CAPACITY BUILDING AT SURVEYING DEPARTMENT OF LIBYA

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SUMMARY

Capacity building seeks to improve the performance of work units, departments, and the whole organization. Organizational capacity building is a system-wide, planned effort to increase organizational performance through purposeful reflection, planning, and action. In particular, capacity building looks in depth at where an organization stands in comparison to where it hopes to be in the future, and develops the skills and resources to get there.

Mapping and surveying in the 21st century relies on computers and management of digital data to allow complex analysis and product delivery. The expertise of staff using such modern digital technology must be increased. A capacity building work plan is required for this; it must be based on an analysis of the current situation and has to show the necessary actions - an institutional capacity building program for the Surveying Department of Libya (SDL) is required respecting the available human resources, promotion of employees as well as new recruitments and recruitments practices.

SDL must shift emphasis from being an organization that is focused primarily on traditional map production and transform into becoming geospatial knowledge managers. This involves using a broader range of information (digital spatial data and attribute data, predictive models, analyses, scientific reports, etc.) and having the ability to incorporate data produced by other organizations.

In this paper, diagnosing what is missing or needed in the organization, planning strategies to change the situation, educating personnel to carry out change, and evaluating results will be discussed in the scope of Libyan National Mapping Project.

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1. INTRODUCTION

Libya, like all developing nations, requires accurate maps depicting its geography, natural resources, population centres, transportation network; and many other types of information that can be presented visually to support decision making and daily government business. For the optimal handling of the resources and any location related planning process geographic information are required. Traditionally the geographic information was available in form of paper maps mainly based on analogue aerial photos.

The organizational structure of the Surveying Department of Libya (SDL) is optimized for the generation of a set of topographic maps with different scales by means of the traditional methods. With the decision of SDL to launch the National Mapping Project of Libya (LNMP), which consists of;

- acquiring digital Elevation Models (DEMs),
- acquiring medium scale orthophoto images,
- acquiring small and medium scale digital topographic maps of the country,
- upgrading the national geodetic network,
- establishing continuously operating reference stations (CORS) in the coastal zone of the country,
- establishing comprehensive geodatabase and portal GIS,

the organizational structure of SDL has to be discussed.

The new techniques require an adjustment of the structures for an optimal data flow. For example with the change from analog photos to digital images no more film development and no more photo laboratory processes are required. The aerial photos existing in the archive and being important also in the future can be digitized and handled as digital images with output by printers instead of a photographic process. The geographic information will be available as seamless digital base map of Libya and maps are generated based on this, not any more requiring map carvings. On the other hand the huge amount of data in the data base and cooperation with other governmental units, having also direct, but partially restricted, access to the data, requires an answer by organizational changes. So some old tasks will become obsolete, some have to be adjusted, while new duties will appear.

The SDL has an old structure and does not meet the current national and international developments in the surveying and mapping discipline.

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2. GOOD PRACTICE FRAMEWORK

SDL should follow the requirements of the Good Practice Framework. The prospect of implementing the Libyan digital base map system offers an opportunity to develop a strategic approach for developing and maintaining new, digital base maps and associated mapping and analysis functions. To assist in developing such a strategy, the core functions that National Mapping/Survey organizations around the globe currently employ as a set of "good practices" are being documented. These good practices are summarized below;

- Adopt and promote the use of standards
- Manage national geodesy
- Provide leadership for basemapping and conduct data collection
- Conduct data compilation and integration
- Manage information systems
- Conduct GIS analysis
- Partnership development
- Provide products and services
- Procurement and contract Administration

3. THE MODERN STRUCTURE OF DATA ACQUISITION AND THE SEAMLESS DIGITAL BASE

To insure accuracy and the ability to share base map data, map products, and survey information requires a commitment to adopt and implement technical standards. Areas where standards are currently being utilized by national mapping organizations (and many other organizations using GIS) include, but are not limited to:

- Datum and projection
- Metadata documentation standards
- GPS data collection
- Survey and mapping standards
- Base map standards
- Data exchange standards

One important role of SDL will be to adapt and promote the use of relevant technical standards as the use of GIS, GPS and related technology expands throughout Libya. Many of the good business practice standards for geospatial information are developed and published by voluntary national or international standards organizations.

