of R/D was signed on 25th October 2017 for the above change.

(2) Accuracy of digital topographic map

At the time of the second dispatch of JPT (12 September – 31 October 2017), the accuracy of the planar position that the digital topographic map of scale 1/2,000 specified by ASIG should have was confirmed to be higher than the accuracy standard of equivalent scale applied in Japan. The former is 40 cm and the latter is 140 cm. Therefore, in addition to the usual digital map creation process, it was decided that JPT together with AGIS would make sure of the following to ensure the targeted accuracy.

1) The newly taken aerial photography shall have specifications equivalent to those carried out in 2015.
2) While carrying out stereo plotting, in principle, operators enlarge the display scale of the aerial photographs used for the work equivalent to 10 times of 1/2,000.
3) ASIG and JPT mutually check the intermediate data by using the newly created orthophotos and make modifications as necessary. The scope and locations of the inspection target shall be decided upon consultation between them.
4) JPT shall submit the provisional final product to ASIG and have it inspected. Based on the inspection results, JPT shall make necessary modifications and submit it to ASIG as the final product, and then obtain the certificate from ASIG by the time of draft final report creation.
5) Likewise, JPT shall receive provisional final products that ASIG produces with OJT and carry out inspections. Based on the results, ASIG shall make necessary modifications and submit it to JPT as the final product. Based on the submitted results, JPT shall summarize suggestions and others in the draft final report.

JICA and ASIG signed on the minutes of meeting dated on 25th October 2017 regarding the above matter.

(3) Change of procurement of equipment and materials

In response to the results of ASIG's actual circumstances survey after the Project began and upon request,

an A3 digital multi-function printer (including expendable items) which was planned to be procured was cancelled, the number of licenses of some software, etc., was reviewed, and the configurations of installation for the software were changed (refer to 3.2.14 for details).

(4) Change of compliant geographic information standards

In the first mission in July 2017, JPT obtained the specification plan of the digital topographic map from ASIG and verified this specification plan on the completion of the first mission. As a result, JPT found that the data acquisition target features were similar to those they assumed at the start of the project, and there was no particular objection in the explanation to the ASIG Director General and the ASIG members. However, when JPT gave a progress report of the work on 10 October 2017, the ASIG Director General stated that "the specifications of the digital topographic map to be created in the Project should be compliant with the INSPIRE directive (geospatial information standard in Europe)". As a result of repeated discussions between JPT and ASIG, JPT and ASIG agreed that it was appropriate to create the digital topographic map compliant with the INSPIRE directive by considering that the INSPIRE directive sets out common rules for geospatial information in each EU country, and the background is that compliance with them is one of the requirements for EU accession. JICA also agreed.

For this reason, comparisons and additions / subtractions between the geodetic reference system and topographic map features that had been independently applied in Albania and those defined in the INSPIRE Directive was conducted.

(5) UN vector tile production

For further promotion of utilization of the topographic maps, vector tile production by using UN Vector Tile Toolkit and the related technology transfer were added to this Project. The project duration was extended from 37 months to 48 months in order to implement this activities and due to the COVID-19 pandemic.

The 2nd amendment of R/D was signed on 24th June 2020 for the above change.

(6) Extension of the project duration due to COVID-19

The project duration was extended again from 48 months to 57 months due to COVID-19 pandemic.

The 3rd amendment of R/D was signed on 30th April 2021 for the above change.

2. Project Outcome, Effectiveness, and Recommendations

2.1. Attainment of the Project Purposes

The given project purposes were attained as follows.

Table 2-1 Attainment of the Project Purposes

Purpose	Attainment
A digital topographic map (approximately 300 km^2) at 1/2000 covering Tirana-Durres area is developed.	In the course of the Project, a 1/2,000 digital topographic map (approximately 300 km^2) was developed.
ASIG's capabilities in photogrammetry and accuracy/quality control are strengthened and thus promote the development of social services and infrastructure.	ASIG's capacity has been enhanced through technology transfer in topographic mapping, including photogrammetry. The overall capacity of ASIG in topographic mapping has been enhanced through technology transfer in accuracy and quality control. ASIG has begun to update the topographic maps by themselves using the equipment provided in the Project. From this, it can also be confirmed that the purpose of capacity building has been achieved. The orthophotos created in the Project have been already utilized in the work of local governments and contribute to the development of social services and infrastructure. ASIG Geoportal has 238 different layers and is accessed by about 1600 users every day. The orthophotos created by the project were uploaded to the ASIG Geoportal on 27 August 2018. According to ASIG Geoportal data from 27 August 2018 to 3 November 2021, the orthophotos are the most clicked by users when compared in terms of clicks per km^2 among 238 layers. In the future, it is expected that the digital topographic maps prepared at a scale of 1/2,000 will be utilized for development of social services and infrastructure as they become more widely available in Albania.

As mentioned in the table above, ASIG has already been expanding and updating the topographic maps by themselves by using used the aerial photos taken in the Project and equipment provided. The map of Figure 2-1 is one of the examples created by ASIG. JPT believes that this is the evidence that ASIG successfully built sufficient capabilities in creation of topographic maps.

Figure 2-1 Example of the map created by ASIG after the technology transfer

2.2. Expected Effect in Future

(1) Now that the 1/2,000 digital topographic maps (about 300 km^2) of Tirana-Durres area have been prepared, they are expected to be used by various users. Especially, municipalities in the Project area where 1/2,000 digital topographic maps were developed will use them for the following purposes; 1) To manage land and houses by overlaying the topographic maps with land registry maps, 2) To record houses on the topographic maps for the purpose of fixed asset taxation, 3) To make a housing development plan on the topographic maps, 4) To record houses damaged by the 2019 earthquake.

(2) The quality of topographic maps to be produced by ASIG in future will be further improved by following the survey regulations and specifications developed by the project.

2.3. Recommendations

Recommendations 1: Provision of digital topographic maps to a wide range of users

The digital topographic maps developed in the Project maintain a high level of accuracy and also contain a variety of information. For this reason, the data are very useful not only for the governmental agencies, but also for a wide range of users, including municipalities, research institutes, private companies, and the general public. It is unfortunate that the existing ASIG geoportal could only show them. In order for users to use digital topographic maps in their daily work and business, the maps need to be provided in the form of vector data that can be analyzed and edited, not just viewed.

JPT recommends ASIG to extend the functions of the ASIG geoportal to enable analysis and editing on the web

browser in the future.

Providing the digital topographic maps in the hands of relevant agencies is also an important preparation for future disasters and pandemics.

Recommendation 2: Update of topographic maps and expansion of topographic map area

Since the land use in the area where the topographic maps were prepared is changing rapidly, ASIG should update the topographic maps in a timely manner and expand the coverage of topographic maps to contribute to the development of local cities and infrastructure.

In order to achieve proper updating of the existing topographic maps and expansion of the mapping areas, in the long term, it is necessary to develop a national plan for the development of geospatial information in Albania and to set national development goals. In the short term, it is necessary to promote map production and regularly update the geospatial information, especially large-scale topographic maps, in densely inhabited districts and planned development areas.

Aerial photography with high resolution by aircraft should be conducted periodically (e.g., every three years) over the entire area where the topographic maps were created, and in large-scale development areas, it is desirable to take aerial photographs by drone each time after the completion of construction and to use them for updating.

These works and the expansion of the topographic map area will require a large budget. Therefore, ASIG should develop a medium- to long-term plan for updating and expanding the topographic maps, as well as a budget plan for these purposes, and to secure financial resources.

In addition, it is expected that the value of topographic maps in the Albanian government will be further enhanced by sharing information with the following geospatial information users. If the use of the topographic maps as a common social infrastructure becomes a standard within the government agencies, the government will inevitably allocate more budget for the expansion of the topographic maps.

It is also effective to carry out partial updating of topographic maps with the cooperation of municipalities. ASIG has a future goal of rebuilding a geoportal equipped with editing functions (building a WEBGIS) and allowing municipalities to update the topographic maps on the geoportal.

In order to realize them, both taking technical measures such as system development and designing the institutional arrangement are required, including clarification of shares of responsibilities among the municipalities and ASIG regarding the topographic map update.

As a preliminary step to achieving this goal, JPT proposes as follows; (1) ASIG establishes a workflow to update topographic maps based on the information obtained from municipalities. (2) Based on the workflow, ASIG receives accurate information from the municipalities on the areas to be updated. (3) ASIG repeats the topographic map update

with the information from the municipalities. (4) After the stabilization of map update process, ASIG trains the staff of each municipality in topographic map revision. (5) Each municipality updates the topographic map based on the information collected by themselves. (6) Each municipality forwards the updated topographic maps to ASIG. (7) After inspecting the updated topographic maps by the municipalities, ASIG keeps them in their server, (8) ASIG starts the design of WEBGIS by which each municipality could update the topographic maps more easily.

Recommendation 3: Promotion of activities to increase the number of GIS users within Albanian governmental organizations

The use of GIS is expected to be effective in facilitating policy making and the implementation in the Government of Albania, the municipalities, and the public corporations in Albania. However, the use of GIS by each institution is not always sufficient at present. The challenges are that the geospatial information (digital topographic maps, etc.) that can be used is not sufficiently prepared as described above, and that the technology using GIS has not fully penetrated the users.

In order for digital topographic maps to be used not only for viewing but also for business purposes, GIS training is needed for municipalities which lag behind in information technology among government agencies and lack the technical personnel. GIS training and procedures for typical use cases should be widely provided. In order to realize this, ASIG shall take the lead in this activity. For this purpose, it is important to further improve the skills of ASIG staff and secure the necessary personnel and budget.

As the number of GIS users increases, the need for new and updated topographic maps will increase. The Albanian government will prioritize the allocation of geospatial information budgets. Then ASIG will be able to create and update topographic maps instantly. JPT recommends that ASIG take steps to actively increase the number of GIS users in order to form this virtuous cycle.

3. Results of Project Implementation

3.1. Workflow

The workflow of the Project was as shown below.

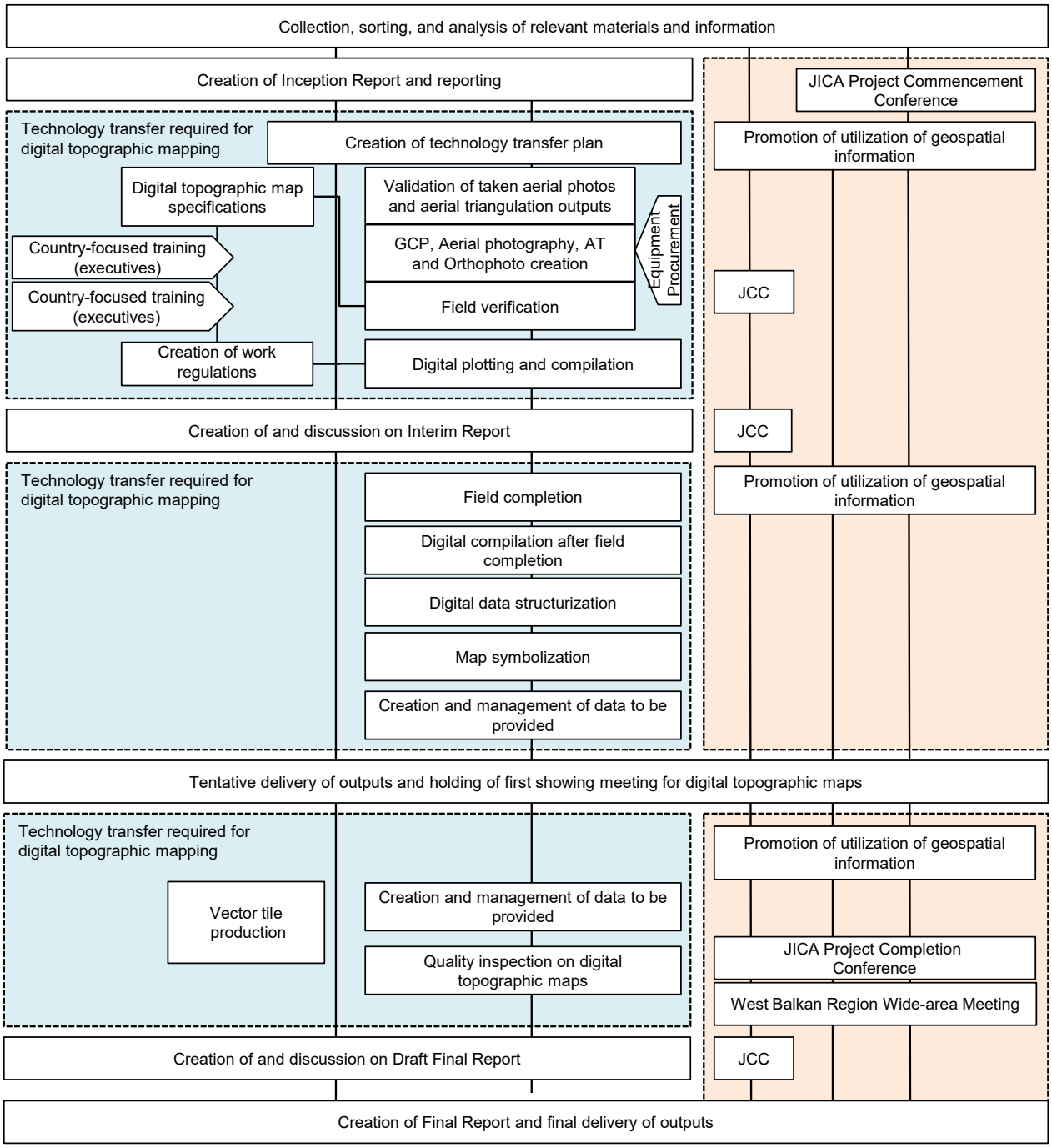


Figure 3-1 Project Workflow

3.2. Completed Work

3.2.1. Collection, Sorting, and Analysis of Relevant Materials and Information

JPT analyzed the materials collected by the detailed planning survey conducted in January 2017. Furthermore, the information and materials available in Japan were collected, sorted, and analyzed in preparation for the

Inception Report of the Project.

