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An Approach Towards The Development of National Geographic Information Strategy in Palestine

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Abdullah .S. Abdullah

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**An Approach Towards The Development of National
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Author:

Abdullah. S. Abdullah

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Foreword

This publication belongs in a series of planned books on Palestine emerging from the Lower Jordan River Basin Project, a collaborative effort between the universities of Birzeit and Bergen. This project has a resource management profile, in which human resources management is seen within the context of economic, political and ecological perimeters. The main objective is to build up research and competence among Palestinians and Norwegians with regard to the culture, history and human ecology of the lower Jordan River Basin of Palestine and Jordan. Research activities and competence building in the program have been defined within three sub-thematics: 1) land, 2) water, and 3) cultural Heritage. The project was stated in 1998 and is currently into its second phase. This second phase of the project involves education and training of researchers, field projects and research in connection to the thematics of the project, and also includes support towards establishments of graduate programmes and a Resources management Centre at Birzeit. The project's aim is to assist Birzeit University to continue to produce a more integrated view of the development processes in this region. Earlier research has generally been of more specialized nature, focusing on either the basin as a physical unit, its agro-economic potential, its archaeological history and antiquities, and of course its political complexities. The project will continue systematic attempts at studying the human Ecology and long-term cultural history of this basin as a foundation on which to develop planned interventions in the valley.

The publications in this series are attempts at contributing to this process. Many of the books are based on Master or Ph.D-theses carried out within the context of the project. Others are based on reports commissioned to address specific fields and problem areas relating to the overall themes of the project. In addition to the monograph series the project also has a "working Paper-series" in which reports, papers and surveys containing valuable empirical information are published.

The First seven planned publications in this monograph series are the following:

No.1: Janne Bøe, " " Farming Will Always Remain the Best Job, it Was the First Love " "

No.2: Abdul-halim Ali Mohammad Tmeizeh, "water Rights and Uses in Midland Palestine"

No.3: Nefissa Naguib, "Knowing Water: Palestinian Women Between the Spring and the Faucet"

No.4: Abdullah S.Abdallah, "An Approach towards the Development of National Geographic Information Strategy in Palestine"

No.5: Bård Kårtviet, "In the US I'm an Arab Terrorist; Here I'm an American Punk ". A Study of Palestinian Return Migration and Identity Management on the West Bank"

No.6: Abdul Rahman Al Mugrabi, Historical, Geography of Central Palestine in the Middle Islamic era (1099-1516 A.D.).

No.7: Ayman Abu Mustafa, The Trade Routes in Palestine During the Mamluk Period (1260-1516 A.D.). A Historical, Geographical and Economic Studies"

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We want to extend our thanks to Mrs. Elizabeth O'Reilley, Devon, Pennsylvania for her work in improving the English language text of the series.

Professor Kamal Abdulfattah and Professor Leif Manger, Project Coordinators.

To

My parents

My wife

And

My children



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GI	Geographic Information.
LRC	Land Research Committee.
NSDI	National Spatial Data Infrastructure.
PALGRIC	PALEstine geographic Centre.
PCGM	Palestinian Centre for Geographic information and Mapping.
PECDAR	Palestinian Economic Council for Development And Reconstruction.
GIS	Geographical Information Systems.
PGDCC	Palestinian Geospatial Data Committee.
PNA	Palestinian National Authority.
PU	Polytechnic University.
QC	Qalandia College.
WBGS	West Bank and Gaza Strip.

Proposal Approach for Development of Geographical Information Strategy to Implement NSDI in Palestine

Abstract. Low level of awareness, lack of data sharing, overlapping and duplication of efforts hamper the effective management of fragmented GIS activities in Palestine. The main purpose of this dissertation is to propose a national approach but government initiative to develop a coordinated National Spatial Data Infrastructure (NSDI) in Palestine. This approach can significantly contribute to minimise data redundancy and activate data integration on one hand, and to facilitate the planning and management of economic development and utilisation of natural resources on the other. The study reviewed GIS implementation in developing countries and the experience of national NSDI initiatives of other countries to learn lessons to build upon. Current Spatial data activities in Palestine were assessed. The success of NSDI initiative will require government political and financial support to develop a comprehensive approach for a geographic information strategy that leads to implementing the activities of NSDI. These activities include establishing of: coordination body, national data clearing house, geographical framework, standards, policies and human resources development program. Finally, based on assessment of current spatial data activities in Palestine and theoretical knowledge of experience of other countries, the approach of Palestinian national initiative for development of geographic information strategy was proposed, outlined and discussed.

1. Background and introduction:

1.1. *Geography, history and political circumstances*

The modern history of Palestine began after the fragmentation of the Islamic Ottoman State early in the last century when Palestine was under British mandate. In 1948, Israel occupied 80% of Palestine's land, the other 20% West Bank & Gaza Strip (WBGS) were administrated by Jordan in (West Bank) and Egypt in (Gaza strip). In 1967, Israel occupied entire WBGS. In 1993, the pace process initiated between Palestine and Israel, according to Oslo agreement the Palestinians are supposed to get back the areas of WBGS. It is composed of two geographically separated territories West Bank and Gaza strip (figure 1). These areas are about 6200 square kilometres where 3.2 million Palestinian inhabitants The other half million displaced

Palestinians are expected to return back to there homeland in the coming 5 years. The area has a high density population. Gaza strip is the highest density in the world 3300 inhabitant per square kilometres.

Map making in Palestine began early by British mandate; the geodetic network was established in the 1920s. Then small and mid scale topographic maps were produced. Some large-scale cadastral maps were also produced. In the period 1947-1967 Israel continued mapping the Palestinian areas under it's control. After 1967, Israel continued the mapping activities in all Palestine for the purpose of facilitating the Israeli colonisation policy which aimed to control Palestinian natural resources and to prevent the Palestinians from utilising there own resources. At the same time, Israel imposed great restrictions that stopped Palestinian access to geographic data. After the pace process began, Palestine (WBGS)

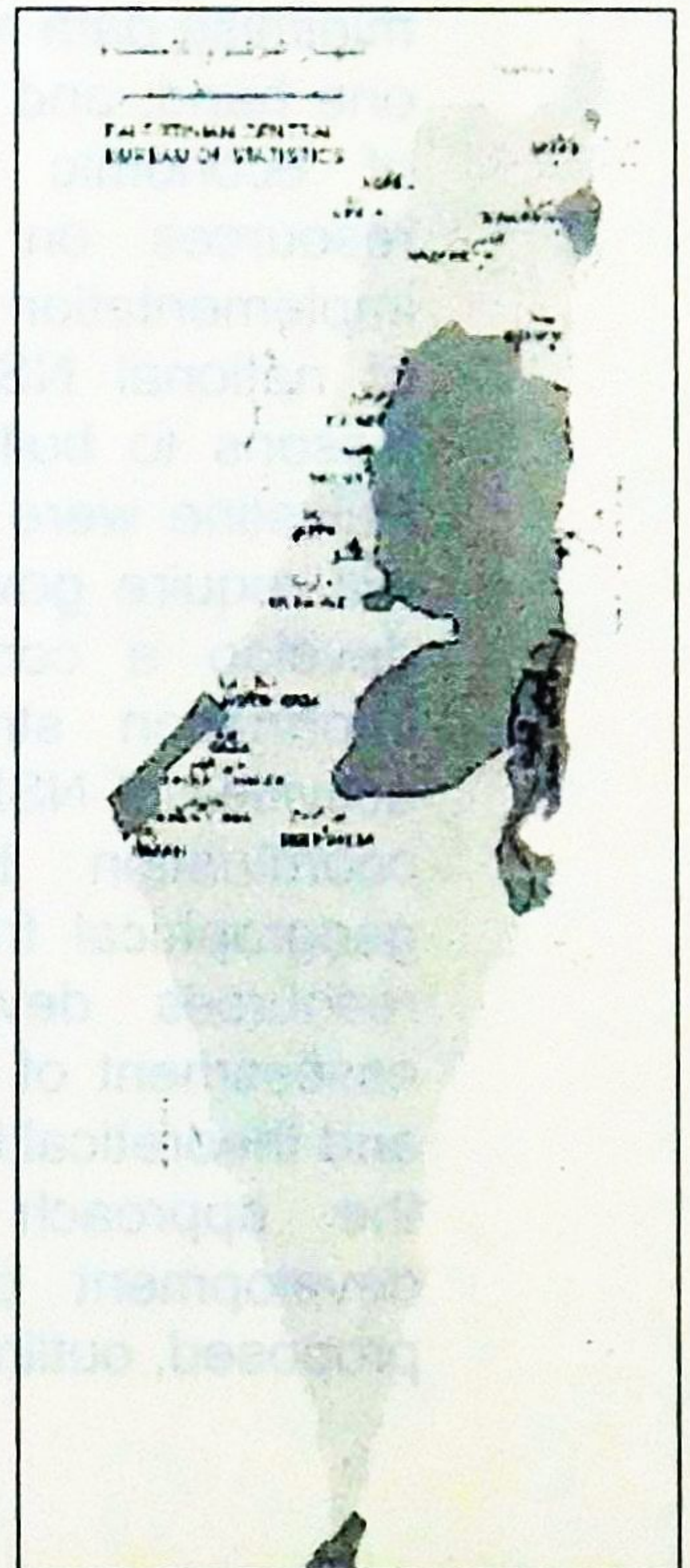


Figure 1: Palestine Map

became autonomous. In the context of the peace agreement, the responsibilities of surveying and mapping are supposed to be transferred from Israelis to Palestinians.

Despite its politically difficult situation, Palestine is an emerging country, with rapid changes in political, social and economical fields in quality and quantity. Rebuilding the national economy will require the efficient management, utilisation of natural resources and making the right decisions to invest land and build infrastructure. A suitable tool to assist in these processes is Geographical Information Systems (Longley *et al.* 1999).

However, implementation of GIS technology in developing countries is problematic, according to Taylor (1991) and Sahay & Walsham (1996). Particular problems faced in Palestine are manifold: there is neither a central national mapping agency (PNA, 1996), nor a national framework for handling geographic data. According to Rhind (1997) detailed geographical knowledge necessitates the establishment of a geographical framework.