A second critical role for the Agency is to adopt policies that describe how the agency will address issues such as data sharing, distribution, information ownership, and information security.

Beside the topics specified in the "tender for 1/25K, 1/50K AND 1/100K – 1/2000K National Mapping and Geodatabase Project", SDL has to maintain the monuments and monument records of the geodetic control network and has to manage the survey support network.

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SDL is responsible for the seamless national base mapping. In future several governmental and private organizations will collect location related information. The Libyan digital base map system must be the base for such information which can be integrated at the other governmental and private organizations. This requires a simple access to the data base. It should be avoided, that other or private organizations build up their own geodatabase. The build-up of private organized geodatabase systems will be provoked by organizational or financial problems in the access of the geodatabase as it happened in several countries. SDL should have the leadership for the base mapping and data collection in Libya; that means it has to cooperate with and has to support other organisations by data sharing, support of data acquisition and by consulting services given by SDL. It also requires:

- Metadata documentation
- Development of data sharing policies
- Marketing
- Dissemination strategies (Internet, Portal, DVD, etc.)

Handling the digital base maps offers possibilities for new products and services that SDL can provide for customers as it can offer to meet special map requests from other agencies. Once technical expertise is in place it will be possible to offer consulting services for new projects, and E-services taking advantage of Internet mapping. Activities included in this function are:

- Consulting on survey and mapping issues
- Standard products
- Special projects
- E-services
- Map requests from other agencies

National mapping agencies in many countries are recognizing the need to modernize work forces and maintain flexibility in their ability to adapt to new technology. The resulting outcome is a combination of in-house staffs with expertise focused on core business functions coupled with assistance from outside contractors. This requires maintaining government skill sets that enable efficient procurement of goods and professional services, as well as capability to effectively manage contracts. Activities included in this function are:

- Development of technical requirements/specifications
- Quality assurance/quality control of deliverables
- Development of contract policies
- Implementation of contract management "best practices"

SDL has to maintain the quality of the geodatabase in the field of accuracy and actuality. A geodatabase is a living system which always has to be updated. By updating the geometrical quality should not be worsened, this only can be guaranteed by SDL itself. The integration of update information reported by others, as there are new roads or railways, reported by department of transportation, has to be made by SDL. In general a system of upgrade has to be established with permanent changes based on reports from other organisations and by periodical check of the completeness of the geodatabase.

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In addition to the geodatabase maps have to be printed in the designed scales. This requires as before the printing operations, cataloguing and distributing.

The primary goal for SDL should be:

- Be the primary provider of base geographic maps and services
- Be recognized experts in surveying and digital mapping
- Serve decision makers and citizens current, accurate base geographic data that can be delivered via the Internet

Based on the established geodatabase and the CORS SDL will be able to get a return on the investment by fees for the use of the geodatabase and CORS, by consultancy services and applied projects. At least a major part of this should be available directly for SDL to reduce the required financial support by the government and for investing it into required technology to stay with the hardware and software on the up-to-date development.

The geodatabase shall serve as a strategic information infrastructure asset for Libya as the foundation for all other location based information.

4. MAIN FUNCTIONS OF PROPOSED ORGANIZATION OF SDL

This proposal consists of a national mapping organization which produces maps and map information internationally and serves these data digitally over a portal.

The business functions of the proposed organization will be,
- Adopt and promote the use of standards
- Manage national geodesy with the main functions of CORS.
- Provide leadership for base mapping and conduct data collection.
- Conduct data compilation and integration (photogrammetry, geodesy and field surveying) and prepare the survey maps in different scales;
- Conduct GIS analysis
- Manage information systems
- Provide products and services
- Qualify offices, companies and authorities that are specialized in survey activities for providing their services based on the conditions and technical specifications that are prepared by the authority
- Strategic planning and development
- Partnership development
- Administrative issues
- Financial issues
- Procurement and contract management
- Education and training

Based on the modern approach of data acquisition, data handling, the seamless digital base map of Libya and the geodatabase as base and partially source for all location related information in Libya some of the exits units become obsolete, others are changed by the

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amount of work and importance, new units have to be included and some structures required for the institutional best praxis should be respected.