3.2.2. Creation of Inception Report and Reporting

Based on the TOR of the Project and related materials, JPT prepared the Inception Report describing the activities, the work process schedule, and the personnel plan of the Project, together with the draft of the technology transfer plan. After that, the several changes described in "1.2" were made based on mutual understanding and agreement among JICA, ASIG, and JPT.

3.2.3. Creation of Technology Transfer Plan and Implementation of Technology Transfer

Technology transfer from JPT to ASIG was carried out throughout the Project based on the technology transfer plan created under the agreement of JPT and ASIG. The details of the technology transfer are described in Chapter 4.

3.2.4. Validation of the Aerial Photos taken in 2015 and their Aerial Triangulation Results

Since digital topographic maps were originally planned to be created using the aerial photographs taken in 2015, JPT validated them together with the aerial triangulation results and found no defect.

A stereo model was established based on the obtained aerial photographs and the results of the aerial triangulation, the reference points were measured in three dimensions, and the model was verified by comparing the reference point value with the measured value. As a result, it was confirmed that there was no issues with accuracy.

3.2.5. Ground Control Points Survey, Aerial Photography, Aerial Triangulation, and Orthophoto Creation

Ground control point survey, aerial photography, aerial triangulation, and orthophoto creation were out-sourced and conducted by Hansa Luftbild AG of Germany (hereinafter referred to as Hansa) which was selected through nominated competitive bidding. JPT managed the progress and supervised the work.

Prior to the aerial photograph shooting, a total of 40 Ground Control Points (GCP) were surveyed and established. Aerial photographs were taken on 26 and 27 May 2018 according to the flight plan shown in Figure 3-2.

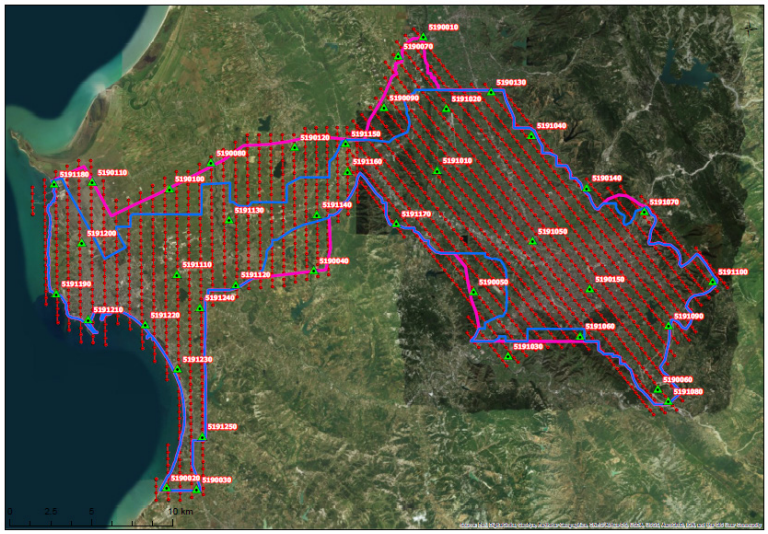


Figure 3-2 Photography plan

After receiving the photographs, orthophotos, and the related documents from Hansa, JPT provided the orthophotos to ASIG in August 2018. The aerial photographs together with the result of aerial triangulation were used for creation of digital topographic maps.

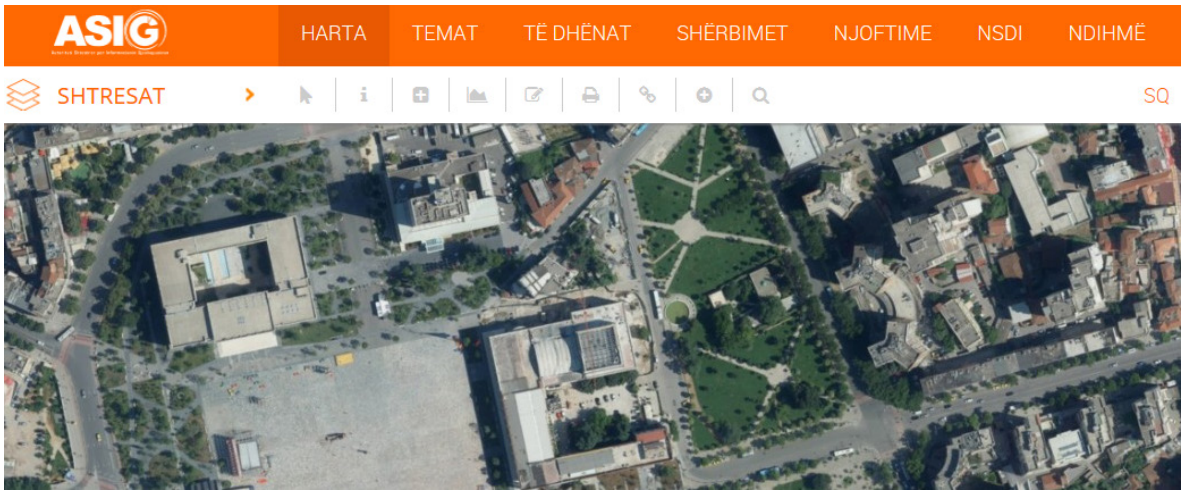


Figure 3-3 ASIG Geoportal (https://geoportal.asig.gov.al/map/?auto=true)

3.2.6. Discussion on Map Symbols, Work Criteria, and Specifications

As described in 1.2（4） above, the Project decided to comply with EU INSPIRE directive.

The directive includes not only general rules concerning the development of geospatial information, but also specific data product specifications, and defines the feature items to be acquired and their data structures. Therefore, in order to comply with the data product specifications, it is not possible to formulate the feature items and data structures to be acquired independently in this project, and the features defined in the data product specifications are within the EU region. It was judged that there would be excess or deficiency in application in Albania due to the setting of general feature items. The following work was conducted.

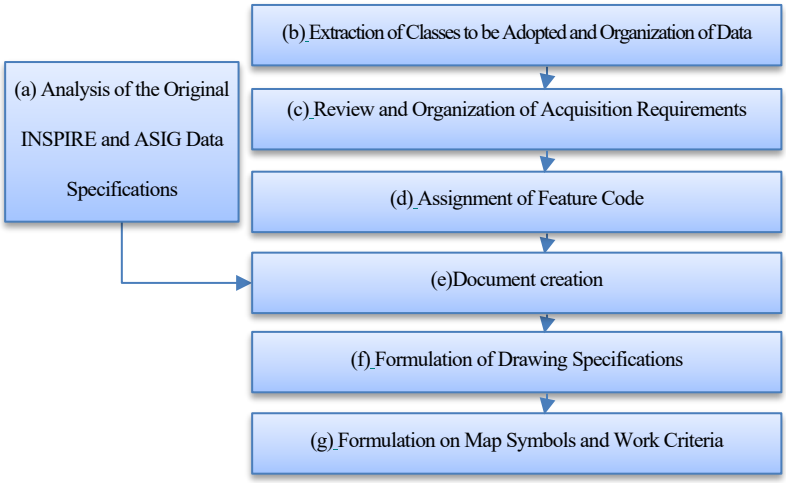


Figure 3-4 Procedure for discussion on map symbols, work criteria, and specifications

a) Analysis of the Original INSPIRE and ASIG Data Specifications
b) Extraction of Classes to be Adopted and Organization of Data Structures and Attributes
c) Review and Organization of Acquisition Requirements
d) Assignment of Feature Codes
e) Document Creation
f) Formulation of Drawing Specifications
g) Formulation of Map Symbols and Work Criteria

In July 2021, the Data Product Specification 1.0 version was prepared after minor correction of its contents and without major update in its contents as the first complete version and provided to ASIG.

Table 3-1 shows the spatial reference system of the digital topographic map.

Table 3-1 Spatial reference system

Spatial Reference System	KRGJSH2010
Ellipsoid	GRS80
Semi-major axis	6378137.000 m
Inverse Flattening	1/298.257222101
Reference System in Height	Mean Sea Level of Adriatic sea
Projection System	Transverse Mercator Zonal
Scale Factor at Origin	1.0000
The origin of coordinate system	20°00'00" East of Greenwich, the equator
False Easting	500,000.00m
False Northing	0.00m
Unit of Measurement	Meter (Three Places of decimals)
Datum	ETRS89 (European Terrestrial Reference System 1989)

3.2.7. Creation of Work Regulations

JPT has prepared a draft of the work regulation for the production of 1/2,000 digital topographic maps, including accuracy and quality control for each step of the process. As a result of the comparison and review of the regulations developed in Japan and in Albania, it was decided that there are three new areas to be developed: creation of geospatial data product specifications, field verification and field compilation, and quality evaluation.

The Public Survey Work Regulation in Japan is based on the ISO 19100 series (Geographic Information). This is in line with ASIG's desire to develop geospatial information based on the INSPIRE Directive, which was created based upon ISO 19100 series. Accordingly, JPT made a decision on the fields to be compared and examined in the Japanese regulations.

The draft regulations were prepared by referring to the following Japanese regulations and manuals. Specifically, the relevant parts of the existing regulations were extracted and reorganized. In addition, JPT prepared a draft of the parts that need to be added or updated, such as those related to the methodology of field surveys using tablet PCs. The English version of the regulations was then prepared.

- Geospatial Data Product Specification Creation Guideline
- JICA’s Survey Regulation (Covering entire mapping works from Trigonometric survey to map revision)
- Guideline on the quality of map data and its evaluation (Rev. 1) (Draft)

The three documents JPT has prepared are draft regulations. However, for the time being, they should be considered guidelines for practical use, and based on the evaluation, they should be redeveloped as regulations in the future. In the technology transfer, JPT explained that they should be developed as part of the official regulations issued in Albania.

3.2.8. Creation of Digital Topographic Maps

3.2.8.1. Field Verification

"Field verification" work is to verify and collect information of features necessary for the creation of maps defined in the specifications that can only be checked on site, such as information of places that cannot be clearly viewed in aerial photos and names and classifications of facilities. The work was carried out in accordance with the Data Product Specification 0.1 version.

Lorenco & Co SHPK (an Albanian company, hereinafter referred to as Lorenco & Co), selected through open tendering, completed the work for 280 km^2 under the supervision of JPT. For the remaining 20 km^2, ASIG personnel completed the work during the OJI for technology transfer (See 4.3 for technology transfer.).

Photo 3-1 Field verification work

ASIG and JPT searched and examined the existing information available in Albania and then decided to use the information listed in Table 3-2 for the topographic map. The information was collected by ASIG from the National Geoportal or related organization and shared with JPT.

The collected information was examined to determine whether it could be applied to new topographic maps, such as scale, location accuracy, and time of information. The facility information (existence and name) that can be confirmed on site (such as Educational_Institutions, etc.) was confirmed and updated by Field Completion work.

Table 3-2 List of existing information to be used for the topographic maps

Source information	Source from	Decision
Geographical_names.shp	ASIG Geoportal information	Use for NamedPlace
Rivers_monitoring_stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/RiverMonitoringStation

Source information	Source from	Decision
Noise_Monitoring_Stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/NoiseMonitoringStation
Pollution_Monitoring_Stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/PollutionMonitoringStation
Beach_monitoring_stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/BeachMonitoringStation
Educational_Institutions.shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Governmental_institutions_(ADISA).shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Governmental_institutions_(RTSH).shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Order1_(State).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace
Order2_(AdministrativeBoundary).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace of QARKU
Order3_(Municipal).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace of Municipality
Land_Covering(CORINE).shp	ASIG Geoportal information	Reference information to create the latest LandCoverUnit area based on the new Ortho image
Monuments_of_Culture_Point.shp	ASIG Geoportal information	Use for NamedPlace
Monuments_of_Culture_Polygon.shp	ASIG Geoportal information	Use for NamedPlace
UKT_WaterandSanitation_20181101	Water and Sanitation Directory of Tirana (UKT) (collected by ASIG)	Use only for reference layer due to poor accuracy (Only overlay with new map data. Do not merge with new map)

Source information	Source from	Decision
roadCategory.shp urbanArea.shp	ASIG Geoportal information/Created and categorized by JPT with APT's instruction	Categorize "highway" and "interurban" road according to the "roadCategory.shp". For the categories except for "highway" and "interurban" and the others ("path"/"underconstruction"/"gardenRoad"/"bicycleLane"), The road inside of "urbanarea (urbanArea.shp)" shall be categorized as "urbanRoad". The road outside of "urbanarea (urbanArea.shp)" shall be categorized as "villageLocalRoad".

Water information (UKT)

As a result of the examination of the collected water network information, problems were found such as topology error in the water pipe network, and misalignment of manhole positioning. ASIG and JPT found that it would be difficult to correct these errors in order to integrate the water network information into the new topographic map. ASIG and JPT discussed and agreed to use the water network information provided by UKT as a reference layer rather than integrating it into the new topographic map.