1.2 Demands for spatial data

With the beginning of the World Bank program for the development and reconstruction, government organisations as well as private sector requirements for access to geographic data had growing rapidly and becoming a necessity due to the needs to formulate new policies and strategies. Policy makers access to accurate data can contribute to make proper decision that raise standard of living and improve the quality of life. Implementation of Many projects was retarded by the lack of data and some times by inaccurate available data. Geographic referencing is needed in many physical and socio-economic areas such as planning, the utilisation of resources, construction and maintenance of infrastructure and utilities, health, education, social rights, in addition to the rapidly growing demands for environmental management. In spite of many available GIS activities in both the public and private sector, there have been real limitations on the capacity to provide spatial data.

There is an urgent need for conceptualisation and development of a geo-spatial data framework to maximise the political, economical, social and environmental benefits of geographical information systems on one hand, and to minimise data redundancy and facilitate integration (Tosta, 1997b) between Palestinian institutes on the other. Where these fragmented GIS activities has been set up or

is under development their effective management is hampered by a lack of co-operation between the different institutions and there is a lack of data sharing, overlapping and a duplication of work.

1.3 Why is this study

This study is trying to answer the following questions: what are the requirements for better management of spatial data? How can we improve access to spatial data? How can we activate a share of spatial data? What are the impediments and obstacles needed to be removed? And how? How we can increase benefits of GIS on a national level? What are the proposals to develop national geographic strategy?

This study attempt to propose an approach for development of a geographic information strategy to implement a coordinated NSDI that can strengthen the capacity of Palestinian society government, private and academic as well as non government organisations to collect, use and provide geographical information.

2. Literature review:

This section will review briefly literature in four related areas: GIS in developing countries, GIS projects and initiatives in the Arab Middle East countries close to the area of Palestine, national initiatives to develop NSDI in addition to rarely available literature about GIS and mapping development in Palestine. Reviewing the literature of GIS implementation in developing and Arab countries is due to the fact that Palestine is an Arab developing country. International experience to develop NSDI will be explored to learn the lessons.

2.1 Implementation of GIS in developing countries:

Taylor (1991) had stated that Implementation of GIS technology in developing countries is in general problematic and marginal in the development process in the third world. Sahay & Walsham (1996) have reinforced that claim. Bernhardsen (1991) takes wider view when he emphasised that in most developing countries GI sectors lack the political interests, financial resources and professional capabilities. Like Bernhardsen (1991), Sahay & Walsham (1996) concluded that the main challenges to introduce GIS are institutional and organisational. Similar to Bernhardsen (1991), Yeah (1991) and Simonett (1993) have pointed to the financial resources as limiting factors for implementation and maintaining GIS databases. Standley

(1997) from the UN reports the following GIS problems: institutional and human resource sustainability, difficulty in obtaining aerial photography, and a lack of interest in standardisation. Viergever (2001) has summarised that the spatial data infrastructure is not already on line in developing countries due to the lack of financial and human resources, attitudes and culture of people and lack of awareness of decision-makers. Other bodies of GIS literature in the developing countries have focused on the means to develop the implementation of GIS. Bernhardsen (1991) has already pointed to the importance of government long-term support based on long-term strategies to build the GIS databases. Sahay & Walsham (1996) proposed that there will be a better balance between the technical and social factors in addition to development of the implementation strategies that could contribute to sustainability. However, GIS was successful in some developing countries such as South Africa and Qatar.

2.2 GIS in Arab Middle East countries:

Burden & Bit-Ishaq (1997) have mentioned that the main obstacles to GIS in Oman are, adequate funding and training, in addition to customisation of the Arabic language and related standards. Although Burden & Bit-Ishaq (1997) agreed with Konecny (1997) on the main problems of developing GIS in the Gulf States, Konecny (1997) took a different view regarding the financial aspect; the reason is that most Gulf States are rich. At the same time, he stressed the problem of effectivity that is a reflection of institutional contexts. Ekmekji (1997) mentioned that GIS industry in Lebanon had begun developing, but it is still not nation-wide. Amer (1997) has stated that the obstacles to developing GIS in Jordan on a national level is caused by the absence of a national steering committee that leads to a consistent GIS implementation, the lack of proper legislation and training. In summery, Palestine has faced all these problems, in addition to others related to politics. However, The situation in Palestine is very similar to the other developing countries and mainly Jordan.

2.3 National initiatives to develop NSDI and geographical information strategies:

Most of Literature focuses on describing the emergence of NSDI and it's primary objectives. Other studies have described the national

initiatives and elements of NSDI. Little of the literature has evaluated these initiatives to investigate what lessons might be learnt from this experience.

2.3.1 Emergence of national initiatives for development of geographic information strategies:

Clinton (1994) in his executive order 12609, identified NSDI as:

'Technology, policies, standards, and human resources necessary to acquire, process, store, distribute and improve utilisation of geospatial data.'

Masser (1998) argued that the National geographic strategy is referring to a national spatial data infrastructure. The term national refers essentially to the government initiative to co-ordinate the management of a number of geographic databases held by various public and private organisations. The use of strategy is to emphasise the need for the government to take active steps to improve the infrastructure and to make the utilisation of the GI continuously flexible and able to respond to the changing demands. Tosta's (1999) view was different, she mentioned that NSDI is used to describe geospatial data coordinating activities. Masser (1998) suggested that the tendency toward formulation of a national initiative to develop GI usage and collection is due to the change in government strategies and the re thinking of there role to organize these resources and deliver better information to a wider market of customers. Rhind (1996) mentioned several features in that definition, but he detailed, that the government is the primary sponsor for the national geodetic framework. And since they have other considerable influence resulted from what he called 'cocktail of laws, conventions and precedents that determine the availability and price of spatial data'. OS (2000) and Bagan (2001) went further and suggest that the government has to utilise NSDI to modernise the business to achieve joined up working of government organisations to provide better level of service for the customers. Unlike Masser (1998), Tosta (1994,1999) had argued that the Primary objective of NSDI was and is still to maximise the opportunities for the data sharing and to reduce duplication. While Rhind (1997), describe that the establishment of geographical framework is important to providing detailed geographical knowledge.

Rhind (1996) and Masser (1998) agree that the broad view of the infrastructure can high light the extent to which NSDI is not only the

collection of databases, but also of people, technology and mixture of laws and precedents. Masser (1999a) and Rhind (1999) reported that since the 1980s some countries had launched national initiatives with different names. These initiatives indicate some form of co-ordination mechanism and policy harmonisation or formulation that maximises the usage and effectiveness of GIS on the national level. Table 1 shows clearly that the scope of most of these initiatives is however public, but it varies in term of the applications.

Table1: Summery of characteristics of main national initiatives

Country	Initiative name	Status mandate of coordination body	Scope	Type of country
Australia	Australia spatial data infrastructure	Coordination activity	Land related information	Developed
Canada	Canadian geospatial data infrastructure	Coordination activity	Wide range of federal agencies and geomatics industry	Developed
Indonesia	National spatial data infrastructure	Formal mandate	Surveying ,mapping and land management	Developing
Japan	National spatial data infrastructure	Formal mandate	Central government surveying and mapping activities	Developed
Korea	National geographic information system	Formal mandate	Central government surveying and mapping activities	Developed

Malaysia	National infrastructure for land information systems	Formal mandate	Surveying , mapping and management	Developing
Netherlands	National geographical information infrastructure	Coordination activity	Data providers and users	Developed
Portugal	National system for geographic information	Formal mandate	Wide range of central governments	Developing
Qatar	National geographic information system	Formal mandate	Wide range of central governments	Developing
United kingdom	National geospatial data frame work	Coordination activity	Key data providers (public and private sectors in addition to academic sector)	Developed
United states	National spatial data infrastructure	Formal mandate	Wide range of substantive interests	Developed

The source of first and second column is (Masser, 1998).

Qatar's experience is relevant for Palestine to learn lessons, as Qatar is an Arab country, with little knowledge about GIS.

2.3.1.1 Qatar NSDI initiative:

The National GIS steering committee was established in 1990 by government support to oversee the development and the building of a comprehensive fully integrated GIS system and infrastructure. The

centre for GIS was established with the mission to co-ordinate a systematic implementation of GIS in Qatar. Tosta (1999) reported that the only likely successful national effort might occur in very small and less complex countries, such as Qatar.

2.3.2 Components of national initiatives for development of geographic information strategies:

It is found that most of these initiatives are using the American model with some modifications. The main components are: coordination, geographic framework, national data clearing house, standards, policies and human resources management.

2.3.2.1 Co-ordination:

Masser (1998) and Tosta (1999) have stressed the importance of coordination. Special bodies have been established with responsibilities for the national geographic information, co-ordination and preparation of proposals and suggestion for the creation and development of national spatial data infrastructure strategies.

2.3.2.2 Geographic framework

FGDC (2001a) is defining the framework as a collaborative effort to create a widely available source of basic themes of geographic data. It is a collection of organisations producing and using spatial data. Geographic framework is composed of:

2.3.2.2.1 Institutional framework

Baker (1995) describes the institutional framework. This framework defines the policy, administrative arrangements for building, maintaining, accessing and applying the standards of the data set.

3.2.2.2.2 Framework data:

Guptill (1994) & Tosta (1997a) agreed that the idea of framework data had been developed by FGDC to help minimise the duplication in the collection efforts and to contribute to the development of acceptability of integrating data from different resources. Data sets are developed by different agencies according to legal mandate. Masser (1998) considered the core data as one of the basic key elements NSDI.

2.3.2.2.3 Partnership:

Tosta (1997a) and Masser (1998) affirmed that the Building of a partnership for the creation, production and maintenance of core national data sets has proved to be an effective methodology.

2.3.2.3 National data clearing house:

Tosta (1994) defined the national data clearinghouse as an effort to use the national spatial data infrastructure to provide an indexed database that describes geographic data held by various national data sets.

Guptill (1999), however, describes the Clearinghouse as composed of three combined main components. Metadata, Internet or any network connections in addition to software query tools. The aim of a data clearing house is to offer data providers the chance to advertise their products and at the same time allow the users to use these to access, query and search for geospatial data that fits their purposes and needs..