Major functions
- Propose the general policy for the country in the area of survey, mapping and their related implementation;
- Conduct a comprehensive survey for all the country and prepare the survey maps in different scales both small and large includes military maps,
- Conduct the special technical activities related to the national boundary and the administrative boundaries in coordination with the concerned parties;
- Prepare, print and provide access to topographic, detailed, marine, magnetic, and atlas maps and other activities for the sake of the authority and other agencies;
- Conduct aerial photos, remote sensing and satellite in different scales for all parties in the government based on the specifications and technical standards that are developed by the authority;
- Conduct national Geodatabase/GIS portal works
- Place norms, standards and technical specifications and provide technical advice for all survey activities in the areas of survey information, aerial photography and satellite, remote sensing and map production for all agencies including ministries, institutions and general authorities;
- Qualify offices, companies and authorities that are specialized in survey activities for providing their services based on the conditions and technical specifications that are prepared by the authority;
- Establishment of CORS
- Manage national geodesy
- Prepare, disseminate and provide technical studies, scientific and applied research related to the use of the visual, electronic and thermal tools and the aerial photography and the satellite imagery in the field of survey science;
- Participation in the development of the technical skills in the area of survey activities, training and capacity building the national human resources for specialization in this area;
- Establishment and management of the library for the survey documentation, the atlas maps, the geographic review and the initiation and management of the GIS system;
- Take the necessary measures for the protection of the CORS/survey points and the geodetic points, its easy access and utilization.
- Educating the technical staff in Surveying and Geoinformation Training Center, coordination of main and prepatory education for other employees and in service education for all of the personnel.

Main Functional Areas
- Create and maintain datum, projections and coordinate systems;
- Create, run and maintain CORS
- Geodetic Survey/Land Surveying
- Create and maintain secondary horizontal and vertical control points;
- Rectification, air triangulation, and stereoplotting;
- Satellite imagery;

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- Cartography, Reproduction, and Printing.
- Create geodatabase and GIS portal
- Develop data policy and data dissemination
- Coordinate mapping related issues in the country

5. CAPACITY BUILDING

The optimal and sustainable use and upgrade of a geoinformation system as the digital base map of Libya never cannot be successful without tailor made education and training. This is one of the key points for the successful build up and continuous use of a geodatabase. Mapping and surveying in the 21st century relies on computers and management of digital data to allow complex analysis and product delivery. The staff expertise in the use of such modern digital technology must be increased. A capacity building workplan is required for this; it must be based on an analysis of the current situation and has to show the necessary actions - an institutional capacity building program for the SDL is required respecting the available human resources, promotion of employees as well as new recruitments and recruitments practices.

SDL must shift emphasis from being an organization that is focused primarily on traditional map production and transform to become geospatial knowledge managers. This involves using a broader range of information (digital spatial data and attribute data, predictive models, analyses, scientific reports, etc.) and having the ability to incorporate data produced by other organisations.

There is no doubt at the fundamental importance of the digital base map system for SDL and the whole country in future; it will dominate the whole administration. Because of the total change of the complete data flow it is more a revolutionary as an evolutionary transformation of the administration, nevertheless it should be tried to integrate the existing knowledge of the staff members in an optimal manner. In addition to SDL also cooperating governmental agencies and private companies are influenced, a solution for the capacity building also of the cooperating groups should be taken into account as well as for job-starters which have to be hired not only by SDL. The data sharing with others is impacting the technical requirements for all related parties. A technology transfer from SDL to other organisations is demanded as well as effective communications to each other. The whole framework, policies and procedures have to be taken into account and should be analysed.