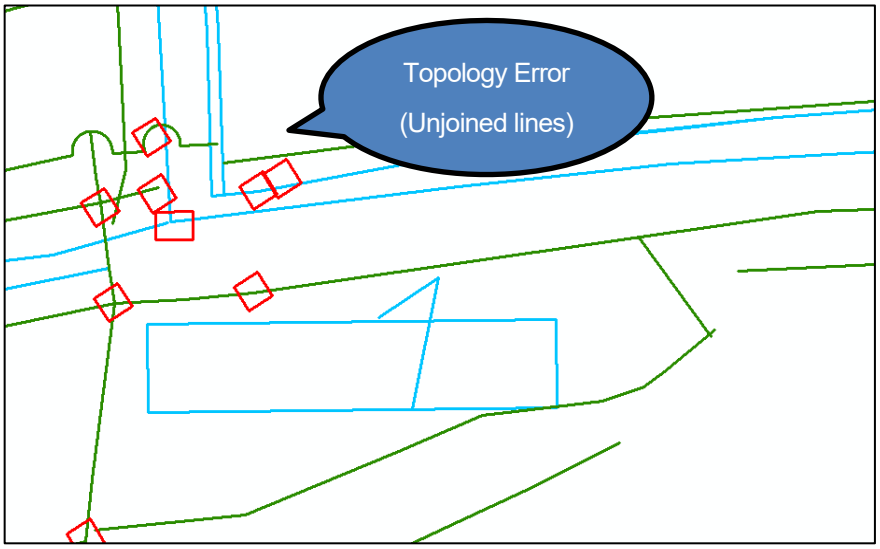


Figure 3-5 Water network data

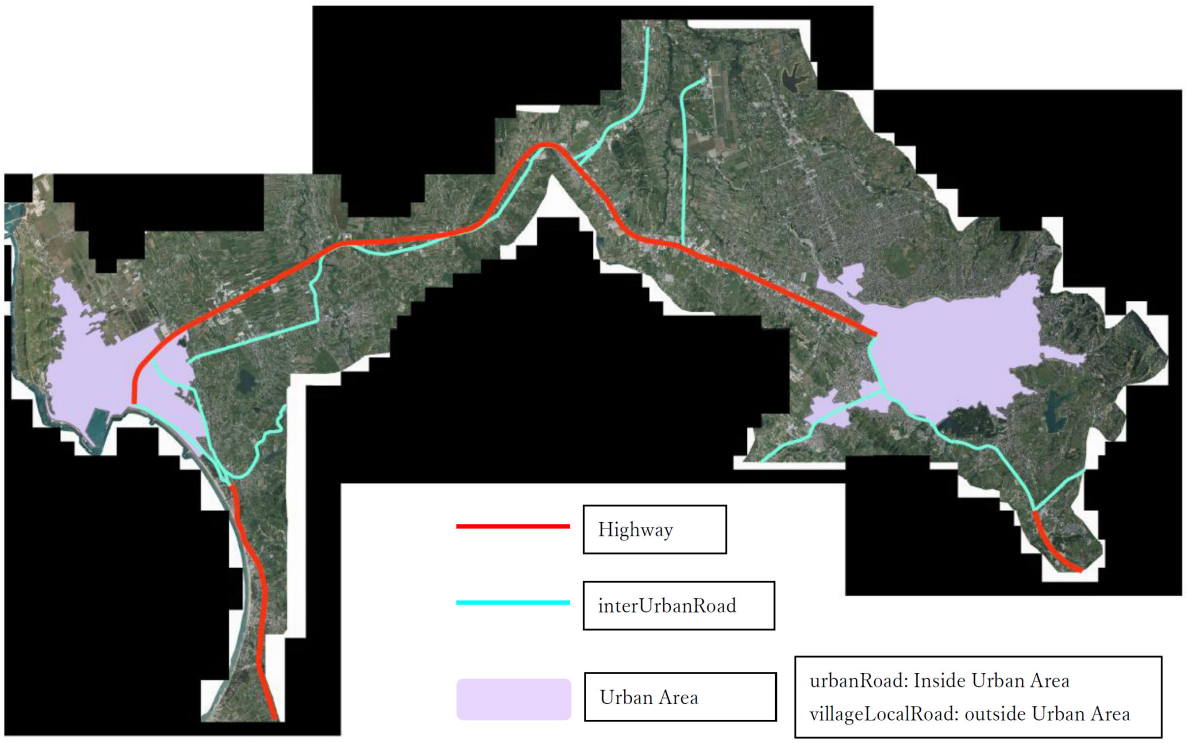


Figure 3-6 Road category

3.2.8.2. Stereo Plotting and Compilation

Based on the DPS described in 3.2.6, topographic and other features were plotted using the aerial photos and the field verification result both in Albania (OJT) and Japan. The procured software for photogrammetry was used for the stereo plotting work and its technology transfer described in 4.4 and 4.6.

Figure 3-7 Examples of stereo plotting ((Left) Roadarea, (Middle) VehicleTrafficArea, (Right) Roadarea and VehicleTrafficArea)

3.2.8.3. Field Completion

"Field completion" work is to verify the things that are found to be unclear during the stereo plotting and compilation work in the field. It is important to understand well the questions and instructions given by the operators of the stereo plotting and compilation work, correctly identify the items to be confirmed, and properly answer questions.

This work was carried out by ASIG (OJT), JPT, and Lorenco & Co.

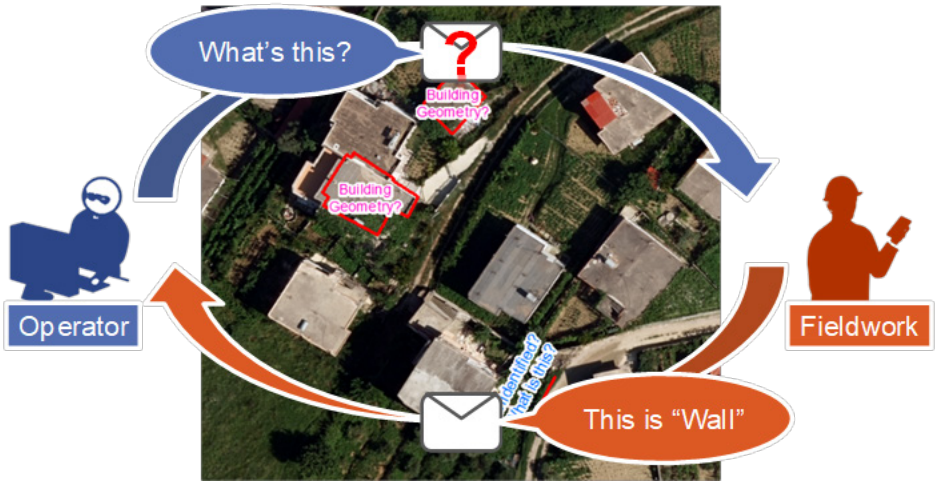


Figure 3-8 Concept of Field Completion Work

3.2.8.4. Digital Compilation

Using the results of the field completion and existing materials such as the administrative boundary, 1/2,000 plot data of the project area were created. Thematic inspections such as classification and attributes and topology inspections were carried out, and the final data were completed.

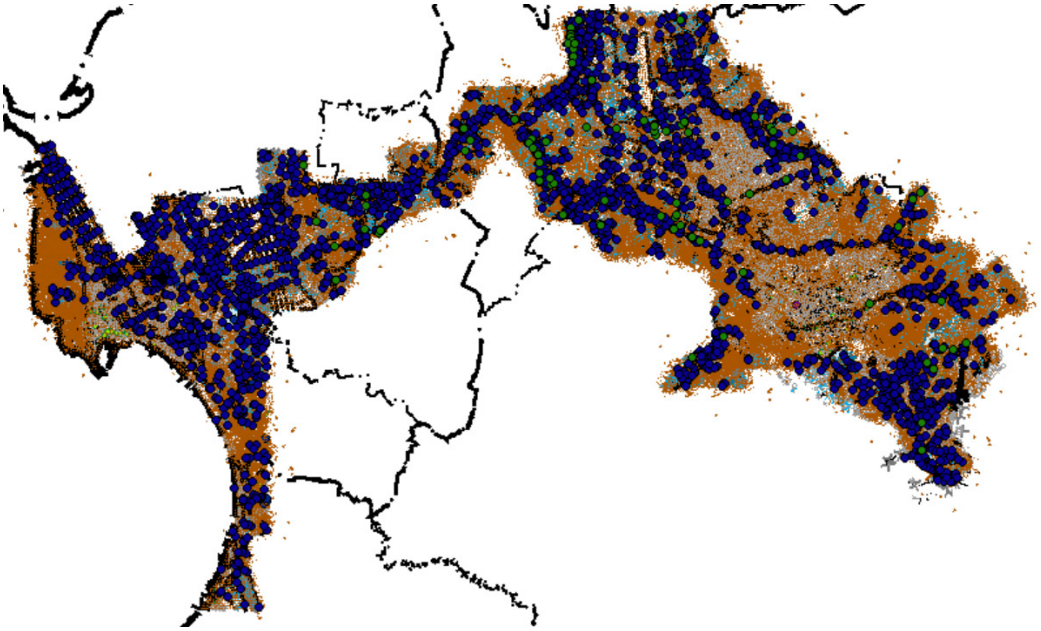


Figure 3-9 Result of Stereo Plotting and Compilation

3.2.8.5. Digital Data Structurization

The digital topographic maps were created in seamless form. Geodatabase has been processed to be topologically structured data that are suitable for applicative GIS purposes. ArcGIS Enterprise 10.6.1 was installed in the procured data storage server and a database (Enterprise Geodatabase) was established for geospatial data. PostgresSQL10 was used as a database management system. The same data specification as DPS described in 3.2.6 was applied. Among the data specifications, some modifications based on technical restrictions of software such as ArcGIS Enterprise and PostgresSQL (limitation on the number of characters in variable names and requirements for prefixes and suffixes) was implemented. The modification was done by replacing characters, codes, etc. that are uniquely bidirectionally exchangeable with the original data specifications.

3.2.8.6. Map Symbolization

Based on the DPS, map symbols were applied as shown in Figure 3-10. The design of map layout was determined as shown in Figure 3-11 based on the request from ASIG for map unit sized symbolized maps.