2.3.2.3.1 Metadata:

FGDC (2001b) and Guptill (1999) have defined Metadata as data about data, It describes the content, quality, conditions and other characteristics. Masser (1998) has positively evaluated the political and organisational dimensions for the building of a metadata.

2.3.2.4 Standards:

The Local Government Management Board (1995) defined data standards as '*specifications for data sets and codes of practice for procedures for their creation, storage, transfer and applications*'. Standards intended to facilitate the sharing of data and to make the technology more user friendly (Guptill *et al*, 1995). Albrecht (1999) has summarised these standards: to increase the understanding and usage of geographic information systems, to enhance the availability, access, integration and sharing of GI, to promote the efficient, effective and economic use of geospatial data and finally to contribute to the unified approach to addressing global, regional and ecological problems.

2.3.2.5 Policies:

Tosta (1994) had stressed the importance of defining the critical factors that form the bases for future policy formulation. This is critical for the success of NSDI. Rhind & Smith (1999) stated that the

policy is a compromise of many factors related to legal, economical, political and some times social issues. Branscomb (1995) had assured the needs for measures to control digital data flow.

2.3.2.6 Human resources:

Bednarz & Ludwing (1997) noted That a human resources component should be institutionalised and established as part of the primary, secondary and university education. Education in GI sciences is a life learning process (Kerski and Ward, 2000), The main characteristic of the education and training program should be to keep up to date knowledge.

2.3.3 lessons learnt from experience of national initiatives for development of NSDI:

Masser (1998) highly evaluated the awareness as a critical factor in the development of geographical information systems. Masser (1998,1999a and 1999b) and Tosta (1999), emphasised the involvement of apolitical commitment to the successful building and sustainability of a geographical information strategy. Tosta (1997b and 1999) and Masser (1998) stressed The importance of an existence of the spirit of cooperation between government organisations. A very important lesson for Palestine is made by Masser (1999a), he stresses the point that where there is little GIS activity coupled with a lack of basic skills and resources it is better to establish a centre to lead the implementation process and to be a key player in creating the NSDI.

2.4 GIS and mapping development in Palestine:

Unlike this study, PNA (1994) has proposed to mandate a non-governmental working group to implement an action plan to develop GIS on a national level with three stages. Similar to our study, PNA (1996) stressed the urgent need for base maps. The report also identified .The need for a central body in Palestine to be responsible for coordinating mapping activities This report had identified the GIS policy as one whose components have marginal output.. Jumaa (1998) has discussed the role that GIS can play in the urban planning in Palestine. His recommendations agree with this report regarding the need for integrated national GIS data set and standards. PNA (1999) is not contradicting the approach of this study. the recommendations of the draft proposal are to develop a

coordinated NSDI. This study is considered a continuation, and complementary academic approach.

3. Methodology

3.1 Data collection

Data collection was difficult and wide, but intensive and in depth. Two sources were used: a small part of the data regarding the survey of Human resources and GIS equipment in organisations (providing, using or educating GIS) was collected from the Palestinian Economic Council for Development And Reconstruction (PECDAR), PECDAR had run last year a project of 'development of geographical information service in Palestine'. The reason to use this data from PECDAR was the difficulty and impossibility to collect any data these days in Palestine due to the tense political situation.

The other major part of the data was collected throughout personal telephone interviews, a total of about 25 interviews was conducted during June 2001, and some o in July 2001. The main organisations 'producing, using or educating GI' are (21) in number, they were identified as the sample. These organisations are ranging from government, private, academic, non-government as well as vendors and contractors. The key person in these organisations was selected to be interviewed, The interviews were conducted with key persons in the these organisations. As a result semi structured interviews were conducted,

Data regarding the legal mandate status, the applications of GIS, the structure of organisations, the available data set, and data dissemination policy were collected. The local government organisations were limited to four (main municipalities). The municipalities data was combined and headed by the ministry of local governments in the tables. The tables were prepared in advance for the interview. The data were collected and tabulated directly during the interview. Part of these interviews was used to update the data that was collected by PECDAR last year. No significant differences were noted. The interviews included discussion, wherever it was possible or necessary, to make sure that common understanding was available for respondent and interviewer. These discussions were used as a complementary part of the data collection. It is important to indicate that for some organisation the key person was interviewed more than once for the

purpose of finding clarifications of some of the data. The use of telephone interviews offered the following advantages:

- It was more practical.
- It was fast. The interviewed person was informed in advance about the reason for the interview and what type of questions would be asked.
- Detailed information could be obtained.
- This method allowed for useful interaction that provided a deeper understanding.

The method had the following disadvantages: limited time, and in difficult to interact when the person was not enough aware of the use and implicit potentials of the GIS technology.

The findings of the survey combined with my previous knowledge and experience of implementing GIS in Palestine was used as a basis for the selection of a key institutes and with the objective of high highlighting examples.

3.2 Framework of analysis

Data analysis was conceptualised to understand, infer and assess characteristics of the spatial data activities in Palestine. Tables of Data were reproduced after considering the discussed notes during telephone conservation. The analysis of the data include; legal status, fields of applications of GIS science/s, structure status, data sets, hardware and software, policies of data dissemination if available and finally human resources. The tables were used to review, analyse and assess the main elements of GIS infrastructure and spatial data activities. To facilitate the analysis and for practical reasons the results of the assessment were presented by sector or type of organisation.

The second part of the research is based on reviewing the literature of GIS implementation in developing countries and the national initiatives to develop NSDI. This knowledge was used to conceptualise an approach for developing national geographic information strategy to implement the elements and activities of NSDI in Palestine. Lessons were also learnt from these experiences and are to be build upon.

Based on the theoretical knowledge and characteristics of spatial data activities in Palestine an approach was proposed, outlined and discussed for developing geographic information strategy to implement NSDI in Palestine.

4. Assessment

Campbell and Masser (1995) stated that GIS implementation is critical, complex and a somewhat problematic process. It is processes in which technology, management and society are interact, to create new practices of work and integrate them with traditions. In the same time, GIS building capacity is expensive and time consuming.

4.1 Current situation:

In 1990, the Palestinian organisations discovered that GIS could be an effective tool to manage spatial data. After the peace process started, GIS was introduced to some of the Palestinian institutes. Most of these GIS activities were donor funded and characterised by a project approach. The GIS experience in Palestine has had positive as well as negative consequences. The GIS activities have expanded to the private sector. Different Palestinian institutes have achieved various degrees of progress; however some GIS projects are not able to sustain themselves. It is important to indicate that no user needs surveys were conducted before implementation. The legal responsibilities and roles of government organisations are very complicated and contradicting. To a considerable extent this is due to the mixture and collection of British, Jordanian, Egyptian and finally Israeli laws. The assessment of current spatial data activities in Palestine is based on a survey conducted in June and July 2001. The survey covers the main organizations using, producing or educating GI.

4.2 Main GIS organisations in Palestine:

Table 2 lists the main Palestinian organisations producing, using or educating geographic information sciences. Eleven organisations are government, two are non-government, four are private sector and finally four are educating courses related to GI sciences, but not GIS. When the education institutes are excluded approximately 70% of organisations are government.

**Table 2: Organisations producing, processing or educating
GI by type of organisation**

Institute/ Organisation	Type of Organisation
Geographic Centre (PALGRIC)	GO
Surveying Department- Ministry of Housing	GO
Palestinian Central Bureau of Statistics (PCBS)	GO
Ministry of Local Authorities (Municipalities)	GO
Ministry of Planning	GO
Ministry of Agriculture	GO
Ministry of Public Works	GO
Water Authority	GO
Ministry of Environment	GO
Ministry of Transport	GO
Ministry of Education	GO
Land Research Committee	NGO
Applied Research Institute of Jerusalem (ARIJ)	NGO
Sky Map	Private Data Producer

All Surveying Solutions	Private Data Producer
Good Shepherd Engineering and Computing	Vendor
Atlas	Vendor
Polytechnic University	Education
Annajah university	Education
Birzeit university	Education
Qalandia college	Education

GO Government Organisation

NGO Nongovernmental Organisation

4.3 Assessment of GIS activities:

Assessment of the Palestinian organisations according to the sector shows the following findings:

4.3.1 Public sector

1. Serious overlapping was noted between the activities and tasks of the organisations. The overlapping has lead to the duplication of work and a waste of resources. This overlapping is caused by the absence of a legal mandate that defines clearly the responsibilities and functions of these organisations. This overlapping is mainly in the fields of the base maps & GIS, the remote sensing and cadastral mapping. It is found that Four key governmental organisations (Geographic centre (PALGRIC), ministry of planning, water authority and authority of environment) have no legal mandate for the collection of GI. The other seven organisations have old legal mandate that are inefficient and need to be updated.

2. The absence of information management strategy. Only one organisation the Palestinian Central Bureau of Statistics (PCBS) has prepared a documented strategy. This is due to the absence of an

organisational mandate and the fact that GIS activities are project based. The other possible reasons that have been argued by PNA (1999) are the lack of personnel capable of translating the organisation's tasks into GIS oriented applications.

3. It is important to stress that some progress had been made in creating a digital data sets by various organisations; however, the data sets were lacking quality control and documenting procedures.

4. The government organisations face the problem of controlled access to Israeli geographic data sources such as aerial photos, satellite images and related surveying data. This control is imposed by the Israeli occupation power, and has had seriously impacted the development of the GIS industry in Palestine. It is considered the largest obstacle.

5. The organisations still lack some hardware elements. Unlike hardware, a basic software that is necessary to run the GIS systems is not available in most of the Palestinian organisations.

6. At the same time, there is an acute lack of hardware and software equipment's, in the fields of photogrammetry, remote sensing and geodesy. These include mainly stereo plotters, GPS's, and related hardware and software.

7. Requirements for NSDI networks are not available in any institute, but PCBS has excellent experience and the capacity to run the WWW site, Internet and Local Area Network (LAN).

8. In general, Human resources are limited to a large extent. Some professional capabilities are available in the CAD, but there are significant shortage in the fields of mapping, GIS, remote sensing and surveying. Most of the available human resources are beginners at the introductory levels. Skilled human resources with intermediate and advanced levels in GI sciences are required to initiate in depth geographic spatial analysis applications. There are some people who have a good working knowledge in the fields of GIS and surveying but they lack an academic background. The reason for the lack of academic knowledge may be justified by an absence of the courses concerning modern GI science in the local universities. Finally, what needs to be emphasised is the significant shortage of managers in all organisations.