In addition to the required organisational changes at SDL a change of the management procedures has to be checked, respecting also expectations from third parties and following the international good practice. In general the salary regulations should be investigated to support personal incentive as fundament for personal engagement and solidarity with the organisation; they should be motivated and take pride in their work. The incentive can be caused by financial, work environment and training opportunities or others. Daily progress reports about work process are required from technical employees for identifying bottlenecks in the organisation and to optimise the structure corresponding to international good practice.

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The change of the SDL from manual cartography to a geospatial knowledge manager influences data, hardware, software, people, and procedures. Corresponding to the "Review and Upgrade of SDL Organisation" the organisational structure of SDL has to be changed together with the related tasks of the influenced staff members. The staff members have to be qualified for the new functions. In general the workforce has to be modernised to fulfil the new functions.

Map products derived from the digital database are different to former static paper maps, now "living maps" will be possible by linking spatial data and tabular attributes; and through the delivery of Internet mapping applications. These powerful applications allow users to interact with data to answer questions or solve problems directly from any Internet browser. This requires the knowledge of handling such systems in SDL and the cooperating agencies requiring a school of Surveying and Geoinformation associated with SDL.

The workforce and associated skills needed in SDL are very different than the skills currently in place in the SDL. Operating in a digital environment will require significant organizational and personnel change. Change must occur in organizational philosophy, followed by willingness, commitment and ability to recruit, hire, and train new staff with expertise to perform the required functions. This means different skill sets and philosophy.

Workforce modernization, at the level necessary to support digital base mapping in Libya, can be achieved through small core groups of subject matter experts in each functional area to provide leadership, foreign contractor support, and provide quality assurance and integration, coordination, and outreach functions are needed. Achieving the goal of workforce modernization will require a timeframe of some years.

It is also strongly recommended that leadership encourage and facilitate in-country professionals of SDL to collaborate with, and acquire training from, organizations outside Libya.

The deployment of a modern systems approach for managing spatial information will offer SDL and cooperating agencies the opportunity to plan a new set of products and services. The following tasks comprise actions that are necessary:
- Identify desired standard products
- Identify consulting and E-services opportunities
- Design a product/services dissemination strategy

SDL should commit to become a key node on the Libyan Spatial Data Infrastructure (LSDI) and work together with other key federal agencies to insure its success. As relevant pilot projects, policy oriented committees, and technical work groups are identified, SDL must take part and contribute. Not only will this allow input into the direction of the LSDI, but the experience gained through participation will serve as important opportunities for mentoring SDL staff.
- Contribute data to the geospatial portal
- Serve on relevant policy committees and technical working groups
- Participate in pilot projects
- Coordinate with other Libyan Spatial Data Infrastructure agencies

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These tasks will be ongoing.

One of the most important strategic actions SDL can undertake is to inculcate the organization with a philosophy of working cooperatively with outside organizations. Aggressive outreach to establish partnerships with others, including government agencies and the private sector in Libya, as well as other organizations internationally is critical for the development and long term viability of SDL. Partnerships will enable mentoring and training for new and existing staff; and will facilitate data sharing to enhance the quality and timeliness of base mapping products. SDL staff has to be open for cooperation within SDL and with other cooperating organisations it must be present what it means to be a "good partner". Such non-technical quality is essential for the progress.

6. REVIEW OF SDL STAFF

SDL has in Tripoli currently 114 staff members; an overview is given in Figure 1.
In addition to the SDL in Tripoli 4 staff members are located in the Benghazi branch.
From the 114 staff members in Tripoli the following number of persons is not belonging to the technical staff engaged directly in the field of surveying, mapping and map production:

Cleaning, telephone, driver, electrician, depot, pilot, technician:	23
Accounting	12
Administration	8