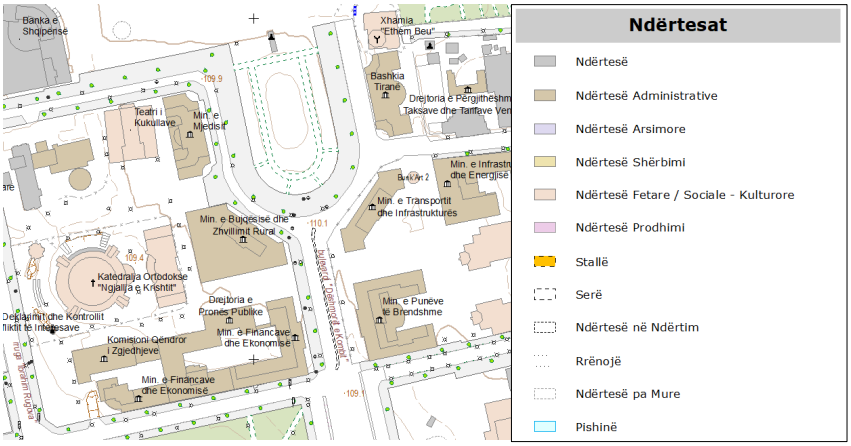


Figure 3-10 (Left) An Example of Symbolized Map, (Right) Legend of “Building

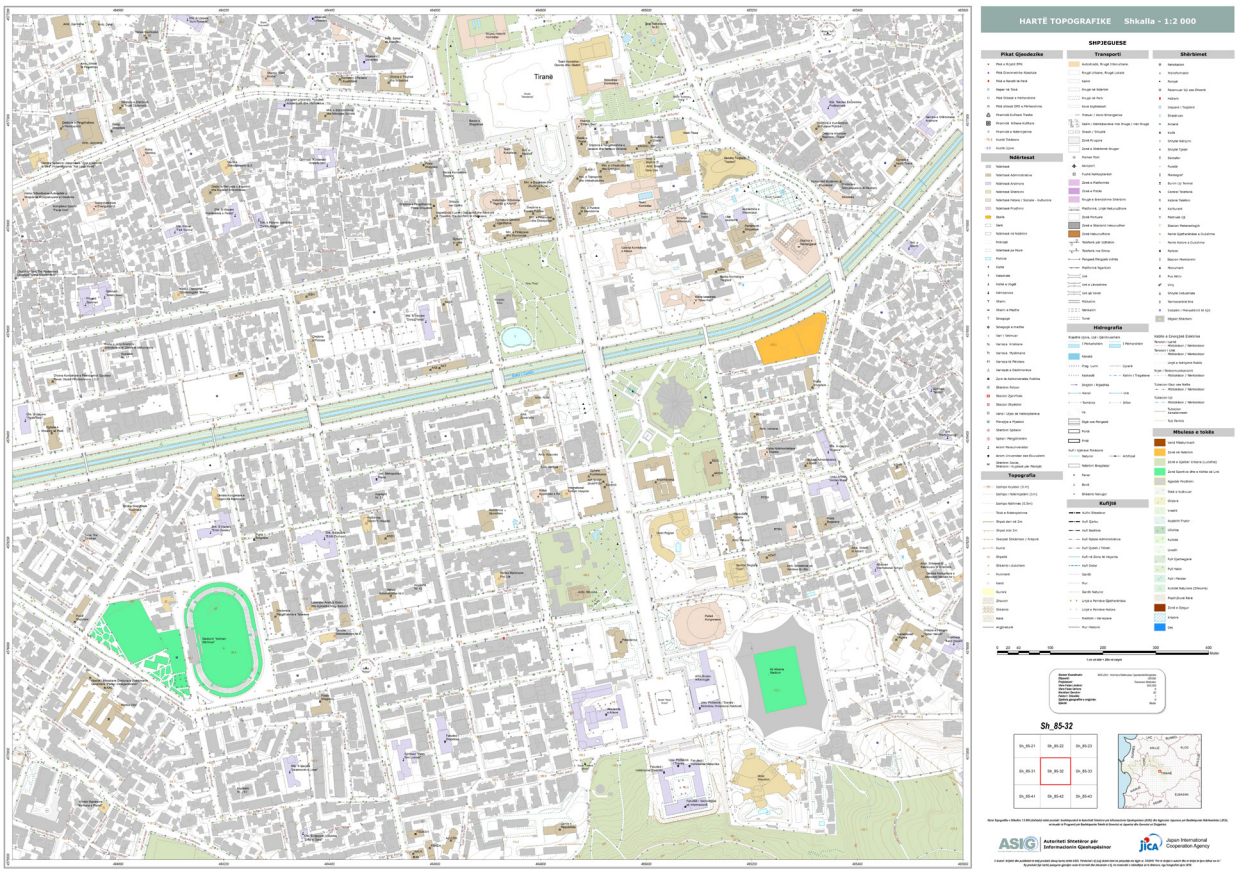


Figure 3-11 Map Layout

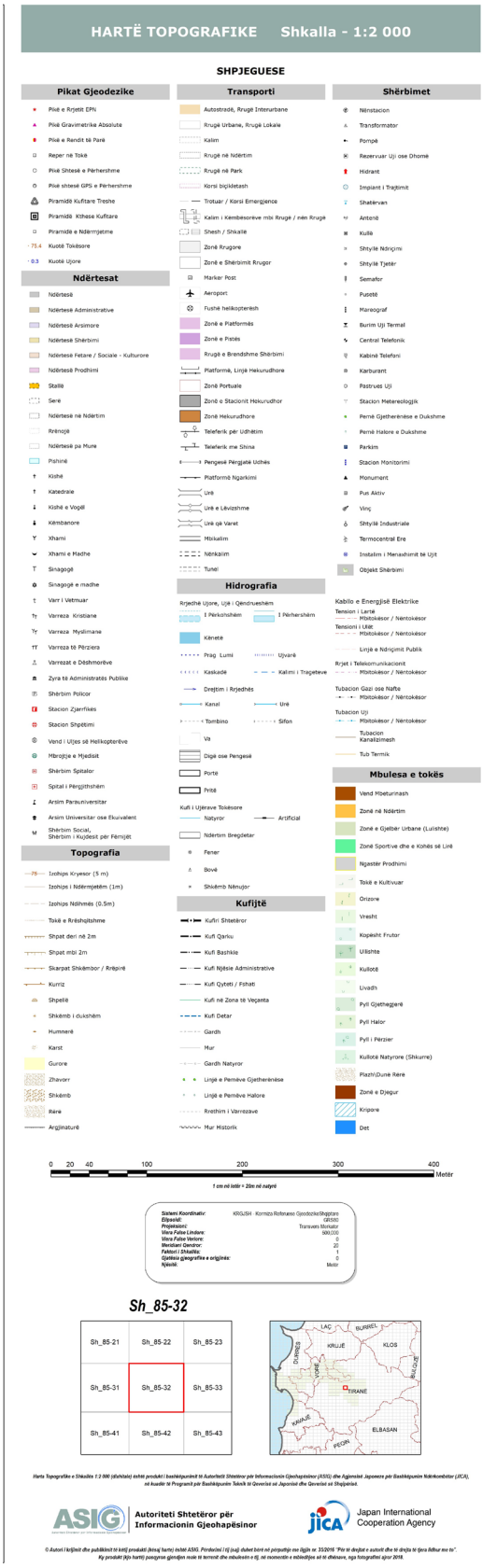


Figure 3-12 Legend of the map

3.2.8.7. Creation and Management of Data to be Provided

As a result of discussions with ASIG, JPT identified the following needs regarding the provision of data.

- Store the digital topographic map maintained by the Project in the data storage server procured by the project, build the web GIS service, and then link it with the existing ASIG geoportal.
- Distribute maps in vector tile format, which realizes high-speed drawing in vector format.
- Use ArcGIS Enterprise as a GIS server for future data disclosure.

Meanwhile, because the initial scope of the Project did not include the establishment of web-based GIS services by JPT, it was difficult to satisfy all the needs within the scope. Therefore, in view of the hardware and software procured, fine adjustment has been made to the current project scope; the scope of work items that ASIG will address after the Project has been set so that it will satisfy ASIG's needs as much as possible (Figure 3-13). JPT proposed the conceptual drawing to ASIG and obtained agreement in December 2017. The final topographic map dataset was installed into the server in October 2021.

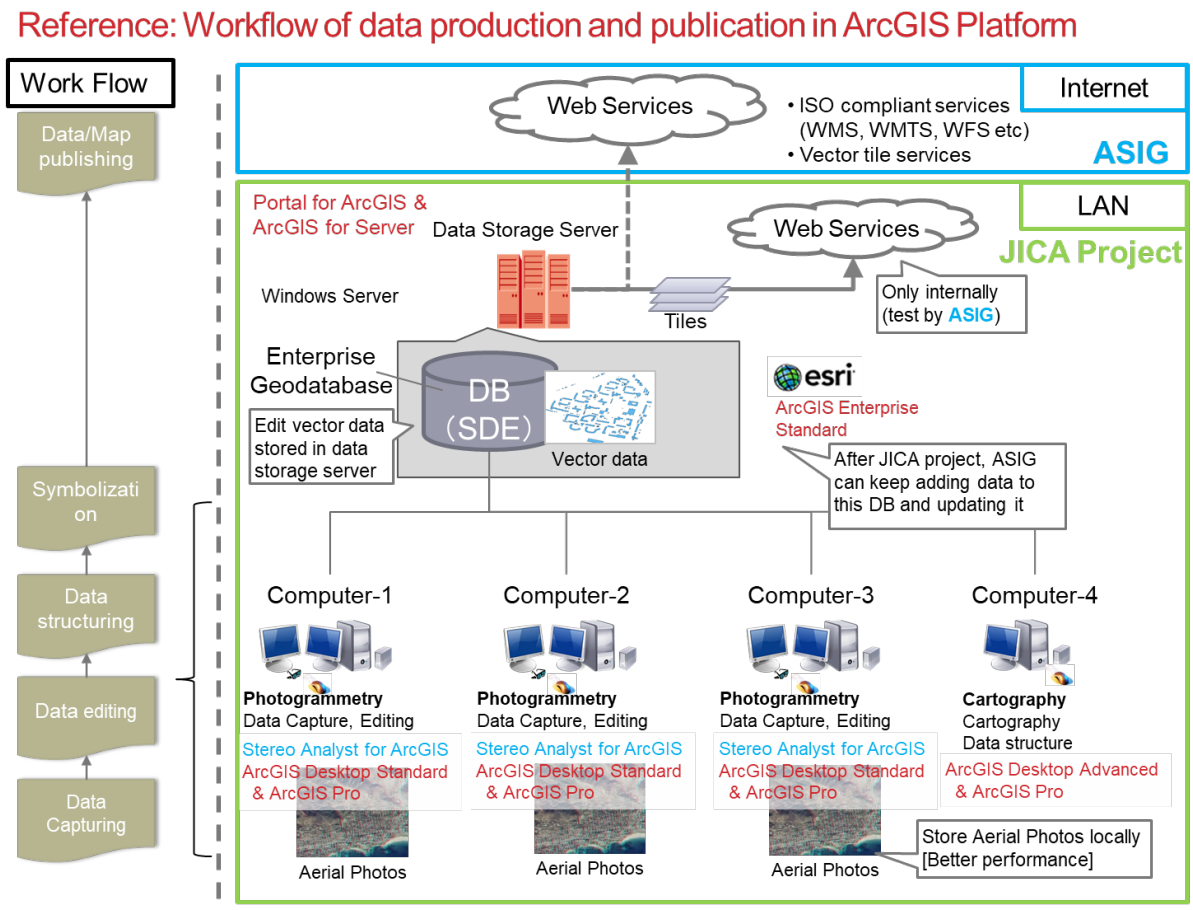


Figure 3-13 Workflow of data production and publication

As a result, the following work items were completed.

- The Project has established a web service establishment environment that can only be used in LAN, using a data storage server and ArcGIS products. With this environment, ASIG can develop the web GIS service

forms (including ESRI vector tiles) they desire and conduct performance tests in LAN.

- The Project has stored the digital topographic maps as a deliverable in the database within the data storage server procured.
- The following technical matters for the deliverables were confirmed.
  1. Database environment: SDE (Enterprise geodatabase)
     ✓ PostgreSQL 10
  2. Project data environment: ArcGIS Pro 2.2 project file and related datasets
     ✓ Symbolization for 1/2,000 topo-maps
  3. Representation environment: Sample ESRI Vector tile package (*.vtpk)
     ✓ Simple symbolization (provisional)
  4. Documents: User's manual, etc.

3.2.8.8. Quality Inspection

The digital topographic maps were completed based on DPS (acquired data items, data structure, quality, portrayal specifications, etc.) described in 3.2.6 and by adding the map layout described in 3.2.8.6. Based on DPS and the Quality Evaluation of Map Data Guideline, quality inspections were conducted on 65 items including place names, buildings, and waterways from the following perspectives.

(1) Completeness
(2) Logical consistency
(3) Position accuracy
(4) Thematic accuracy

As a result, it was confirmed that the quality of the digital topographic map created in this project is satisfied.

■ Quality evaluation of positional accuracy

RMSE (Root Mean Square Error) is used for quality evaluation of positional accuracy of the digital topographic map.

Quality requirements of the digital topographic map are as follows.

- Horizontal accuracy: 0.40m (95.4% reliability)
- Elevation accuracy: 0.60m (95.4% reliability)

RMSE is 68.2% reliability, thus quality criteria for evaluation are as follows.

- Horizontal accuracy: RMSE=0.20m (68.2% reliability)
- Elevation accuracy: RMSE=0.30m (68.2% reliability)

To check the positional accuracy, JPT and ASIG conducted GNSS-RTK survey. As for 38 locations which JPT conducted, the results satisfied the quality requirement, however, for 71 locations which ASIG conducted, the elevation accuracy was not satisfied the quality requirement described above. JPT investigated the difference and found that the difference does not occur randomly but is offset by a certain amount in a certain

direction, and the difference is bigger in the port area in Durres. It is considered that when the difference does not occur randomly but is offset by a certain amount in a certain direction, the cause may be due to the accuracy of the geoid model.

The geoid model defined in the Albanian datum is EGM2008. It has been reported that the accuracy of EGM2008 is low in coastal areas and mountainous areas.

If a high-accurate geoid model is developed in Albania in future after conducting gravity survey and leveling survey in accordance with the ASIG's plan, the accuracy of elevation of GNSS survey and topographic maps is expected to be improved.

3.2.9. Production of UN Vector Tile

Production of UN vector tiles from the developed digital topographic map was carried out as OJT. Raspberry Pi[2] (refer to Figure 3-14) and United Nations Vector Tile Toolkit (UNVT) were used for UN vector tile production work with the cooperation of Geospatial Information Authority of Japan (GSI).

Raspberry Pi is a small single-board personal computer (all the necessary electronic devises are integrated on a single board). UNVT is a project as well as a toolkit created by the United Nations Senior Geospatial Specialist aiming to ensure that map providers such as public institutions and any other map suppliers can share their maps on the web using the latest web map technology.

Figure 3-14 Raspberry Pi package

As a result of OJT, UN vector tiles of the topographic map were produced as shown in Table 3-3 and Figure 3-15. In addition, a web map site was established on Raspberry Pi where users can access the UN vector tile map

[2] Developed and provided by the Raspberry Pi Foundation (UK) for the purpose of education.

layer with a web browser.

Table 3-3 Zoom level and the number of UN vector tiles and layers

Zoom Level	Equivalent Scale	Number of Tiles	Number of Layers (Total number of layer file)
7	1:4,000,000	2	2(4)
8	1:2,000,000	2	4(7)
9	1:1,000,000	3	7(19)
10	1:400,000	6	12(53)
11	1:200,000	11	23(169)
12	1:100,000	21	46(503)
13	1:40,000	42	92(1257)
14	1:20,000	83	183(2881)
15	1:10,000	164	365(6375)
16	1:5,000	47	483(9461)

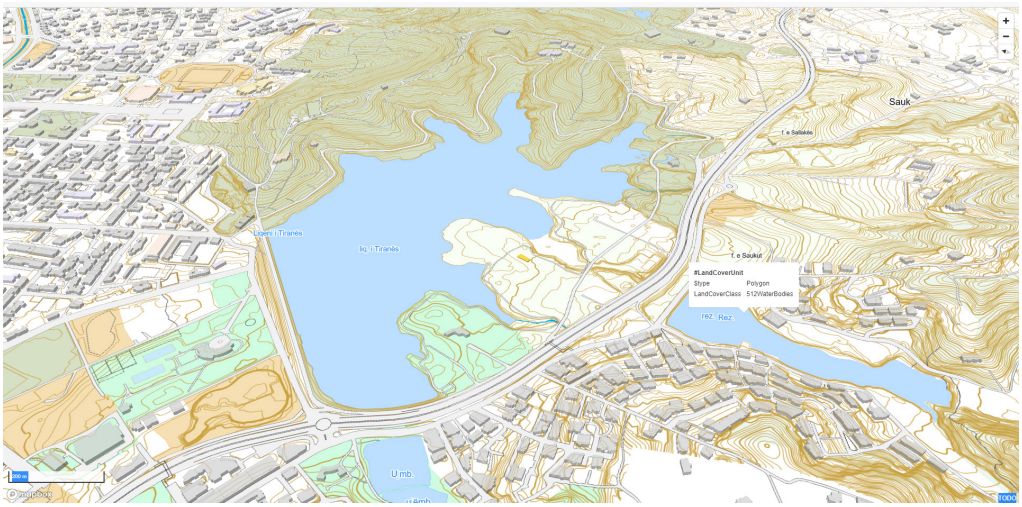


Figure 3-15 Sample Image of UN Vector Tile

The inspection of vector tiles conversion has been done as follows, and confirmed that project data are converted without any errors;

- No errors while running the conversion program
- The converted data are stored in the specified folder
- Tile specification file (tiles.mbtiles) and Style file (style.json) are created correctly
- Web map service can be started with the converted data
- The converted data are shown in correct scale and symbols which are specified in the definition file with web browser

The generated UN vector tiles can be seen on in 2D as well as 3D through the test site. Also, ASIG will be able to establish a UN vector tile based web map portal to provide the topographic maps to the public where any users can access the topographic maps as vector data with their web browser.

3.2.10. Country-focused Training

The following two courses of country-focused training were conducted.

3.2.10.1. Training for Executives

（1） Overview and participants of the training

Training for ASIG executives was conducted in December 2017. The participants learned Japan's case examples and acquired knowledge in a wide range of areas from the development and provision to the utilization of geospatial information.

Table 3-4 Overview of the country-focused training for executives

Dates	3-16 December 2017
Aims of training	Provide ASIG executives with information and knowhow that will contribute to the business development and operation of ASIG
Training items	1. Intellectual property rights to geospatial information 2. Examples of utilization of geospatial information 3. Supervision method for creation of geospatial information 4. Techniques for creation of geospatial information using leading-edge technologies 5. Business development through cooperation among industry, government, and academia
Venues	Geospatial Information Authority of Japan (GSI), National Space Policy Secretariat of Cabinet Office, Secom Co. Ltd., Topcon Corporation, Zenrin Co., Ltd., Mitsubishi Electric Corporation, Kameoka City of Kyoto Prefecture, PASCO Corporation, and Kokusai Kogyo Co., Ltd.