9. Very few cases of the sharing and exchanging of data were noticed; PALGRIC and LRC have exchanged satellite data SPOT and LANDSAT. These saved tens of thousand of dollars for both of them. Limited cases of the Sharing of data was noted also between PALGRIC and a number of other ministries such as (the ministry of planning, the ministry of education, water authority, and the authority of environment).

10. There are two reasons for the Lack of political interest in the geospatial data: first a lack of awareness about the potentials of the GIS technology at high political level and secondly the dominance of political concern for the Palestinian leadership. This fact resulted in major problems blocking the development of these GIS organisations. Some examples are; the lack of funding,, administrative problems, the lack of cooperation between organisations and the frustration of employees.

11. The lack of existence in the coordination of activities was clearly noted.

12. The local government ministry is representing and coordinating the work of the municipalities (urban areas), they are the major actors, creators and maintainers of the large-scale maps. They have extensive requirements for cadastral, topographic data and public facilities inside there mandated areas. There are major efforts required to develop large-scale spatial databases containing cadastral, planning, cultural, infrastructure and resource features. The effort required to build the GIS databases for local governments is considered a serious obstacle due to lack of resources; human and financial.

13. Access to GI in government organisations is hampered by the different practices. This is due to the inconsistency, the lack of standards (PNA, 1998) and the absence of a regulatory framework for the national polices relating to data acquisition, availability, use, share, access, pricing, copyright and dissemination.

4.3.2 Private sector:

For political reasons Israel has intentionally deteriorated to large extent the Palestinian private sector. The private sector activities were limited to some cadastral jobs and no modern mapping or GIS markets were established. In the past few years, after beginning of

the development and reconstruction some private companies have emerged in the fields of photogrammetry production and value-added activities. The managers of these companies are young, ambitious and active. They are establishing, sacrificing and trying to build to capacity and to compete with Israeli companies in the limited Palestinian market. Two companies, 'sky map' and 'ALL surveying solutions' are producing large-scale photogrammetry mapping for local government and executing civil engineering applications. Unlike these two, 'Good Shepherd Engineering & computing co' and 'Atlas' are more involved in digital CAD & GIS value adding activities. Although the last two companies are vendors (hardware & software), it appears that 'Good Shepherd Engineering & computing co' is more active in GIS consultancy application development while 'Atlas' is involved more in marketing significant Israeli originated digital data for Palestine. It appears that the Technical capabilities of these companies is still limited in terms of the nation-wide needs.

Finally it is important to emphasise that the numbers of spatial data users is growing in some sectors of business such as: sales managers, Palestinian telecommunication company, and tourism. Undoubtedly, the emergence of such tendencies will flourish in the local market of spatial data and develop the added value industry. The private sector advantages-of simpler products, lower cost and a shorter respond time- over government will evolve in the private sector.

4.3.3 Academic institutes

The fieldwork has identified four educational organisations involved in teaching courses related to GI sciences. The Polytechnic University (PU) is offering a four year program in traditional surveying. The curriculum is about to be developed to include modern GI sciences such as remote sensing, GIS, cartography, photogrammetry and geodesy. This institute has qualified lecturers in the fields of modern geomatics (three MSc and one PhD). An other institute is Qalandia College QC that is a part of UNRWA UN social education activities. The QC program is a two year course, Land surveying is the main topic in the college. Five qualified teachers in surveying engineering are teaching at the college. The college is the well equipped with land surveying tools and a computer lab. Unlike



Figure 2: Aerial photos

Sample of geographic data originated from dominant Israeli market

PU, Annajah national university is offering some courses in surveying, cartography and remote sensing. It is expected that a community college in the university will start a diploma program in photogrammetry and GIS (Geomatics). The university has three well-qualified lecturers (MSc remote sensing, PhD surveying and PhD GIS). Unlike the other three, BirZeit university is offering a four year geography program. The program includes mapping and cartography. Some courses are still traditional. The program is looking to the future with an open vision, GI sciences are considered a promising potential, and are one of the futurer priorities. Similar to the West Bank, Gaza has one traditional geography program in the Islamic University.

Shortage of modern equipment both hardware and software are the real big obstacle to the development of these institutes. This shortage is due to a lack of investment, which reflect a lack of awareness regarding the importance of the geospatial data on a high decision making level. PNA (1999) has discussed that Concentration of resources can contribute to solve such problem.

In general, all Palestinian academic institutions are in need of more qualified human resources, a better and more modern curriculum due that responds to the needs of society for development, in addition to equipment for training and education.

4.3.4 Non government organisation

Non governmental organisations had been established during the occupation for political reasons. These institutions made a valuable and great contribution to institutional building in terms of know how and experience (PNA, 1999). They are also considered as important resource for information about the previous period of Israeli occupation. Currently their function is duplicating the work of governmental organisations. The main two institutions are: the Applied research institute which has an active involvement in water and environmental projects, and the land research committee LRC which is involved in land use and soil classifications projects. LRC studies were the corner stone in land and soil studies. After the beginning of the peace process these organisation began to loose their sources of funding and most of their employees had moved to work in government organisations.

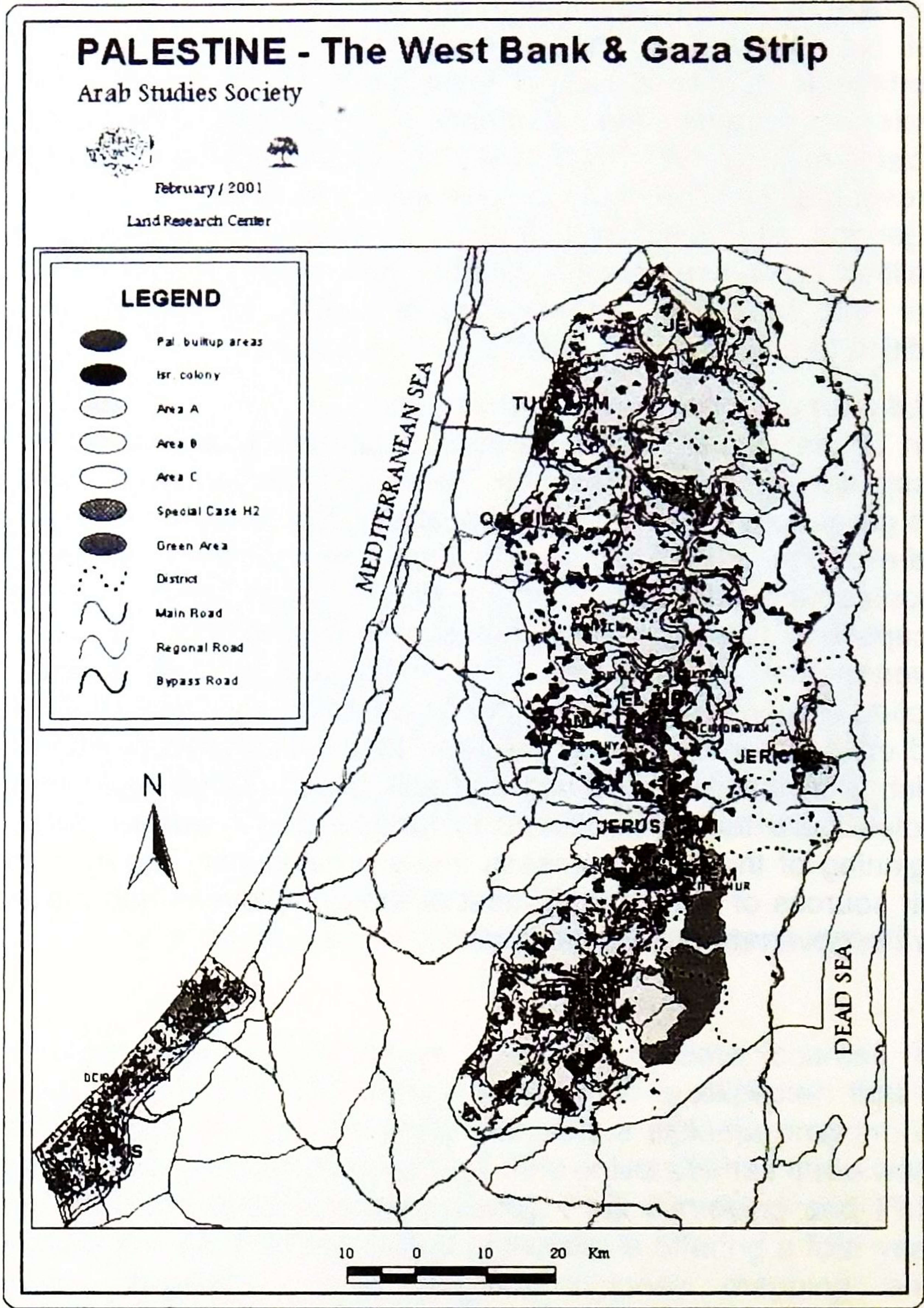


Figure 3: Map according to Oslo Agreement
Sample of maps produced by land research committee

4.4 Key institutes of geographic information in Palestine:

4.4.1. Palestinian Geographic Centre (PALGRIC):

PALGRIC was established in 1991 as a Palestinian non-governmental organisation for the purpose of the production of maps and GIS databases. In 1995, PALGRIC had become a directorate in Palestinian National authority (PNA) under the ministry of transport. Over the last years PALGRIC has become increasingly involved in production of digital data. It had produced 1:50,000 space images covering the West Bank and Gaza from spot data in 1995. These images have been used for visual and automatic data extraction. The centre has produced about 35 layers of GIS mid scale base maps. The base map has been shared with some of the other ministries to build a topology of basic thematic databases to be used for both national and regional planning. PALGRIC has developed a limited range of digital products. They vary from cartographic to pure GIS databases for small and mid scale projects. These products were vital for the different urban and environmental applications including land use maps, tourist maps, GIS, base maps and small-scale data. Most of the PALGRIC products are available at a nominal price. Thus covers only the costs of the reproduction and copying. The products are free from copyright restrictions.