In total:	43

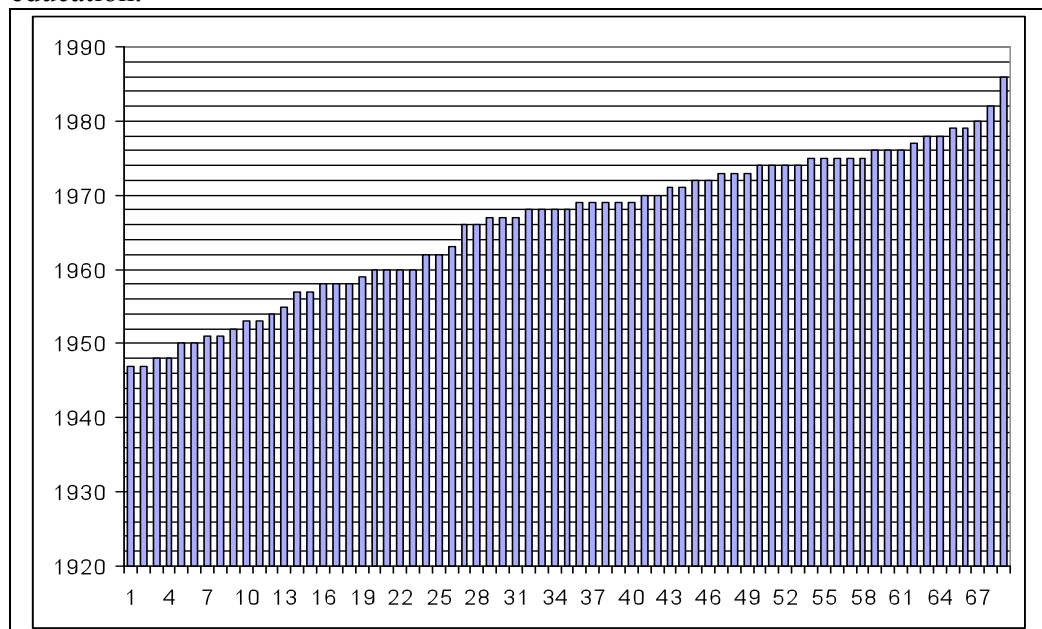That means 71 staff members are belonging to the group able to get technical training and education.

Fig. 1: Age structure of SDL staff with ability for technical education
Vertical: year of birth horizontal: summed up number of staff members below listed year of birth

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For an education to BSc and MSc the age of the staff members should be respected.
Up to 25 years old: 1
Up to 30 years old: 5
Up to 35 years old: 20
Up to 40 years old: 34
Up to 45 years old: 42
Up to 50 years old: 50

7. EDUCATION TO BSC AND MSC

It is decided to send to foreign countries: 20 persons for SDL to bachelor studies in the field of geomatics engineering, partially named also as surveying engineering, but including also geoinformation, and 20 persons for master studies in the field of in geodesy, photogrammetry, GIS, cartography, surveying and mapping (see also table 2" below). For an education as BSc or MSc the staff member should not exceed the age of approximately 35 years. In addition the candidates have to fulfil the required basic education, should have the flexibility, willingness and knowledge of language for attending university courses abroad. With these requirements it is obvious that it is not possible to find enough staff members at SDL be able and willing to get such university education abroad. Required courses in the named fields are not available in Libya. A staff member with BSc or MSc grade should not get a second education of the same level. So SDL has to hire additional staff members for such an education.

The establishment of the digital base map system using modern photogrammetric techniques may be used as base for the master-thesis, which may be executed in cooperation with a foreign university in Tripoli.

It has to be ensured, that the staff members getting a BSc or MSc education in a foreign country are returning to SDL. The candidates should sign a contract that they are willing to work as SDL staff members for twice the time of the education, if they are leaving SDL before they have to return the money for the education.

In addition also the progress of the education abroad has to be checked by passed exams to ensure a successful study. Of course some tolerance should be given just in the first year, when the candidates have to improve their language and have to adapt them to the required level of education.