Table 3-5 Participants in country-focused training for executives

Name	Position
Mr. Lorenc Çala	General Director
Mr. Kristaq Qirko	General Manager, Directory of Geodesy and Cartography
Mr. Klaudio Collaku	General Manager, Directory of National GIS and Geoportal
Mr. Myrtezan Kollcaku	General Manager, Directory of Finance and Support Services
Mr. Klajd Jankulla	Manager, Directory of Finance and Support Services

(2) Training results

The participants achieved the following results through the training.

Table 3-6 Results of Training for Executives

Item	Result
Understanding of concrete work processes of development and maintenance of digital topographic maps	Through the training at GSI, Zenrin, Kokusai Kogyo, PASCO, etc., the participants deepened their understanding of the development and maintenance of digital topographic maps and other geospatial information. They created a workflow based on what they learned in the training, and it was considered an item of the action plan presented by the participants on the last day of the training.
Understanding of the quality management methods	Through the training at GSI, Zenrin, etc., the participants reaffirmed the importance of quality management. They also learned quality management flows and concrete methods at PASCO Okinawa Office through demonstration with actual data.
Understanding of accuracy of topographic maps	Through the lecture at GSI, the participants learned the history and purpose of the establishment of accuracy regulations in Japan, and through the subsequent training, understood "it is important to set accuracy requirements according to the purpose". They also acquired a very important awareness that "provision of latest information brings more benefits to the users than unnecessary pursuit of accuracy". At PASCO Okinawa Office, they also watched how to ensure accuracy of the topographic maps to be created in the Project, and their concerns were relieved.
Learning about utilization of topographic maps and other geospatial information	Through the training at Secom, Topcon, Zenrin, Kameoka City, Kokusai Kogyo, PASCO, etc., the participants learned that geospatial information is utilized for various purposes not only in government organizations but also in local public bodies and private companies. They especially realized that 3D data have greater possibilities than just showing "objects three-dimensionally" through spatial analysis.
Collection of information of latest technologies concerning geospatial information	Through the training at GSI, Cabinet Office, Topcon, Mitsubishi Electric Corporation, Kokusai Kogyo, PASCO, etc., the participants collected information of the latest technologies for the development, maintenance, dissemination, and utilization of geospatial information. Development of a microsatellite in the country, analysis of LiDAR data, and establishment of regulations concerning the use of drones were especially incorporated into the action plan presented by the participants on the last day of the training.
Collection of information about intellectual property rights to geospatial information	Through the training at GSI, Zenrin, etc., the participants collected information about handling intellectual property rights to geospatial information. The participants made a comment that careful consideration should also be given to the creation and distribution of geospatial information in Albania.

Item	Result
Collection of information about business development through cooperation among industry, government, and academia	Through the training at the Cabinet Office and the private companies, the participants collected information about the importance of cooperation and human resources development with universities, the roles played by private companies in the creation, maintenance, promotion, and utilization of geospatial information, and collaboration with private companies. The participants, in particular, realized that collaboration with private companies was one of the success factors in the creation and utilization of geospatial information in Japan. Asking the government to consider local companies important stakeholders was stated in their action plan.

As mentioned in the table above, the participants acquired awareness through the training that "roles played by private companies and cooperation with private companies are very important in the development, maintenance, dissemination, and utilization of geospatial information, and this is one of the success factors in Japan". JPT could not agree more. It is hoped that ASIG will find good partners in Albania and that development and utilization of geospatial information will be further promoted.

3.2.10.2. Training for Engineers

(1) Overview and participants of the training

Country-focused training for ASIG engineers was conducted in October 2018. Through the training, including practical training in the offices of PASCO CORPORATION and KOKUSAI KOGYO CO., LTD., the participants learned about plotting work and acquired knowledge and skills for the work.

Table 3-7 Overview of country-focused training for engineers

Dates	14-27 October 2018
Aim of training	Provide basic knowledge to create efficient digital topographic maps of appropriate quality and promote their use
Training items	1. Operation of national surveying and geospatial information 2. Examples of utilization of geospatial information 3. Rules and quality management of geospatial information work 4. Photogrammetry plotting (including practical training)
Major venues	GSI, Increment P Corporation, Kyoritsu Air Survey Co., Ltd., Mobara City of Chiba Prefecture, Kokusai Kogyo Co., Ltd., and PASCO Corporation

Table 3-8 Participants in country-focused training for engineers

Name	Department
Ms. Safete Mihali	Directory of Geodesy and Cartography / Cartography Sector
Ms. Esma Hoxha	Ditto
Mr. Martin Rusi	Directory of Geodesy and Cartography / Remote Sensing Sector
Ms. Boronica Margjeka	Ditto
Ms. Denisa Kukaj	Directory of National GIS and Geoportal / Standards of Geoinformation Sector

(2) Training results

The participants achieved the following results through the training.

Table 3-9 Results of training for engineers

Item	Result
Understanding of operation of national surveying and geospatial information	Through the training at GSI and the Association of Precise Survey and Applied Technology, the participants deepened their understanding about the development, operation, maintenance, and dissemination of spatial information by a national organization and the purposes of the surveyor system, which is a national qualification system, and the surveying work rules. They understood that GSI's methods to update maps would be especially useful for the maintenance of spatial information at ASIG. Albania does not have a surveyor qualification system, but the participants understood that such a registration system would be useful in the country to ensure the reliability of the work.
Understanding of examples of utilization of geospatial information	Through the training at Mobara City office, Increment P, Georepublic, Dynamic Map Platform, Kokusai Kogyo, and PASCO, the participants learned that geospatial information is utilized for various purposes not only in government organizations but also in local public bodies and private companies. In the lecture about the development of the high-accuracy 3D maps that are currently under development to achieve an autonomous driving and safety support system, they learned that maps are not used by people but by automobiles for autonomous driving, combining information of dynamic positions such as information of congestion and traffic restrictions. Such concepts of spatial information do not exist in Albania, and the participants deepened their understanding about new activities and possibilities concerning spatial information.

Item	Result
Understanding of rules and quality management of geospatial information work	Through the training at GSI, Increment P, etc., the participants reaffirmed the importance of quality management. At PASCO Okinawa Office and Kokusai Kogyo Okinawa Office, they also learned flows and concrete methods of quality management through demonstration with the actual data of the Project. They also became acutely aware that, if geographical information is not updated, the quality will decline, giving less credibility and eventually destroying credibility of the responsible organization.
Understanding and acquisition of photogrammetry plotting techniques	At Kyoritsu Air Survey, the participants acquired knowledge about all the processes of aerial photographing, which will be necessary for photogrammetry. The lecture about the preparation for takeoff (flight permission, confirmation of flight courses, confirmation of weather conditions, and aircraft inspection) was realistic, using video of the company's daily operations, and the participants learned hidden efforts and the reality that could not be learned in regular lectures. They also saw photographing aircrafts and aerial cameras that do not exist in Albania and deepened their understanding about the acquisition of photo data, which is the most important tool for plotting. At PASCO Okinawa Office, the participants learned how to create digital topographic maps using the plotting devices and software to be used in the Project. They had different views about 3D plotting method, partly because it has not been established in Albania. However, through the training, they reached consensus on how to acquire data. At Kokusai Kogyo Okinawa Office, they received lectures and technical guidance about filtering of aerial laser measurement data, creation of digital topographic maps based on the data acquired with MMS (Mobile Mapping System, high-accuracy 3D mobile measurement system), and techniques to create true Orthophotos using aerial photos.
Collection of information of latest technologies concerning geospatial information	Through the training at GSI, Dynamic Map Platform, Increment P, PASCO, etc., the participants collected information concerning the latest technologies for the development, maintenance, dissemination, and utilization of geospatial information. They especially learned the spatial information technologies that will contribute to the improvement of social environment in Albania, such as information about high-accuracy 3D maps using MMS, preparation of large-volume POI (Point of Interest, certain point in map) information, how to publish updated map information as soon as infrastructure improvement is completed, and utilization of maps that can be easily used by the general public who are not used to using maps.

In addition to the above, the participants also renewed awareness that "the government and local public bodies bear a reasonable amount of cost to develop infrastructure and update spatial information, and this routine work contributes to the preservation of national land, improvement of people's lives, and business development of private companies". In Albania, development of topographic maps, etc. is rarely conducted

through public-private partnership or by local public bodies. It is expected that the lessons learned from the training will be shared with many people and contribute to the development of spatial information in Albania.

3.2.11. Promotion of Utilization

3.2.11.1. Promotion Activities to the Organizations under the Government of Albania

JPT invited Albanian governmental organizations in need of geospatial information to the kick-off meeting for the Project. In October 2017, JPT visited the following organizations individually to discuss the details of the Project.

Table 3-10 The organizations visited in October 2017

Name of Organization	Utilization of Geospatial Information
Governmental Organizations	
Immovable Property Registration Office, Ministry of Justice (IPRO)	IPRO is responsible for management of cadastral maps as one of their duties. IPRO has a registration section (4 staff members), a cartography section (4 staff members), a GIS section (3 staff members), and a CORS section (5 staff members) related to geospatial information. IPRO is developing cadastral index maps using AUTOCAD and ArcGIS.
National Territorial Planning Agency Ministry of Energy and Infrastructure	The Agency uses the orthophotos in ASIG Geoportal for an integrated development plan in Durres and Tirana. A few staff members of the Agency utilize the licensed ArcGIS paying service and maintenance fees, mainly for land use plan. The challenge that the Agency faces is that they collect the data from the related municipalities for land use but the data from them are too obsolete to adjust to the current situation.
Agency for Legalization, Urbanization, and Integration of Informal Areas and Buildings, Ministry of Construction and Transportation (ALUIZNI)	ALUIZNI has a GIS section with a head and 2 staff members and a Cartography section with a head and 3 staff members for management of geospatial information, focusing on buildings, roads, water, and land parcels in urban areas. They use the orthophotos produced in 2015 through ASIG Geoportal.
Agency for Territorial Development, Ministry of Urban Development	The Agency has a GIS Division consisting of 5 engineers. The Division is responsible for geospatial information regarding land use plans and urban development plans prepared by contractors. The Division has 5 sets of ArcGIS (Version 10.5) and pays annual fees for service and maintenance. The GIS Division visualizes the changes in the urban area by overlaying the orthophotos from two periods, 2007 and 2015, provided by ASIG Geoportal.

Name of Organization	Utilization of Geospatial Information
Governmental Organizations	
	The results are useful for urban planning work. The Planning Section uses AUTOCAD and Illustrator Software for cartography.
University	
Faculty of Civil Engineering, Polytechnic University of Tirana	The Department of Geodesy is one of five departments in the Faculty of Civil Engineering. They lecture the students on GIS and photogrammetry. In 2014 the Department received 20 sets of PCs, 4 total stations, 4 Theodolites, 2 GNSS receivers, and a server donated by the Chinese Government. In addition, EU provided 3 GNSS receivers and 12 PCs to the Department in the same period. Since they could not afford to purchase ArcGIS, which is the de facto standard GIS software in Albania, they use open source GIS software.

3.2.11.2.Promotion Activities to Municipalities in the Project area, University and Private Companies

（1） Introduction of topographic maps and provision of GIS training to the municipalities in the Project area

In October 2017, JPT and ASIG visited the municipalities in the Project area prior to the implementation of the aerial photo shooting. JPT explained to them about the overview of the Project, requested cooperation (for the municipalities where JPT will conduct field verification), and had a Q&A session. In order to determine the area for the aerial photograph, JPT interviewed the municipalities about the area where they need to take the aerial photos. JPT tried to meet their expectations as much as possible.

In February 2020, JPT revisited the municipalities where they showed the topographic maps and provided GIS training using the maps. In this training, JT introduced ideas on the low cost use of digital topographic maps and other geospatial information

（2） Collaboration with a University in Pursuit of Fostering of Geospatial Information Engineers

Practical training to the future engineers in the field of geospatial information was organized where students of the Faculty of Geodesy of Polytechnic University of Tirana were invited in May 2019.

JPT and ASIG jointly provided both indoor and outdoor training on creation of digital topographic maps. His Excellency, the Ambassador Mr. Ito, visited ASIG and had a constructive dialogue with the participants.

（3） Private companies

Through the commencement conference, JPT and ASIG introduced the development of digital topographic maps to local private survey companies. JPT and ASIG also invited the private companies to the project final conference and introduced the developed digital topographic maps.

Since many of the private companies related to geospatial information use GIS software for their daily business and/or contracted projects, it is expected that the digital topographic maps will be utilized in their future business activities.

3.2.11.3. Promotion Activities to geospatial information community in the Western Balkan region

ASIG and JPT members attended the following conferences/meetings and introduced the Project as well as JICA's cooperation in this region.

A) XI Regional Conference on Cadastral and Spatial Data Infrastructure (Montenegro, May 2018)
B) XII Regional Conference on Cadastral and Spatial Data Infrastructure (Bosnia and Herzegovina, September 2019)
C) EuroGeographics General Assembly (Czechia, October 2019)

Photo 3-2 Presentation on the Project by Ms. Esma Hoxha at XI Conference


Photo 3-3 Presentation by ASIG General Director at Eurogeographics General Assembly

3.2.11.4. Provision of information and recommendations for ASIG regarding promotion of utilization

(1) Provision of sustainable methods to maintain geospatial information

In order for users to use geospatial information with confidence, it is essential that geospatial information is updated appropriately and continuously. Therefore, during the training in Japan for ASIG managers in December 2017, GSI provided lectures on how to maintain and manage the basic national base maps. GSI explained to them that the new orthophotos and 1/2500 topographic maps owned by local governments can be used to update the wider areas of the national base maps.

In addition, GSI explained to the ASIG managers that the topographic map update in small parts, such as new construction of major roads, major developments, and changes of administrative boundaries, is carried out by GSI as soon as the public survey results are received from the relevant authorities.