Figure 4: Map of demolished villages
Sample of maps produced by Palestinian Geographic Centre (PALGRIC)



Figure 5: Map of Inhabited Areas
Sample of data produced by Palestinian Geographic Centre (PALGRIC)

PALGRIC is equipped with mapping, remote sensing, and to lesser degree the GIS

hardware and software. Although PALGRIC is considered to be officially responsible for mapping, it is not legally mandated and there are no hierarchical structures that define clearly the responsibilities. PALGRIC has begun to have the legal mandate to function as mapping and GIS centre. In addition to the management problem, PALGRIC is suffering from a lack of resources inside the ministry of transport. At the same time, it appears that PALGRIC had succeeded to build a unique local capacity in mapping and GIS. But in the last three years PALGRIC has lost the main part of the core team due to administrative reasons.



Figure 6: Space map

Sample of space image produced by Palestinian Geographic Centre (PALGRIC)

4.4.2 Ministry of Planning:

In the framework of the Norwegian aid program, the ministry of planning has developed a unit for utilising GIS as a tool in the planning process. The unit has been fully equipped with hardware and software, and is enriched by the Norwegian experts as Key persons in the unit. Wide ranges of data sets were produced. The project did added to the Palestinian capacity and enriched the local experience. Nevertheless, it seems that Part of the work in this project was a type of duplication and overlaps with PALGRIC, PCBS and the local government ministry. The core of this unit is 5 persons,

they still lack an integrated diversity of geomatics knowledge. Like other funded projects the activities decreased to large extent for different reasons.

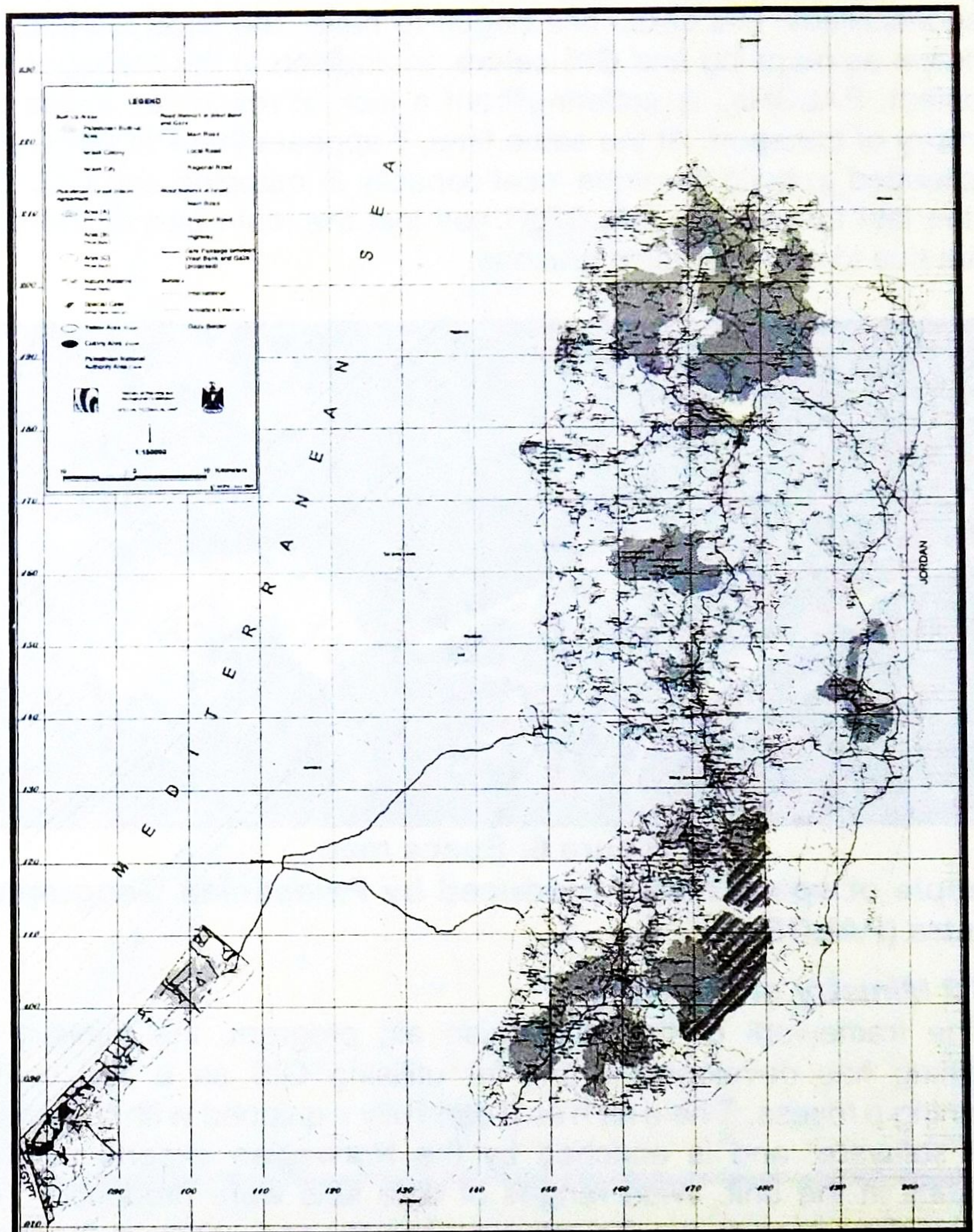


Figure 7: Map of west bank
Sample of maps produced by the Ministry of Planning and international affairs (MOPIC)

4.4.3 Palestinian Central Bureau of statistics (PCBS):

It had been founded in 1992. It is a large and complex organisation. The center has been charged with establishing a new central database of key economic and social statistics according to a new ratified general statistics law in the last year. PCBS may be the most well managed Palestinian government organisation. The centre has a master plan and documented information management strategy. It is putting a considerable focus on utilising the IT information technology for the benefit of integrating the use of information as an essential need for the proper policymaking and an important element for the democratic process. The standardisation department in the centre is responsible for the data quality. PCBS is staffed with highly qualified seniors. It has worked closely with other key players in the GI in the planning of its decennial census. The PCBS has made draft & inaccurate large-scale maps covering more than 550 urban areas for the purpose of statistics. Within this context PCBS is attempting to develop a number of products using GIS technology.

Achievements related to GI are statistical enumeration districts, establishing of Palestine voter registration, transport and communication and post coding projects. PCBS is considering GI as part of a national statistical information system.

4.4.4. Surveying department

The Surveying and land department of Palestine was founded by British mandate in 1927. The main task of the department was to establish, produce and maintain national topographic maps, and the registry of land titles. Israel's occupation power has fragmented the department of land and surveying into two new departments: surveying under the ministry of housing and the department of land under the ministry of justice. Over the years, Israeli occupation has dramatically deteriorated and restricted the role of these departments. Political reasons have motivated the desire to decrease as much as possible the capacity of the Palestinians to manage their natural resources and land in particular. After the responsibilities of the Israeli occupation power had been transferred to the Palestinians, the department began to improve but very slowly. Although the department is badly equipped, some old professional experience still survives.

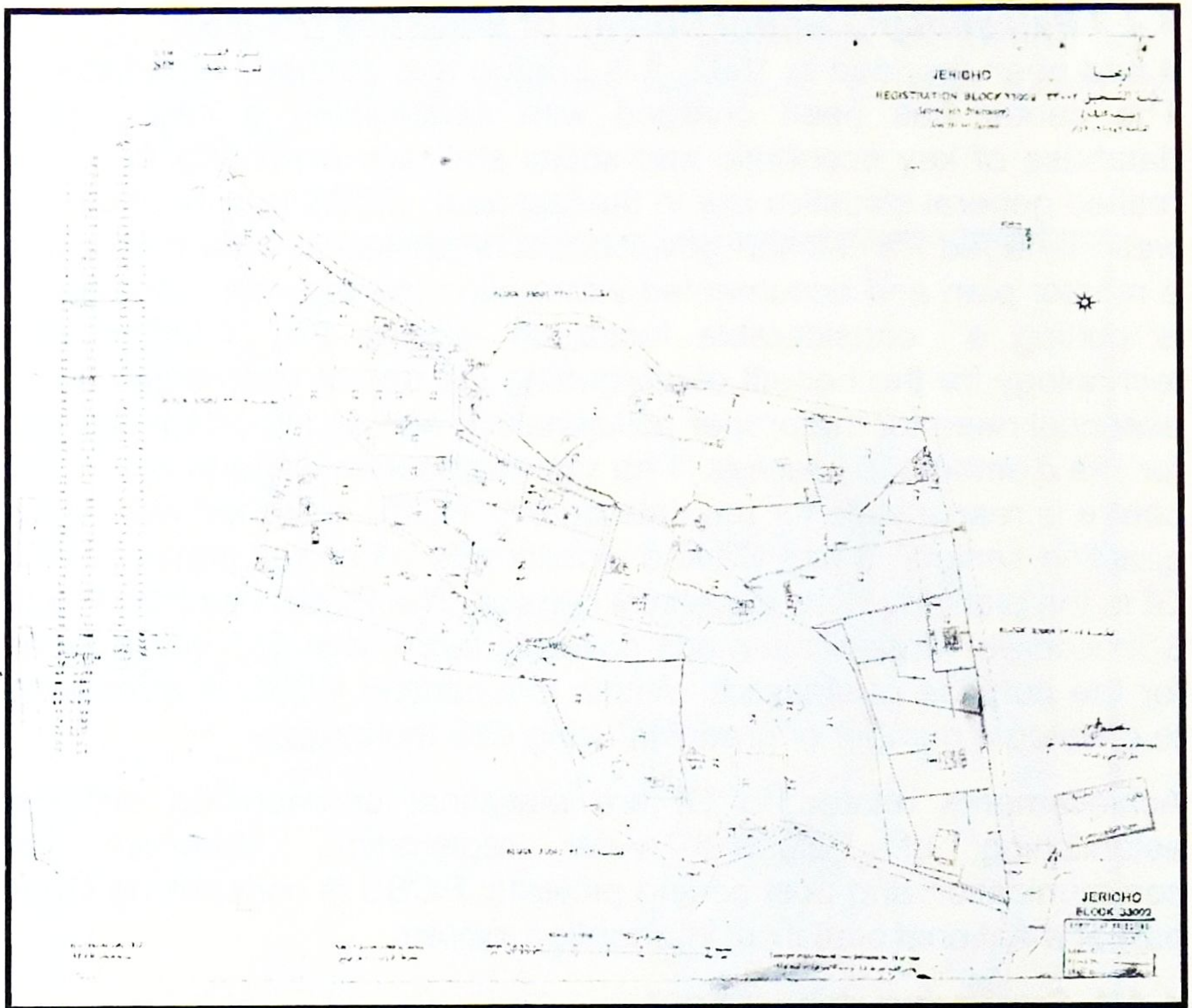


Figure 8: Parcels Map

Sample of maps produced by Palestine surveying department

In 1998, the ministry of housing realised the need to develop the land management capacity of the department by using GIS. The ministry of housing initiated a development project financed by Finland To make institutional building in land management. The project was a new experience in the use of modern ortho photos to determine the boundary of parcels and later register the titles in GIS database. Private sector has been activated to contributed efficiently in this project. The department of survey still needs much effort to build capacity to be able to perform its duties for developing a land information system. Most of the data sold by the surveying department is analogue and traditional in spite of the fact that they have some digital data, but the department is still unable to run a digital system to sell their products or derive new products or services.