8. TRAINING ON THE JOB
Several training components are included in the tender for the national mapping and basedata project. Such training on the job is absolutely necessary for an effective handling and operating of all components of the Libyan digital base map system. The training components specifies fully to train SDL staff through:
- General training
- Software training
- Project related training
- On-the-job training

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- Short courses abroad – the short courses are specified in table 2 with 25 candidates, each for 2 month, in the field of geodesy, photogrammetry, GIS and Mapping (see below) Education for BSc. degree in geometics engineering Education for MSc. degree in geodesy, photogrammetry, GIS, cartography, surveying and mapping engineering

For CORS the training is specified in the tender as following:

Training – Training shall be provided to SDL personnel. As far as CORS sets, other hardware, spares, software, Control Center for CORS-LIBYA (CC) operation and training are concerned three sets of users manuals, guidelines, procedures, documents, reports (in English and if available Arabic as well) for installation, maintenance, repair, operation, etc., all in paper print and pdf on CD/DVD – ROM shall be provided. Training will cover the following topics:
- CORS receivers, other hardware / equipment, CORS and CC installation, integration and maintenance
- CORS and CC Operation (communication with CORS, network solution, computations of corrections, post-processing, etc.), and services to users

in order to assure that the clients' staff will receive proper training and build capacities to later run the system on their own.

The training will be provided to a minimum of 6 personnel each from SDL for at least 10 days on each lot by qualified specialists (subject to the approval of SDL) with a minimum experience of two years.

The bidders shall provide a complete description of the training topics, lecturers and training notes together with their proposal in this tender.

NO	ITEM	QTY
ESRI Licences		
1	ArcView Concurrent	10
2	ArcEditor Concurrent	2
3	ArcScan Concurrent	2
5	ArcGIS Server ENT Basic Upto 4 cores	2
6	ArcGIS Server Advanced Up to 4 Cores	2
7	ArcGIS Server Advanced Network Extension Up to 4 Cores	2
8	ArcGIS Server Advanced Spatial Extension Up to 4 Cores	2
9	Annual Subscription for ESRI Developer Network (EDN)	2
10	ArcGIS Image Server Up to 4 Cores	2
11	ArcGIS Data Interoperability Concurrent Use License	2
12	ArcGIS Survey Analyst Concurrent License	2
13	ArcGIS Portal Toolkit	2
14	ArcPAD together with Rugged Tablet PCs	10
ORACLE Licences		
1	Oracle Database Enterprise Edition (Processor Based)	2
2	Partioning (Processor Based)	2
3	Tunning Pack	2
4	Configuration Management Pack	2
Microsoft Licences		
	Windows Server Enterprise 2003 R2a Win32 English	

In table 1, the software licenses for which training is required are listed.

Table 1 software licenses for which training is required

NO	SUBJECT	QTY
M. Sc. In Geodesy		
1	Satellite Geodesy, GNSS, CORS	2 Student / 2 years
2	Physical Geodesy, Geoid	2 Student / 2 years
M. Sc. In Photogrammetry and Remote Sensing		
3	Aerial Photography, LIDAR, sensors and Orthophoto Mapping	2 Student / 2 years
4	Digital Photogrammetric Mapping, City models	2 Students / 2 years each
M. Sc. In GIS		
5	Information Systems, Database Design, Geodatabase Establishment	2 Student / 2 years
6	Web-Based GIS, Portal GIS, Data Dissemination	2 Students / 2 years each
M. Sc. In Cartography		
7	Map Publishing, Map Generalization and Presentations	2 Student / 2 years
M. Sc. In Surveying and Mapping		
8	Surveying and Mapping	2 Student / 2 years
M. Sc. In Software Engineering and Systems		
9	Software Engineering	2 Students / 2 years each
10	System Administrators / Analysts	2 students / 2 years each
B. Sc. In Geomatics Engineering		
11	Geomatics Engineering	20 students / 4 years each
Short Courses Abroad		
12	Geodesy, Photogrammetry, GIS, Mapping	25 students / 2 months

Table 2, specifying MSc and BSC education as well as 2 month short courses in geodesy, photogrammetry, GIS and mapping abroad

9. SCHOOL FOR SURVEYING AND GEOINFORMATION AT SDL

As always stated in the proposal for the upgrade of the SDL organization, the capacity building process cannot end with the successful end of the national mapping and geodatabase project, it has to be continued after this.