GSI also explained that one of the basic policies of GSI is to update the national base maps with the latest geospatial information provided by municipalities and public road management agencies.

(2) Proposal to strengthen user supports in ASIG Geoportal

JPT confirmed that ASIG Geoportal already has a user contact point and a function for providing information to users. To improve the service to users, ASIG Geoportal is expected to add a Chatbot function where users can give short text or voice instructions to a computer and receive the results, and to expand the Geoportal guidance in English.

(3) Proposal for the use of topographic maps in the field of disaster prevention

JPT made a presentation on the use of topographic maps by municipalities in the field of disaster

management at the Project Final Conference held in November 2021.

JPT introduced to the participants the disaster management measures implemented by Japanese municipalities using large scale topographic maps. In addition, JPT selected a part of the central area in Tirana municipality as a model district and attempted to create a disaster prevention map using only the topographic data created in the Project.

It is hoped that the Albanian municipalities will make use of the topographic maps for disaster management in the future.

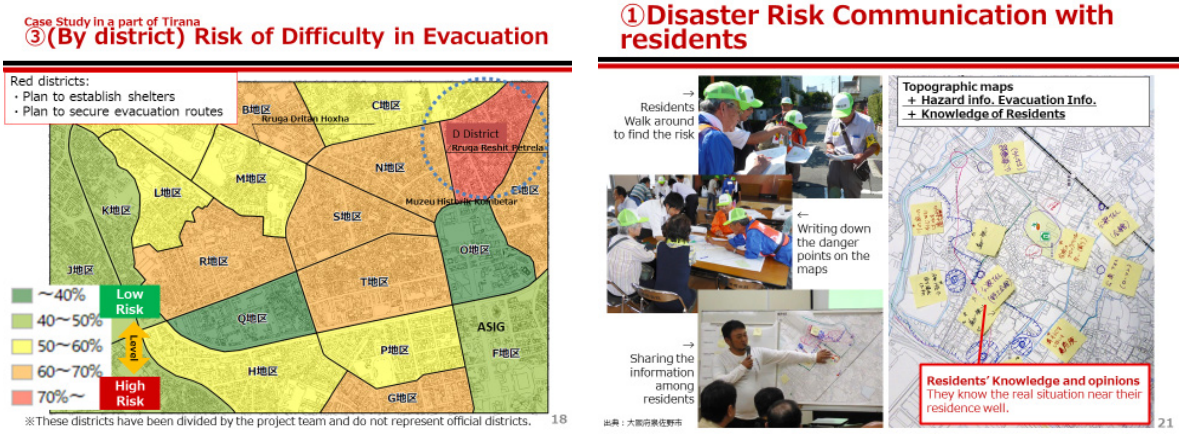


Figure 3-16 (Left) Risk Difficulty in Evacuation in a part of Tirana, (Right) Disaster Risk Communication with residents

(4) Activities aimed at increasing the number of geospatial information users

In February 2020, the project team visited municipalities in the area of topographic mapping and conducted basic GIS training for them using open source software (Q-GIS).

Through a series of training sessions, it was found that there are many municipal officials who want to utilize geospatial information but have no opportunity to learn how to use GIS.

So far, ASIG has developed briefing sessions on the utilization of the ASIG Geoportal for local governments nationwide. In addition, ASIG has been actively establishing dissemination activities that contribute to increasing the number of geospatial information users through online conferences and SNS. In the future, if it is possible to distribute videos on how to use topographic maps using QGIS for GIS beginners, it will lead to further expansion of users.

An increase in the number of geospatial information users will lead to an increase in the social value of ASIG's existence. Therefore, ASIG is required to improve the quality of the topographic maps created by the Project regarding topographical features, land use, and buildings and to expand the areas of topographic maps especially in major cities and towns to meet the needs of prospective users.

As a result, it is expected that the government will determine that it is necessary to strengthen human

resources for ASIG and secure a budget for the expansion of geospatial information, which in turn will create a virtuous cycle of geospatial information development.

3.2.12. Holding of Meetings and Conferences

3.2.12.1. Joint Coordinating Committee (JCC)

(1) First JCC

On 19th June 2018, the first JCC was held to share the progress of the project, and confirmed the contents of subsequent activities. The delivery of the completed orthophotos and the timing of installation on the geoportal were confirmed. In addition, ASIG mentioned a request for technical assistance related to the publication of deliverables.

(2) Second JCC

On 11th April 2019, the second JCC was held to share the progress of the project, and confirmed the contents of subsequent activities. In the meeting, participants exchanged opinions on the importance of easy accessibility of geospatial information, the importance of data distribution and maintenance, and usage of new technologies (e.g. drone, open source). As a result of the meeting, the interim report was accepted by all participants.

(3) Third/ Final JCC

On 10th November 2021, the third/final JCC with 12 participants from ASIG, Embassy of Japan, JICA Balkan Office, JICA in Tokyo, and JPT was held to review and confirm the result of the Project. As a result of the meeting, the draft final report was accepted by all participants.

3.2.12.2. Holding of Conferences

JPT together with ASIG held the following conferences to introduce the development of digital topographic maps and promote it.

Instead of holding “First-Showing Meeting of JICA Digital Topographic maps” which was planned at the beginning of the project, JPT visited each of the municipalities and government agencies and showed the digital topographic maps.

(1) Holding of JICA Project commencement conference

The JICA Project commencement conference was held on 24th October 2017, where the contents of the

Project and JICA's support status related to geospatial information in the Balkans area were widely explained to the people concerned in Albania. Speakers from the Kosovo Cadastral Agency (KCA) and Agency for Real Estate Cadastral (AREC) were invited to share the outcome of the topographic map project supported by JICA.

(2) Holding of JICA Project Final Conference

The JICA Project final conference was held on 4th November 2021 to inform the parties concerned in Albania of the achievements of the Project. The main objectives of the Conference were for the closing ceremony of the Project, reporting what ASIG and JPT have done throughout the Project, and introduction of UN vector tile and usage of topographic maps as a tool of disaster prevention.

As a part of the COVID 19 measures, the conference was held in a hybrid format, with a group meeting having 22 people in total in a large space and an online meeting with 66 accesses.

(3) Holding of Regional Conference

Gathering geospatial information agencies in North Macedonia, Kosovo, Montenegro, Bosnia and Herzegovina, and Albania, a regional conference was held on 5th November 2021. The main objectives of the Regional Conference were as follows;

- Introduction of JICA Project in Albania
- Introduction of JICA's Geospatial Information Projects in Balkan Region
- Introduction of UN vector tile
- Exchange activities of national geospatial information agencies in the respective countries
- Expectation to JICA's technical cooperation from the recipient countries

The conference was held in a hybrid format, with a small group meeting with 17 people in total in a large meeting room and an online meeting with 59 accesses.

3.2.13. Creation of Reports and Reporting

Table 3-11 shows the list of reports which are created throughout the project implementation.

Table 3-11 List of reports of the project

Name	Time created
Inception report	July 2017
Interim report	April 2019
Draft final report	October 2021
Final report	January 2022

3.2.14. Procurement and Provision of Equipment

Prior to the procurement of equipment, JPT and ASIG collaborated to examine items, quantities, and specifications of the equipment to be procured. As a result, it was confirmed that an A3 multifunction printer was not greatly needed. It was necessary to adjust the number of PCs and software licenses which were required for creation and maintenance of digital topographic maps, considering the ASIG organization. Consequently, it was decided not to procure an A3 multifunction printer, and the GIS software licenses were reviewed as shown in Table 3-13.

JPT locally procured the equipment listed in Table 3-12, and the provision and installation of equipment was completed and all of the goods were handed over to ASIG in mid-November 2018 together with the equipment listed in Table 3-13 which had been procured by JICA.

Table 3-12 List of equipment procured by JPT (Initially planned quantity in parentheses)

Item	Quantity
Workstation for photogrammetry with 3D monitor, 3D glasses, 3D mouse, 2D monitor, and UPS	3
Workstation for GIS and cartography with 2D monitor and UPS	1
Data storage server	1
Adobe Acrobat	4
Anti-virus software	5
Notebook PC	1
Android tablet	3
Digital level and accessories	1
A3 digital multi-function printer	0 (1)
A0 printer (with scanner function)	1

Table 3-13 List of equipment procured by JICA (Initially planned quantity in parentheses)

Item	Quantity
Software for aerial triangulation, stereo plotting, editing, and orthophoto creation IMAGINE Photogrammetry, IMAGINE AutoDTM, IMAGINE Terrain Editor	1
Software for photogrammetry Stereo Analyst for ArcGIS	3
Software for GIS and cartographic ArcGIS Enterprise Standard	1

Item	Quantity
ArcGIS Desktop Advanced and ArcGIS Pro Advanced	1
ArcGIS Desktop Standard and ArcGIS Pro Standard	3 (2)
ArcGIS 3D Analyst	4 (3)
ArcGIS Spatial Analyst	4 (3)
ArcGIS Network Analyst	1 (3)

4. Technology Transfer

The following technology transfer was implemented according to the technology transfer plan. The contents were modified where appropriate based on the results of questionnaires and/or interviews on the participants' experience levels and technical levels.

4.1. GCPs Survey, Installation of Photo Signals, Utilization of CORS, and Leveling

(1) Contents, schedule, and participants

6 ASIG staff members (Table 4-2) from the Reference Geodetic Frame Sector and the Infrastructure and CORS System Sector participated. As the result of questionnaire and interviews, it was confirmed that although all participants had sufficient experience and knowledge of GCP survey or GNSS survey, they did not have sufficient experience of leveling survey. Table 4-1 shows the schedule and contents of the technology transfer.

Table 4-1 Schedule and contents of GCP survey, etc. technology transfer

NO.	Period	Contents
1	September 2017	Interview and discussion with participants
2	March to April 2018	GCP survey field confirmation Survey on the current situation of CORS (ALBPOS)
3	April 2019	Digital leveling

Table 4-2 Participants of GCP survey etc. technology transfer

NO.	Name	Position	Department
1	Arben Xhialli	Head of sector	Reference Geodetic Frame Sector
2	Arian Lasku	Specialist	Ditto
3	Eduart Blloshmi	Specialist	Ditto
4	Albin Koci	Specialist	Infrastructure and CORS System Sector

NO.	Name	Position	Department
5	Rudens Konomi	Specialist	Ditto
6	Oltjon Balliu	Specialist	Reference Geodetic Frame Sector

（2） Activities carried out

[1] GCP survey, installation of photo signals, and utilization of CORS

JPT together with the participants observed the GCP survey work conducted by Hansa and reconfirmed some skills required to conduct GCP survey and GNSS survey. CORS data were used for the GCP survey.

[2] Leveling survey

Lectures on basic theory of leveling, error elimination method, instrument verification method, etc. were provided. In particular, focus was placed on the error elimination method.

After the lectures, the observation training focusing on the inspection and adjustment method of the digital level and the adjustment method of the level staff was conducted while carrying out the work on actual level routes. At the same time, technology transfer was carried out regarding the method of height connection from benchmark to the fixed points of the tidal stations by first-order leveling.

（3） Evaluation of technology transfer

The participants reached the level where they can successfully plan, implement, and calculate GCP surveys. They can also perform calculation using CORS data without any problems. It is expected that the participants will further enhance the contents of the manual to make it useful for the work.

As for leveling survey, the participants can carry out observations without problems on routes with relatively few undulations. For routes with many undulations, it may take some time to set up a digital level; however, their skills will be improved as they gain experience in the future. They are capable of creating the observation result table by using the calculation arrangement method.

4.2. Aerial Photography Plan, Aerial Triangulation, and Orthophoto Creation

In addition to the initially planned technology transfer of aerial photography planning, aerial triangulation, and orthophoto creation, training on the method of inspecting photography results using the DAT / EM Systems' stereo plotting instrument (Summit Evolution) was carried out in response to a request from ASIG.

（1） Contents, schedule and participants

5 ASIG staff members (Table 4-4) from the Remote Sensing Sector participated. Table 4-3 shows the schedule and contents of the technology transfer. The participants had little experience on performing aerial

photography plans, aerial triangulation, and orthophoto creation by themselves; however, they had knowledge and experience of managing the work because ASIG had outsourced such a project in 2015.

Table 4-3 Schedule and contents of aerial photography plan, etc. technology transfer

NO.	Period	Contents
1	April - May 2018	Inspection method of photography results, aerial triangulation, and simple stereo plotting method using Summit Evolution
2	July-September 2018	Aerial photography plan, aerial triangulation, and import/export of the result of aerial triangulation
3	July - August 2019	DEM creation and DEM editing, ortho rectification and ortho mosaic

Table 4-4 Participants of aerial photography plan, etc. technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Directory of Geodesy and Cartography / Remote Sensing Sector
2	Martin Rusi	Specialist	Ditto
3	Boronica Margjeka	Specialist	Ditto
4	Ledia Aliu	Specialist	Ditto
5	Brikena Sinjari	Specialist	Ditto

（2） Activities carried out

[1] Aerial photography plan and inspection of photography results

JPT provided lectures on the theory and method of aerial photography planning. Then, the participants had training on the inspection method of photography results using the existing data and Summit Evolution which ASIG had.

[2] Aerial triangulation

JPT provided lectures on the theory and method of aerial triangulation and evaluation of aerial triangulation results. Then, the participants had training on how to examine the contents of the calculation report of aerial triangulation results using the actual calculation report.

[3] DEM creation and Orthophoto creation

JPT provided lectures on the theory of DEM creation and orthophoto creation, in terms of the process, required parameters, quality and relation of quality of DEM, and that of orthophoto. Then, the participants had training on creation of DEM and orthophoto using the aerial photos taken and the software procured in the Project.

(3) Evaluation of technology transfer

Through the technology transfer, most of knowledge and skills reached the level of "Able to teach other technicians". The edited DEM and the positional accuracy of the orothophotos generated from the DEM met the required specification. The participants need further continuous training to achieve the level of trainer for "DEM editing".

4.3. Field Verification

Technology transfer of field verification was conducted in the form of lecture and on-site OJT. The participants had had little knowledge and experience on field work for collecting information required for creation of 1/2,000 topographic maps. Therefore, JPT conducted a questionnaire survey and adjusted the contents of the technology transfer accordingly.