4.4.5 Land registration department:

The land registration department is a highly centralised administration. It includes about one third of registered parcels of titles land in the West Bank. The data is documented on paper, and non of the information is digitalised yet. This department could be the corner stone for building attribute data quality in any land information system.

Both the survey department and the land department require an extensive integrated programs for the modernisation and the building capacity for 'land and registration management'. The program is supposed to include GIS as main component.

5. Proposed national geographic information strategy:

Many countries in the world are launching national initiatives to improve the access to geospatial data and to promote its reuse and sharing; to reduce the duplication of efforts, as well as increase its investment in NSDI. These initiatives are focusing on coordination, the harmonisation of standards as well as conceptualisation and the establishment of geographical framework. NSDI can in the long term an attempt to move towards a more transparency, e-government and joined up one. Palestine's vision for the development of a Palestinian geographic information strategy is to activate economic growth, protect the environment, and support the political struggle to achieve independence and social security.

The following sections will propose an outline and discuss a strategy for developing the elements of the NSDI in Palestine.

5.1 Establishment of coordination body

For the case of Palestine, it is proposed to create a Palestine Geospatial Data Coordination Committee (PGDCC) as a coordinating body with the responsibilities to lead the coordination for the development of NSDI in Palestine. To be an effective approach, the proposal is to empower the body by being formal and mandated as a national governmental initiative. As Masser (2001) argued this step aims to guarantee the creation of the active machinery that is required for coordination. The body can be chaired by high senior level representation to gain political support. Active coordination combined with strong leadership is very important and critical to gain success.

5.1.1 Responsibilities of coordination body:

PGDCC is responsible for promoting and coordinating the development, use, sharing and dissemination of the spatial data through government and nongovernment agencies. For the development of industry, the coordination body should identify the benefits, goals and objectives for building NSDI as well as identifying the changing needs of the users. PGDCC is set up to take a broad view of spatial activities and to perform the following tasks:

- Co-ordinate the developments, use, share and dissemination of GI including mapping, surveying and other related NSDI activities.
- Raising awareness.
- Encourage the greater use of GI.
- Create and develop the national geographic framework.
- Co-ordinate the creation of national standards.
- Create national framework policies for GI.
- Establish the data clearing house as well as development of metadata services.
- Decrease legal barriers.
- Develop human resources and support academic and research activities.
- Develop spatial data market.
- Co-ordination with the neighbouring regional countries such as Israel, Jordan, Egypt Syria and Lebanon.

To strengthen the organisational framework the coordinating body has to continue to raise the awareness in the community about its role in general. Particular efforts have to be focused on the organisations involved in the geographic information strategy as well as to ensure the political support on highest levels.

It is important for the Coordinating body to keep an on going evaluation of the NSDI program. This will define the constraints and opportunities regarding NSDI management, institutional needs, technology, global and local markets.

5.1.2 NSDI organisation:

Figure 2 shows the proposed NSDI organisation in Palestine. The PGDCC is recommended to be structured from the highest level in the government (deputy minister level) to raise the political visibility of a geo spatial data industry. It is proposed that the committee consists of representatives from the ministries of planning, local

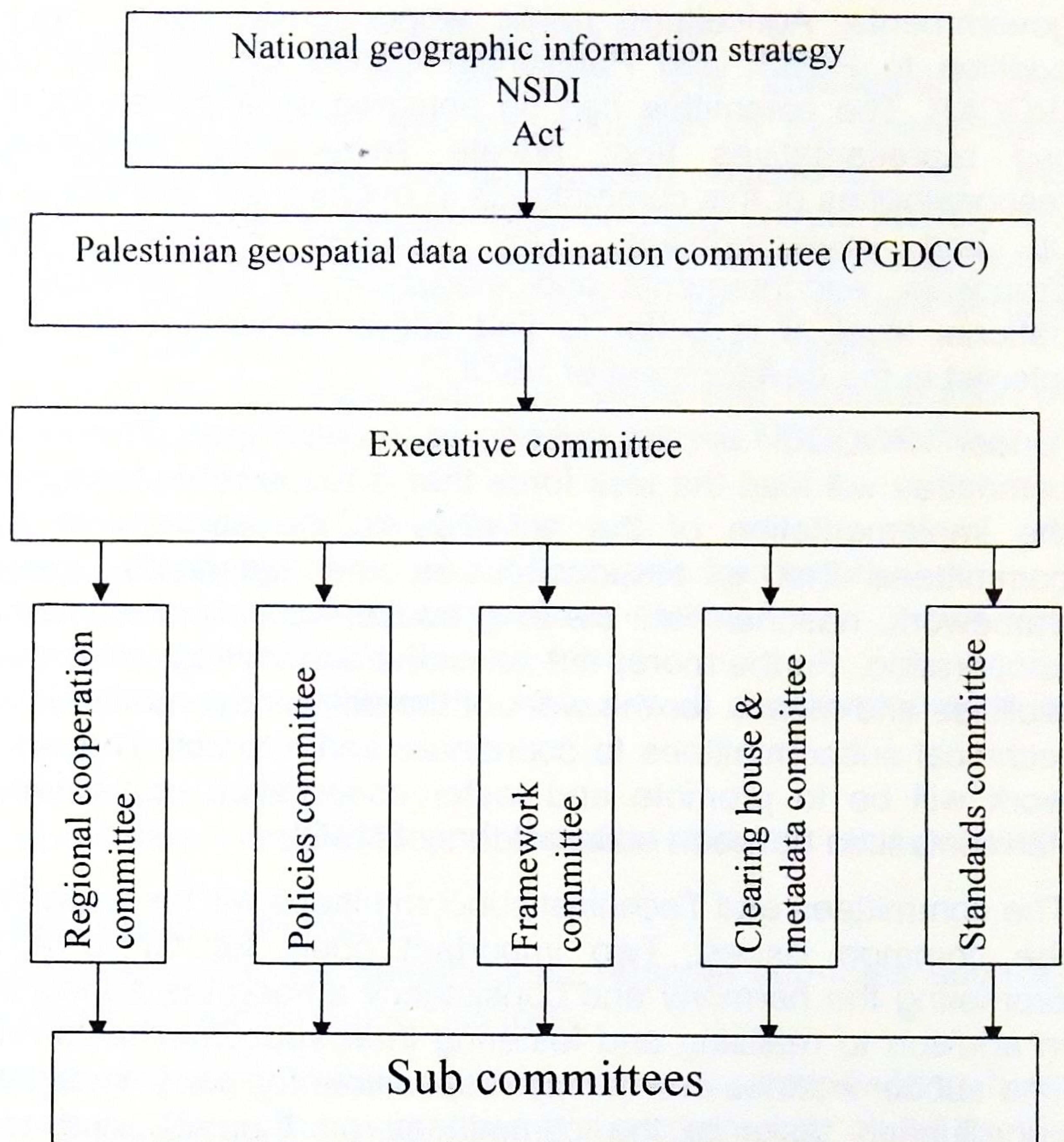
governments, Agriculture, public works, environment, housing in addition to PCBS, and Palestinian Centre for GIS and Mapping (PCGM). The committee can be enriched by experiences of other two representatives from private sector and academia. The responsibilities of this committee is to oversee the process of setting up and implementation. This includes Research, planning, proposals, endorsements and evaluation of the strategy on the national level. It is better to find active leadership with a strong interest in the development of NSDI.

Under PGDCC is the executive committee. The executive committee will lead the task force that is responsible for supervising the implementation of the activities of the strategy in the five committees that is responsible for the standards, geographic framework, national data clearing house, policies and international cooperation. Furthermore, the executive committee will provide the facilities and means for the work of the different committees and the technical subcommittees to coordinate and interact. The aim of the work will be to promote and foster cooperation, consistency and harmonisation between stakeholders of NSDI.

The committees and Technical subcommittees will be responsible for the common issues. Two important goals for GI to achieve : promoting the harmony and consistency among the subcommittees in addition to realising and fostering inter subcommittee's relations. The subcommittees are mainly responsible for carrying out the real coordination tasks of the committees on thematic and technical levels.

5.1.3 Establishing the Palestinian centre for GIS and mapping (PCGM):

Palestine suffers due to the non-existence of a national mapping agency responsible for the creation of base maps. This situation had resulted in a lack of data, many uncoordinated activities, and lack of institutions that can play a relevant role in the process of the development of society. Setting up PCGM is critical and necessary to achieve systematic implementation of NSDI strategy. This takes advantage of the successful experience of Qatar. It makes use of PALGRIC capabilities and PALGRIC becomes part of new structure of PCGM.



Coordination and logistic support activities for NSDI are housed in PCGM

Figure 9: NSDI Organisation

The proposed main functions of PCGM are

1. Develop and maintain a geodetic framework on the national level.
2. Provide and archive, nation wide coverage of the original sources of data such as aerial photos, remote sensing data, old base maps.
3. Provide or ensure the availability of base maps on a national level.
4. Development of base maps standards and specifications.
5. Administration and housing coordination activities of NSDI.