The successful use of the Libyan digital base map system, not only by SDL, requires educated staff. Training and education will be given during the national mapping and geodatabase project, but the requirement for training never ends. In addition by the periodic cycle of new

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and retiring staff members, a basic education corresponding to the requirements of the Libyan digital base map system should be possible within Libya. There is a lack of education in surveying and geoinformation, as required by SDL and others, within Libya. Also on the university level education in surveying engineering in combination with geoinformation, today often named also as geomatics, does not exist. This is not only a problem for SDL, it is a general problem for the development of the country. Trained technician with knowledge about surveying and geoinformation, including modern field survey and the handling of geo-information systems (GIS), are required for all more complicate constructions and for the optimal use of the geo-data base. In addition staff members of other governmental units have to be trained for the use of the digital base maps. Such applied training should not be made for a high amount of money in foreign countries; it should be made within the country to allow also an education parallel to another job and it should be related exactly to the required topics. SDL has and will become staff members able to give qualified courses at the required School of Surveying and Geoinformation which should be directed by SDL and can be located within the office building of SDL. This school should start with education on the level of technician and should give training courses for other governmental units. A mayor topic of this education is the applied training. More necessary as theoretical knowledge is the practical handling of the equipment and the software. It may be possible to add later on in cooperation with a university the education on the level of BSc, while the education on MSc-level at least for a while has to be made abroad.

10. CONCLUSION

Up to date the following works have been done, in scope of Institutional Development / Capacity Building works;

- Organization have been reviewed and a new Organizational Chart have been proposed
- Capacity Building program
- Technical Training program
- Strategic Plan
- Data Policy
- Project Management approach and proposal
- Map projection and datum
- 1/1K,1/5K,1/10K base maps technical specifications
- QA/QC for field surveying
- Geographical names
- Mapping Index
- Building Construction Technical Specification

SDL has to specify the candidates for BSc, MSc training as well as for the short courses. As preparation for this SDL should ask via a form any staff member working in the field of geodesy, photogrammetry and mapping if they are willing and able to attend such education abroad.

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It is obvious, that from the available staff members of SDL not required number of candidates for BSc and MSc can be recruited. In addition it would be difficult during the implementation of the Libyan digital base map system, when also the applied training should be given by the chosen bidder, to operate SDL without the well pre-qualified BSc and MSc candidates, so additional staff has to be hired. The MSc and BSc education abroad, should start be not later than 2010. It may be required to give language courses to the candidates before they start with the education abroad. All this has to be respected for hiring new staff members.

The MSc and BSc candidates should sign a contract that they are willing to work as SDL staff members for twice the time of the education, if they are leaving SDL before, they have to return the money for the education.

The candidates for the CORS and CC training have to be specified in time. The same has to happen for the software and general training.

The salary regulations should be investigated to support personal incentive as fundament for personal engagement and solidarity with the organisation; the staff members should be motivated and take pride in their work. The incentive can be caused by financial, work environment and training opportunities or others.

Daily progress reports about work process are required from technical employees for identifying bottlenecks in the organisation and to optimise the structure corresponding to international good practice.

A School of Surveying and Geoinformation for applied education on the level of technician and for giving training courses to other governmental units as well for continuous training of SDL staff members should be founded. It should be directed by SDL and be located within the office building of SDL. At least a mayor part of the technical staff can be staff members of SDL giving a limited number of lecture hours per week. This has the advantage of tailor made education for the requirements of SDL and in general the Libyan digital base map system.

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He was born in Turkey at 1959. He had his BSc at 1983, MSc at 1988 and PhD at 1997. He had worked at the Geodesy, Photogrammetry, Cadastre departments of General Directorate of Land Registry and Cadastre. He executed the World Bank`s MEER/MERLIS and ARIP/Cadastre projects. He worked as executive staff at `Turkish National Spatial Data Infrastructure Project phase I and II` and Land Registry and Cadastre Information System. He worked at CORS-TR project group. He had published more than 30 papers for various academic publications. He works for GeoTech Group as Vice President and executes Libyan National Mapping Project.

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