(1) Contents, schedule, and participants

5 ASIG staff members (Table 4-6) from the Cartography Sector participated. Table 4-5 is the syllabus of the technology transfer.

Table 4-5 Syllabus of field verification technology transfer

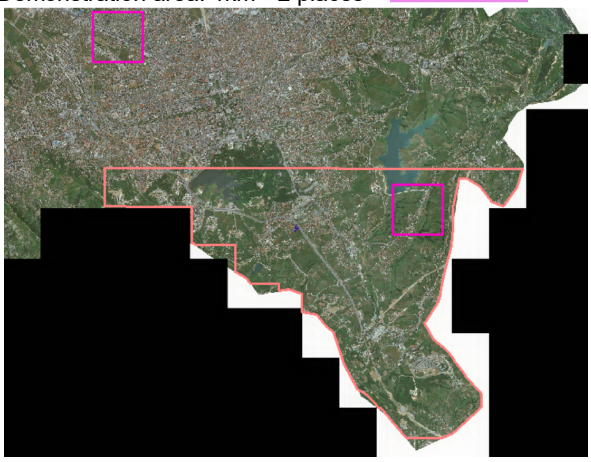
Title	Field Verification	
Overview	The technology transfer on field verification shall be conducted through actual work on an OJT basis in the area of 20km^2. This transfer shall be conducted in reference to a data product specification made in this project. "Manual for Field Verification and Field Completion" will be prepared by the instructor and provided to the participants. The notebook PC and three sets of Android tablets will be used. Therefore, three parties (1 to 2 participants in each party) shall be assembled.	
Area	OJT area: Approx. 20km^2 Demonstration area: 1km^2×2 places 	
Goals	The technology transfer is aimed at improving the ASIG staff's capabilities to create and maintain nationwide digital topographic maps on their own towards completion of such maps.	
Contents & Schedule	17 September 2018, 10:00-12:00	Method of Investigation for the Digital Field Verification(DFV) Quality Control & Schedule Management
	28 August 2018, 10:00-16:00	QGIS, Tablet & Qfield (1)
	17 September 2018, 10:00-12:00	QGIS, Tablet & Qfield (2)
	28 August 2018, 10:00-16:00	Explanation of the Data Product Specification for DFV
	29 August 2018, 10:00-15:00	Demonstration in a urban area
	30 August 2018, 10:00-15:00	Demonstration in a rural area
Others	The JICA project team provides English and Albanian version manuals. We would like the ASIG side to correct and append it so that it will be effectively used in the future.	

Table 4-6 Participants in field verification technology transfer

No.	Name	Position	Department
1	Saimir Burba	Head of Sector	Cartography Sector

No.	Name	Position	Department
2	Bledar Sina	Specialist	Ditto
3	Brikena Sinjari	Specialist	Ditto
4	Esma Hoxha	Specialist	Ditto
5	Safete Mihali	Specialist	Ditto

(2) Activities carried out

The technology transfer started from confirming the outline of the field survey, work procedure, specifications of topography, and features to be expressed on the digital topographic map determined in DPS 0.1 version. After that, the participants carried out the work for the OJT area of 20 km^2.

(3) Evaluation of technology transfer

As a result of observation of the participants' attitude towards fieldwork and the result of field verification results, it can be evaluated that ASIG staff reached a level at which they can independently perform a series of work from preliminary work, preparation, fieldwork, through office work. JPT and the participants created the manual in English and Albanian based on the experience through the technology transfer.

4.4. Stereo Plotting and Compilation

The technology transfer of stereo plotting and compilation was conducted in the OJT area of 20 km^2.

(1) Contents, schedule, and participants

3 ASIG staff members (Table 4-8) from the Remote Sensing Sector and the Cartography Sector participated. Table 4-7 shows the schedule and contents of the technology transfer. It was confirmed that most of the participants did not have experience on stereo plotting and compilation. In addition, they did not have good knowledge about EU INSPIRE. Having considered these, the contents were modified and adjusted.

Table 4-7 Schedule and contents of technology transfer

No.	Period	Contents
1	August-September 2018	- Preparation for technology transfer and discussion and confirmation of the contents of technology transfer - Discussion and confirmation of specifications of field verification work and stereo plotting work - Establishment of technology transfer equipment and improvement of the environment of ASIG existing stereo equipment

No.	Period	Contents
		- Discussion and confirmation of GDB prototype, storing in server, simultaneous editing work test, sharing of the stereo plotting specifications - Stereo plotting technology transfer - Field verification technology transfer to the stereo plotting team
2	November-December 2018	- Stereo plotting technology transfer (continued) - Stereo plotting trial for capability check and evaluation of the result - Quality evaluation - Technology transfer relating to incorporating field verification result
3	June-July 2019	- Technology transfer relating to incorporating result of "Field Completion" - Quality control and digital editing

Table 4-8 Participants of stereo plotting and compilation technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Directory of Geodesy and Cartography / Remote Sensing Sector
2	Martin Rusi	Specialist	Ditto
3	Boronica Margjeka	Ditto	Ditto
4	Ledia Aliu	Ditto	Ditto
5	Brikena Sinjari	Ditto	Ditto

(2) Activities carried out

The technology transfer started from understanding INSPIRE detective. After that, the participants carried out the actual work using the photogrammetry software and ArcGIS. The technology transfer was carried out while sharing the knowledge of large-scale topographic maps and the knowledge and technology of ArcGIS among the participants. The OJT area was further divided into 3 blocks, and 3 participants were assigned for each of the blocks.

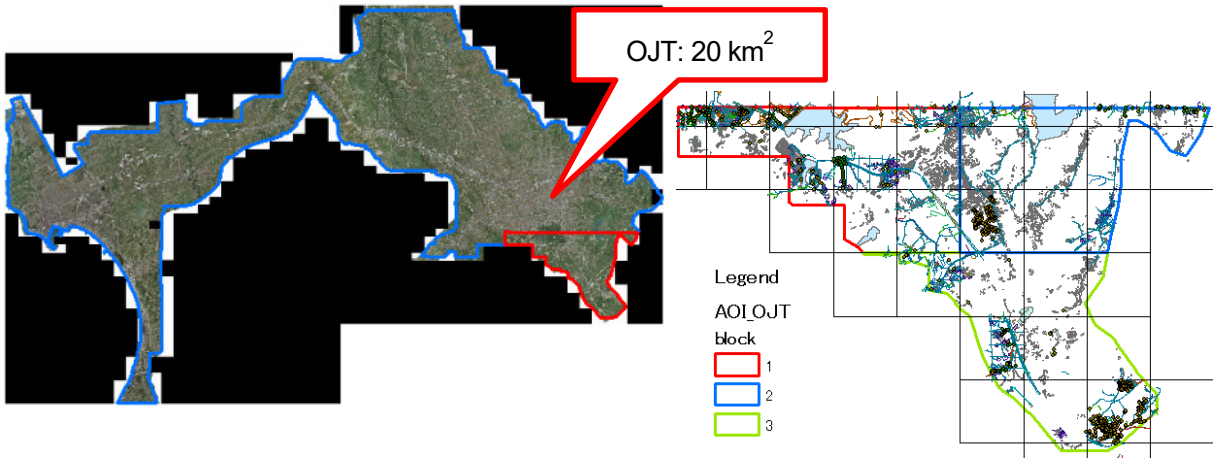


Figure 4-1 OJT Area (20 km^2)

（3） Evaluation of technology transfer

Through the technology transfer, most of knowledge and skills reached the level of "Stable performance to carry out self-Creation and Self Update" and "Able to teach other technicians" with appropriate quality. As proof, the participants expanded topographic maps into the damaged area of the earthquake occurred in November 2019 by themselves.

4.5. Field Completion

Technology transfer of field completion was conducted in the forms of lecture and on-site OJT.

（1） Contents, schedule, and participants

9 ASIG staff members (Table 4-10) from the Remote Sensing Sector and the Cartography Sector participated. The participants had little knowledge and experience on field work for collecting information required for creation of 1/2,000 topographic maps. The technology transfer was conducted from May to July 2019.

Table 4-9 Contents of field completion technology transfer

Item	Description
Overview explanation (Lecture)	- Differences between field verification and field completion - Understanding "unclear things" which plotting operators face during digital editing work
Preparation (OJT)	- Preparation of data for the field work - QGIS setting on PC, QField setting on tablet PCs
Work in the field (OJT)	- Confirmation of "unclear things" instructed by plotting operators and record

Item	Description
	- Survey of additional information
Work at office (OJT)	- Data backup of the results of daily work

Table 4-10 Participants of field completion technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Remote Sensing and Imagery sector
2	Boronica Margjeka	Specialist	Remote Sensing and Imagery sector
3	Ledia Aliu	Specialist	Remote Sensing and Imagery sector
4	Martin Rusi	Specialist	Remote Sensing and Imagery sector
5	Saimir Burba	Head of sector	Cartography sector
6	Bledar Sina	Specialist	Cartography sector
7	Brikena Sinjari	Specialist	Cartography sector
8	Esma Hoxha	Specialist	Cartography sector
9	Safete Mihali	Specialist	Cartography sector

(2) Activities carried out

The technology transfer started from confirming the importance of field completion work in the entire process, work procedure, points to keep in mind, etc. After that, the participants carried out the actual work from the field survey to compiling the collected information of the OJT area. JPT carefully explained the importance of responding to the questions/requests from the plotting operators in a proper way.

(3) Evaluation of technology transfer

JPT confirmed that the participants performed all of the work from preparation to the work in office described above without any problems. In addition, the participants were able to respond to the given questions/ instructions while cooperating with the plotting operators, which is the most important point of the field completion work. From this, it was evaluated that the participants reached a level where they can properly carry out the work by themselves.

4.6. Digital Compilation

During the OJT of Stereo plotting (data acquisition), the participants marked unclear/ invisible items and anything where they had questions. These items were transferred to the participants of the field completion

technology transfer and confirmed in the field. The results of the field completion work were returned to the stereo plotting work where the participants continued data acquisition while referring to the results.

The technology transfer of digital completion was completed by lecture and on-site OJT.

（1） Contents, schedule, and participants

3 ASIG staff members from the Remote Sensing Sector and the Cartography Sector participated. The technology transfer was conducted from June to July 2019.

（2） Activities carried out

Training was carried out for detection of areas which has difficulty of photo interpretation and areas which need annotation in the digital plotting process, and types and descriptions of questions to operators of "Field completion". Then after the OJT of "Field completion", training for importing and reflecting the result of "Field completion" was carried out.

（3） Evaluation of technology transfer

Contents and locations of questions given by the participants were appropriate for the work of the Field Completion.

An operator of the Digital Plotting took part in the Field Completion and was able to feedback questions to consider by checking field directly.

The training of importing and reflecting of Field Completion was a good opportunity of revising the same work in the preceding process of Field Verification, and participants carried out this training without any problems. This shows the participants can properly carry out the work by themselves.

4.7. Cartography and Generalization

JPT carried out the training of cartography in Albania through OJT. In addition, JPT carried out the training of generalization from October to December 2020 online as well as in August 2021 on site.

（1） Contents, schedule, and participants

5 ASIG (Table 4-12) staff members from the Cartography Sector participated.

Table 4-11 shows the schedule and contents of the technology transfer. As it was confirmed that the participants did not have sufficient experience on cartography and generalization, the contents of the technology transfer were modified and adjusted accordingly.

Table 4-11 Schedule and contents of cartographic and generalization technology transfer

No.	Period	Contents
1	May June 2019	- Preparation for technology transfer and discussion and confirmation of the contents of technology transfer - Discussion on specification for symbols and generalization - Symbol creation
2	January - March 2020	- Symbol creation (continued) - Result check & feedback - Symbol adjustment
3	November December 2020 (Remote)	- Introduction of scale base compilation - Pre-requisite setting - Scale base compilation rules setting - Exercise of 1/2000 to 1/5000 compilation
4	August 2021	- Revision of previous Training - Discussion on specification - Training of generalization 1/5,000, 1/10,000 - Revision of training and wrap-up

Table 4-12 Participants of cartographic generalization technology transfer

No.	Name	Position	Department
1	Saimir Burba	Head of sector	Directory of Geodesy and Cartography / Cartography Sector
2	Safete Mihale	Specialist	Cartography Sector
3	Brikena Sinjari	Ditto	Cartography Sector
4	Brunilda Tafa	Ditto	Cartography Sector
5	Arli Llabani	Ditto	Cartography Sector

（2） Activities carried out

Based on the result of preliminary confirmation about the participants, JPT decided to start the training with discussion of specification concerns about map symbols and designing of symbols. After that, the participants carried out the actual work from symbol creation, symbolization, and symbol adjustment. They also conducted scale base compilation from 1/2,000 to 1/5,000 and 1/10,000 while discussing the specifications. Even the members of the Cartographic Sector had few experience of generalization. Therefore, JPT supplementarily made a movie tutorial to increase effectiveness of the training.

(3) Evaluation of technology transfer

Through the technology transfer, most of knowledge and skills reached the level of "Able to teach other technicians".

About symbol creation, the participants are able to create new symbols from design size, color, and pattern. About symbolization, the participants understood the printed 1/2000 map and had a required capacity of symbolization such as "Map layout","Transition", "Thinning", "Generalization", etc.

4.8. Data Structurization

Technology transfer was carried out on how to store the topographic map data, which are the final product, on the ASIG server. In the technology transfer, training was conducted on setting up a PostgreSQL database to be used in the ArcGIS Enterprise Geodatabase format, creating an Enterprise Geodatabase, inputting topographic map data to the enterprise geodatabase, and backing up the database.

Also, technology transfer related to data structuring was carried out remotely for the purpose of acquiring practical technology for utilizing the developed digital topographic maps. In addition, technology transfer related to the installation of the digital topographic map data in the database was carried out onsite.

(1) Contents, schedule, and participants

10 ASIG staff members (Table 4-14) from the Cartography Sector and the GIS Sector participated. Table 4-13 shows the schedule and contents of the technology transfer. The participants did not have much experience in uploading data to online environments or working with relational databases.