5.2 Geographic framework:

The framework consists of two main components; The institutional arrangements, and the framework data (core data) in addition to the policies for data integration. Establishing the geographical framework begins with the institutional framework arrangements and then the framework data. Defining fundamental or core data set is considered a primary key in the data infrastructure. The coordination committee should emphasise the vision of the creation of a national framework that can efficiently link and integrate the various data sets held by the different agencies. This step is important to a large extent in the development of a national geographic information strategy.

5.2.1 Institutional framework:

The creation of an institutional framework is a basic requirement for the development of NSDI. A successful geographic strategy will require a well done institutional arrangement in which the organisations coordinate and integrate their efforts and activities to build the institutional framework to provide a starting point for the sharing and exchange of data by the entire GIS community. The institutional framework will be effective in the elimination of overlapping. But the institutional framework should be open and flexible.

5.2.2 Framework data:

In Framework data, the core data sets from government organisations as well as from private and non-governmental organisations are linked. It is vital to develop a methodology to identify the high benefit information included in the core data sets for short-term plans as well as mid and long term strategy.

The extent of the creation of the core data set is proportionally related to the way in which the main responsibility for GI is distributed. The appropriate and clear legal mandate of responsibilities can contribute positively to increase the advantages.

As the building of databases is costly and slow, the priority to identify databases should be based on user customer requirement.

The framework data is essential for GIS applications as it provides both a spatial context and a spatial structure (Rhind & Smith, 1999). In addition, it is suppose to provide the geospatial foundation for the users to add valuable details or to attach the thematic attribute data or to register and compile accurately the other layers or themes of data (FGDC, 1995).

Rhind and Smith (1999) have summarised three types of benefits of the framework data; this ensures a consistency of the data collection, provides the users with access to the same data and finally promotes efficient of decision-making.

In this framework it is necessary to consider strong incentives that can be offered to the custodians to share their data with other users. Based on the discussions above regarding institutional framework, core data set, and framework data, the geographic framework for Palestine (institutional framework & framework data) is proposed in figure 3. The responsibilities and roles for the main institutions in the framework are proposed in table 3.

The institutional arrangement is more important than technology, it is important to mandate the responsibilities and role of each institute. These roles should be integrated, not contradicting and flexible to a large extent to allow for modification, as easily as possible, in this fast-changing world.

Table 3: Geographic framework (Institutional framework and framework data)

Organisation	Sector	Responsibilities Collection, management and maintenance of
PCGM PALGRIC become included in the PCGM	Government /public	Geodetic network. 1. Base maps standards. 2. Original data sources including orthophotos and satellit data.

Proposed approach for development of national geographic information strategy in Palestine

		3. Coordination of NSDI activities.
Department of surveying and department of land	Government/public	Cadastral data.
Ministry of Public works	Government/public	Road net work and infrastructure data on national level.
PCBS	Government/public	Social and economic Statistics data.
Local governments (Municipalities)	Government/public	Local Infrastructure, planning and administrative boundary data.
Water authority	Government/ public	Hydrology
Ministry of planning	Government/public	Planning data on national level.
Ministry of agriculture	Government/ public	Land cover
Private sector	private	Large scale data bases & value added data
Education institutes	Government and Public	Education and training
Authority of environment	Government/ public	Specific environmental data.

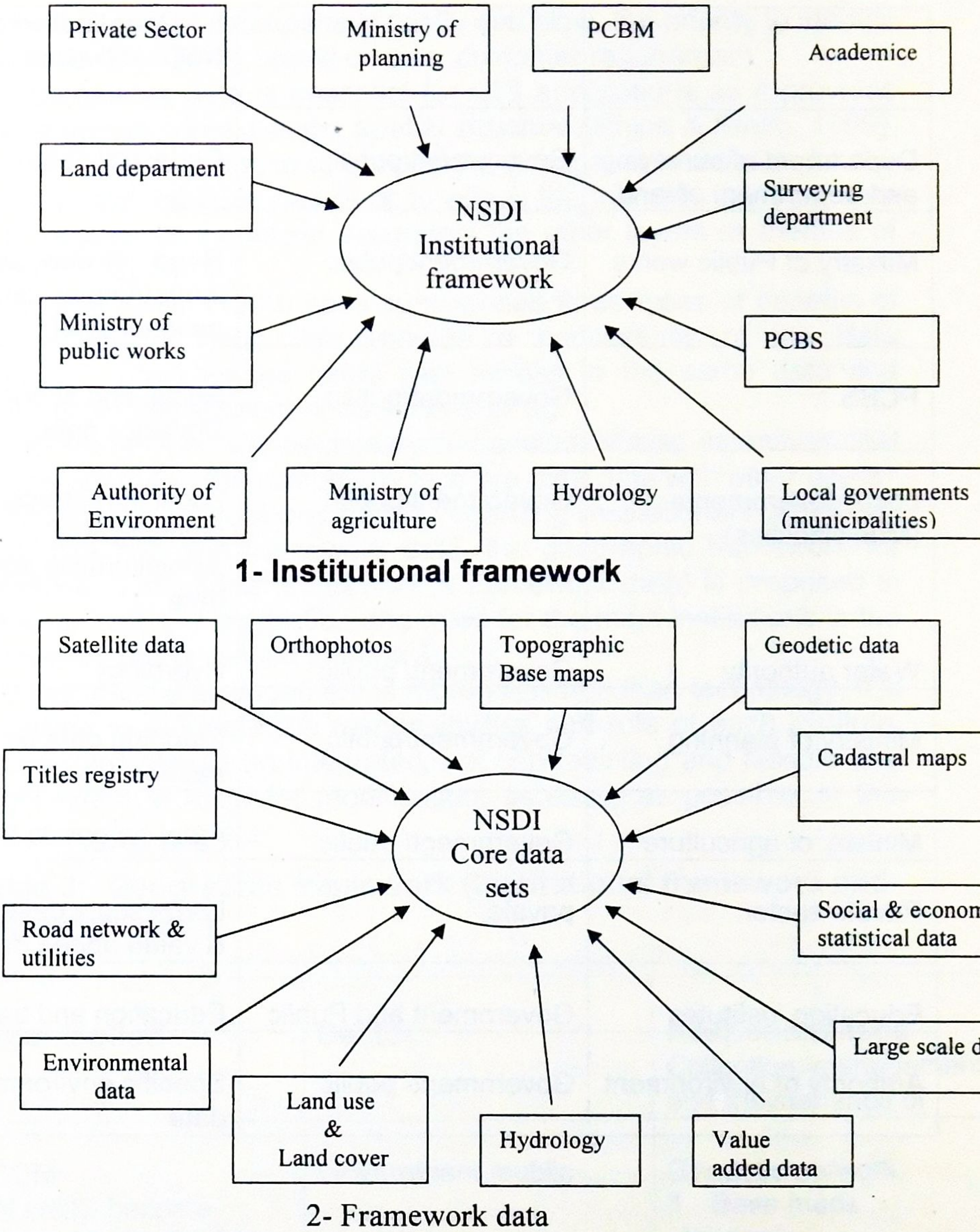


Figure 10: Proposed NSDI Geographic framework
1- Institutional framework.
2- Framework data.

5.2.3 Partnership:

A partnership is considered necessary for building institutional relations that contribute to the sharing of information, that develops standards and maintain the national geospatial data sets. This is an interdependency that can strengthen communications between the institutes and create better relations across the institutional boundary. Organisations involved in the NSDI must seek to create partnerships to build new data sets in a more cost-effective way. In Palestine it is recommended to create many partnerships. For example, a partnership composed of a department of surveying, a department of land, local government (municipalities) and a ministry of finance can continue to build coverage for the cadastral GIS database. This can serve the acute needs of the four partners and land management community.