Table 4-13 Schedule and contents of data structurization technology transfer

No.	Period	Contents
1	February, 2019	- Demonstration of contents of the technology transfer - Understanding of Vector Tile Generation on ESRI Environment
2	February 2019	- Install PostgreSQL to Local environment - Create Enterprise Geodatabase - Import topographic map data to the database - Backup topographic map data
3	November December 2020 (Remote)	- Creation of 3D buildings and 3D continuous surface features - Generation of a hazard map of landslide - Generation of a map for selecting suitable places for photovoltaic power stations - Database structure improvement and evaluation
4	October 2021	- Installation of the digital topographic map data set to the server

Table 4-14 Participants of data structurization technology transfer

No.	Category	Name	Position	Department
1	Data installation	Klaudio Collaku	Head of the sector	GIS sector
2		Erin Mlloja	Specialist	GIS sector
3		Ergert Sphillari	Specialist	GIS sector
4		Eriona Shabani	Specialist	GIS sector
5		Erisa Garciu	Specialist	GIS sector
6	Data structuring	Saimir Burba	Head of sector	Cartography sector
7		Brikena Sinjari	Specialist	Cartography sector
8		Safete Mihali	Specialist	Cartography sector
9		Brunilda Tafa	Specialist	Cartography sector
10		Arli Llabani	Specialist	Cartography sector

(2) Activities carried out

Technology transfer related to the installation of the digital topographic map data

JPT provided hands-on training for understanding PostgreSQL and storing the topographic map data to the server. As a part of the technology transfer, training was provided on generation of vector tiles on ArcGIS environment.

- Install PostgreSQL to local environment
- Create Enterprise Geodatabase
- Configure Enterprise Geodatabase structure
- Import topographic map data to the database
- Create new database, backup, recovery, and Transfer to other Database
- Create ESRI vector tile set

Technology transfer related to data structuring

JPT provided online training for the following GIS data processing.

- Create 3D buildings
- Create 3D continuous surface features
- Generate a hazard map of land slide
- Generate a map for selecting suitable places for photovoltaic power stations

(3) Evaluation of technology transfer

Technology transfer related to the installation of the digital topographic map data

The participants learned the following:

- How to create PostgreSQL database and ArcGIS Enterprise Geodatabase.
- How to maintain ArcGIS Enterprise Geodatabase and respond for disaster recovery.
- How to generate vector tile on ESRI environment.

Technology transfer related to data structuring

The participants understood that the outputs of the four kinds of exercises can be created as derivative products only from topographic map data, and they also understood the procedure for creating them. Through the technology transfer, JPT advised the participants to consider ideas for other derivative products and services that utilize the developed topographic map data.

4.9. UN Vector Tile Production

Technology transfer of UN vector tile production was conducted by online lectures and on-site OJT. Lectures from and discussions with GSI were remotely provided at some points of the technology transfer sessions.

(1) Contents, schedule, and participants

6 ASIG staff members (Table 4-16) from the GIS Sector participated. Table 4-15 shows the schedule and contents of the technology transfer. None of the participants had knowledge of the UNVT.

Table 4-15 Schedule and contents of UN vector tile production technology transfer

No.	Period	Contents
1	October 2020 (Remote)	- Assembling a Raspberry Pi - OS installation on Raspberry Pi
2	October 2020, February 2021 (Remote)	- Installation of UNVT environment and setup of Raspberry Pi and the OS - Installation of UNVT environment and setup of Raspberry Pi and the OS (redo)
3	February- May 2021 (Remote)	- Conversion of sample data set to UNVT and operation check using Web Map Server
4	April 2021 (Remote)	- Conversion of the project data to UNVT and operation check
5	December 2020-February 2021 (Remote)	- Discussion and consideration of data display according to enlargement / reduction scale
6	October 2021	- Review of UN vector tile creation and control of data display (display scale, symbols)

Table 4-16 Participants of UN vector tile production technology transfer

No.	Name	Position	Department
1	Klaudio Collaku	Head of the sector	GIS sector
2	Erin Mlloja	Specialist	Ditto
3	Ergert Sphillari	Specialist	Ditto
4	Eriona Shabani	Specialist	Ditto
5	Erisa Garciu	Specialist	Ditto
6	Safete Mihali	Specialist	Cartography Sector

（2） Activities carried out

The technology transfer was conducted using Raspberry Pi and UNVT while having technical advice from GSI.

1) Hardware installation / OS setup to know the operation of UNVT
2) Installation and setup of UNVT Tools
3) System construction using open data (data conversion, WEB server setup)
4) System construction using project data (data conversion, WEB server setup)
5) Optimization of distribution data (display scale setting, cartography)

（3） Evaluation of technology transfer

Before this training, participants did not have knowledge of UNVT. Through this training, the participants learned the following things;

- How to set up UNVT web map system in Linux environment.
- How to create UN vector tile data from project data (ArcGIS based data set).
- How to design the map layer on UNVT.
- How to modify and optimize the UN vector tile data for web map system and open to the public.

4.10. Online Technology Transfer

Online technology transfer was carried out in the period of restriction to visit to Albania due to the COVID19 pandemic, for the purpose of effective use of time, periodical communication and support of self-training by the participants, and early completion of OJT area. The following are issues and propositions found through the online training.

Table 4-17 Issues of Online training

Technology transfer	Difficulty / Issues	Recommendation
All	- In comparison to face to face training, it is difficult to arrange schedules of both APT and JPT to keep enough time, due to time difference. - It is difficult to prepare appropriate training contents corresponding to individual levels of trainees in case participants differ in skills and tasks. - It is difficult to recognize comprehension level of training of participants.	- It is effective to prepare some kind type of manual providing not only documentation but also movie tutorials capturing desktop manipulation. - It is effective to arrange combination of online and face to face training.
Generalization	- It is difficult to start from "What is generalization" with the inexperienced participants. - Features whose data size is huge are not suitable to online training because of time loss for displaying or processing. - It is difficult to carry out case by case training or complicated combination of tools in comparison to the basic manipulation and introduction of basic tools.	- It is effective to prepare training with specific images while introducing similar examples from other countries. - It is effective to carry out training distinguishing target of features, processes, and steps by taking advantage of both online and face to face training.
Data Structurization	- It was difficult to acquire practical techniques because the training was not hands-on, but consisted of multiple presentations of tasks and confirmation of the previous tasks. - For the reasons mentioned above, it was also difficult to grasp the individual proficiency levels of the participants, and follow-up according to the level of proficiency was not possible.	- There is a need for technology transfer in an environment where hands-on training can be conducted, and the introduction of hands-on learning equipment such as wearable AR glasses should be considered in the future.
UN Vector Tile Production	- UNVT works in Linux environment (not in Windows). Compared with Windows, the knowledge of Linux is insufficient and this caused the difficulty of training and error handling. - Checked the error screen with USB web cam; however, the image is not clear. Also it takes a time to capture the image which should be taken. - There are limitation with meeting time; however, web meetings are not limited by the date and are easy to hold frequently. This is a strong point.	- To study the basic knowledge is only dependent on each person. There is no other way. - Both sides need to deepen their knowledge about the construction of a remote environment so that they can accurately grasp the situation by using screen sharing. This is a basic requirement of remote training. - It is difficult to completely transfer technology by remote training alone. Onsite confirmation must be done.

5. Work Process Schedule

The work process schedule was as follows.

Work Item	Plan/ Actual	2017							2018												2019												2020												2021												2022	
		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	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Collection, sorting, and analysis of relevant materials and information	Plan																																																										
	Actual																																																									
Discussion on map symbols, work criteria and specifications	Plan																																																								
	Actual																																																									
Validation of taken aerial photos and aerial triangulation outputs	Plan																																																								
	Actual																																																									
Aerial photography and orthophoto creation	Plan																																																								
	Actual																																																									
Field verification and Field completion	Plan																																																								
	Actual																																																									
Digital plotting, digital compilation, and digital compilation after field completion	Plan																																																								
	Actual																																																									
Map symbolization	Plan																																																								
	Actual																																																									
Digital data structurization	Plan																																																								
	Actual																																																									
Creation and management of data to be provided	Plan																																																								
	Actual																																																									
Promotion of utilization of geospatial information	Plan																																																								
	Actual																																																									
UN Vector Tile Production	Plan																																																								
	Actual																																																									
Creation of technology transfer plan and implementation of technology transfer	Plan																																																								
	Actual																																																									
Implementation of country-focused training	Plan																																																								
	Actual																																																									
Creation of work regulations	Plan																																																								
	Actual																																																									
Holding of JCC	Plan																																																								
	Actual																																																									
Holding of Regional Conference	Plan																																																								
	Actual																																																									
Holding of Project Conferences	Plan																																																								
	Actual																																																									
Creation of and discussion on Inception Report	Plan																																																								
	Actual																																																									
Creation of and discussion on Interim Report	Plan																																																								
	Actual																																																									
Creation of and discussion on Draft Final Report	Plan																																																								
	Actual																																																									
Creation of Final Report	Plan																																																								
	Actual																																																									

6. Project Implementation Organization and Personnel

6.1. Project Implementation Organization

The organization of Project members in Figure 6-1.

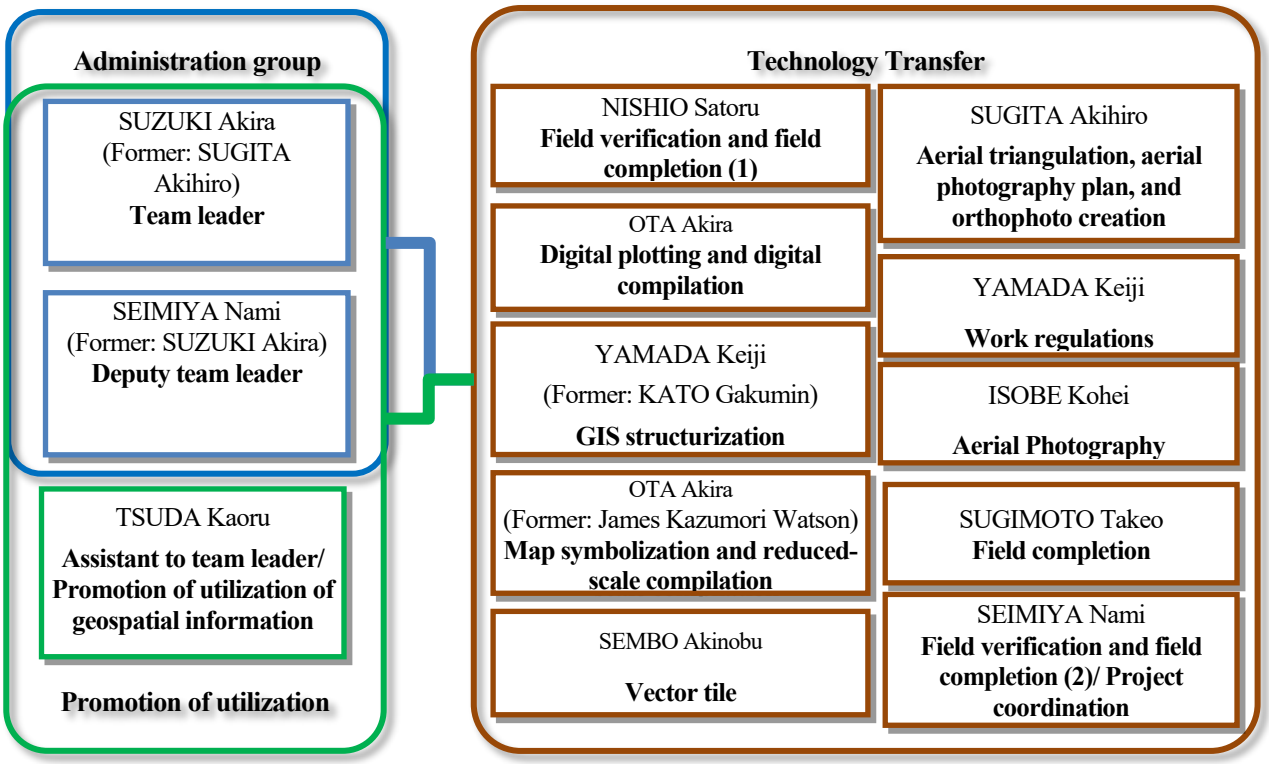


Figure 6-1 Organizational chart of the Project Team

6.2. Personnel Assignment

The personnel assignment was as follows.

	Name	Plan/ Actual
In Albania	**SUGITA Akihiro (Former)**	Plan
		Plan
	SUZUKI Akira	Plan
	Team leader	Actual
		Actual
	SUZUKI Akira	Plan
	Deputy team leader/ Technology transfer	Actual
	NISHIO Satoru	Plan
	Field verification and field completion (1)	Actual
	OTA Akira	Plan
	Digital plotting and digital compilation	Actual
	KATO Gakumin (Former)	Plan
	YAMADA Keiji	
	GIS structurization	Actual
	James Kazumori WATSON(Former)	Plan
	OTA Akira	Plan
	Map symbolization and reduced-scale compilation	Actual
	TSUDA Kaoru	Plan
	Promotion of utilization of geospatial information	Actual
	SUGITA Akihiro	Plan
	Aerial triangulation, aerial photography plan, and orthophoto creation	Actual
	YAMADA Keiji	Plan
	Work regulations	Actual
	ISOBE Kohei	Plan
	Aerial Photography	Actual
	SEIMIYA Nami	Plan
	Field verification and field completion (2)/ Project coordination	Actual
	SUGIMOTO Takeo	Plan
	Field completion	Actual
	SEMBO Akinobu	Plan
	Vector tile	Actual
In Japan	**SUGITA Akihiro (Former)**	Plan
	SUZUKI Akira	Plan
	Team leader	Actual
	YAMADA Keiji	Plan
	GIS structurization	Actual
	James Kazumori WATSON(Former)	Plan
	OTA Akira	Plan
	Map symbolization and reduced-scale compilation	Actual
	SEIMIYA Nami	Plan
	Field verification and field completion (2)/ Project coordination	Actual
	SEMBO Akinobu	Plan
	Vector tile	Actual