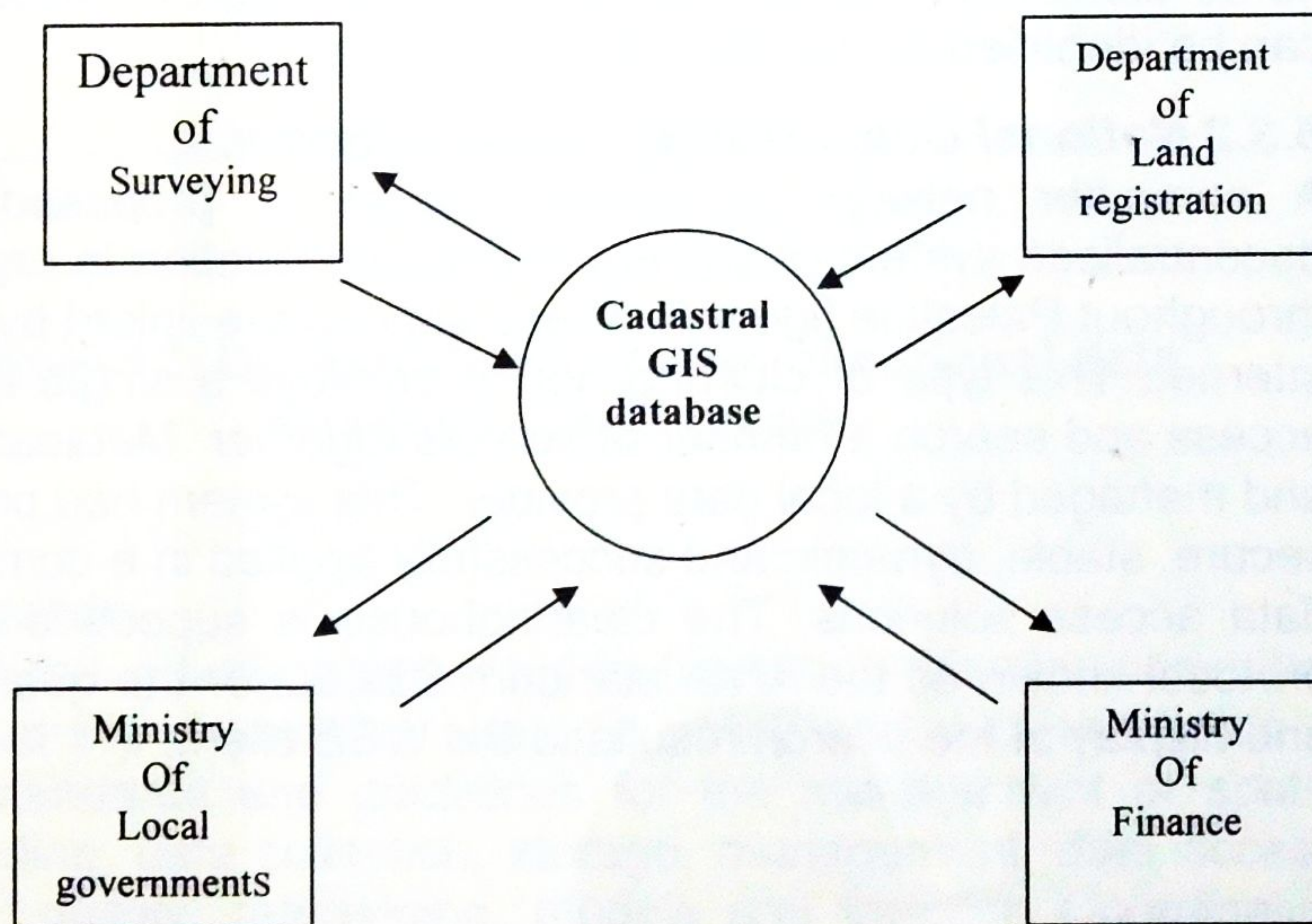


Figure 11: Partnership of cadastral GIS database

5.3 National data clearing house:

The data clearinghouse provides access to the spatial data in accordance with the national standards for data quality and policies of institutional framework, It can also foster the integration of fundamental data sets. The development, implementation and

maintenance of the data clearinghouse require a considerable amount of money and effort. However, the benefits of decreasing overlapping and duplication, in addition to fostering data sharing can be effective and worth the investment of time and money. The components of national data clearing house are:

5.3.1 Metadata:

The development of metadata services should be given a high priority due to the fact that Metadata is necessary to identify the spatial data sets collected, produced or maintained by organisations, another reason is that metadata can be developed in a very short time and at a low cost. Implementation of a metadata system might be carried out after some research to choose which elements to begin with. For Palestine, It is preferable to begin with selected elements of metadata from ISO/TC211 19115-metadata or something that is harmonises with it. The recommendation is to begin with 40-50 elements. The number is flexible and part of these elements can be identified as conditional or obligatory.

5.3.2 National Data clearing house network:

A computer network in clearing house is proposed to be a decentralised system of servers in different location in organisations throughout Palestine figure 5. These servers are linked by use of the internet. This type of clearing house employs a single interface to access and search a number of servers together. Metadata is stored and managed by a local data provider. This system had proved to be secure, stable, dynamic and successfully applied in e-commerce and data access solutions. The clearinghouse is supposed to use the protocol known as the ANSI standard Z39.50 for the query, search, and display of the search results to the WEB client.

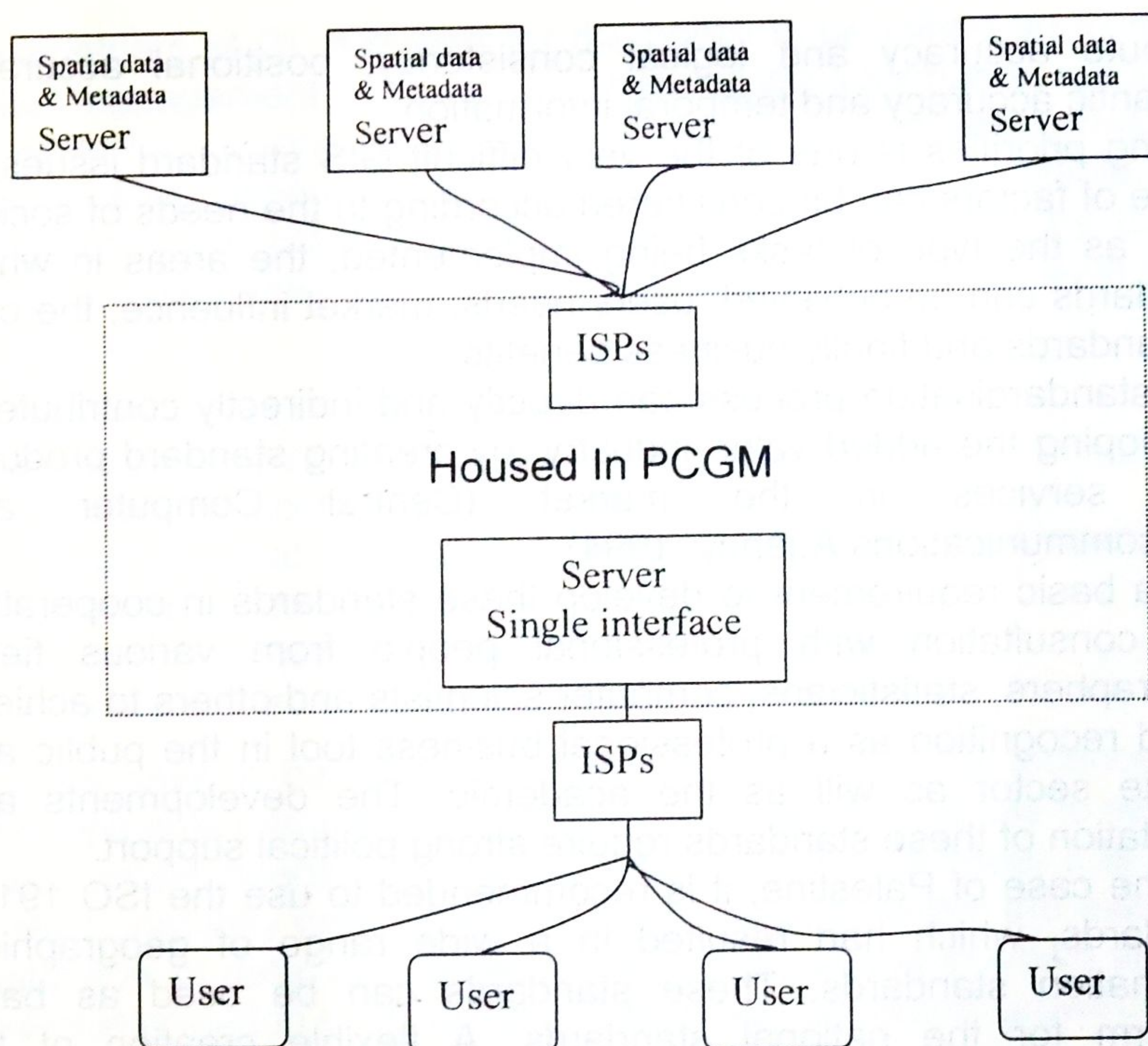


Figure 12: Decentralised system of national data clearinghouse network.

5.4 Standards

The coordinating body represented by the standardisation committee has to lead the developing strategy, policy and implementation of national standards and guidelines for the management of spatial data including, data collection, storage, management, data access, exchange, quality, referencing, models and transfer. Coordinating the developments of standards makes it possible for data held in different databases to be combined in other databases in order to maximise that potential usefulness, in addition to minimising barriers to community access.

Data quality is an area in which GIS standards can play a useful role since GIS data accuracy is important and can be sensitive to the quality of GIS decision making. Standards related to the quality of GI involve the following areas; completeness, spatial accuracy, lineage,

attribute accuracy and logical consistency, positional accuracy, semantic accuracy and temporal information.

Setting priorities is one of the very difficult GIS standard issues. A range of factors can be considered according to the needs of society such as the type of tasks being implemented, the areas in which standards can be achieved, users needs, market influence, the cost of standards and finally business benefits.

The standardisation process can directly and indirectly contribute to developing the added value industry, by creating standard products and services in the market (Central Computer and Telecommunications Agency, 1994).

It is a basic requirement to develop these standards in cooperation and consultation with professional people from various fields geographers, statisticians, computer scientists and others to achieve board recognition as a professional business tool in the public and private sector as well as the academic. The developments and adaptation of these standards require strong political support.

For the case of Palestine, it is recommended to use the ISO 19100 standards, which had resulted in a wide range of geographical information standards. These standards can be used as basic platform for the national standards. A flexible creation of the standards committee can create technical subcommittees to develop any required type of GIS standards.

5.5 National policies

Policies and standards are creating the environment in which NSDI can develop. The policy is outlined to define the means, goals and constraints. Some of these policies need to be dealt with on technical level while some of the other policies related to the political, legal and financial interest will require a broader official legal and political level.

The policies have to encourage GI market, activate the role of private sector and increase the complementary interaction between the public and private sector (Lopez, 1998). The private sector could be a major contributor for a sustainable geographic information strategy. It is important to avoid the creation of the environment that Tosta (1994,1999) has argued and in which an increasing presence of the private sector can lead to the impediments for data sharing.

NSDI in Palestine will require the government to create a new strategic information policy that can be implemented to serve the

stakeholders of GI. It is best for the policy to be joined up to reflect better management by the government of the information resources to serve the national objectives. To promote economic growth the spatial data dissemination must be efficient and equitable. The following policy practices, which have been discussed by (Lopez 1998) are recommended for the future government information policy in Palestine:

1. Institutionalise the dissemination policy model.
2. Encourage diversity of dissemination channels.
3. Activate the access to government information.
4. Adopt marginal cost recovery price for government information.
5. Establish relaxed copyright.
6. Activate institutional Partnership and cooperation.
7. Activate electronic access and take advantages of Internet, www.

Policies have to be flexible and able to cope with the technological developments that affect the GI providing agencies. It has to respond to customers needs. The legal policy framework is wide. It is better to start gradually creating it. The policy must consider the electronic digital flow of data, data access, copyrights, pricing in which an easy flow of information is achieved to encourage economic growth.

5.5.1 Copy rights:

It is important to bear in mind the need for the creation of legislation for giving GI legal protection. The legislation should be proceeded by further research so that the objectives of legislation are clearly defined in advance. The copyright can protect the databases, creators, and publishers.

5.5.2 Pricing:

Pricing is a critical issue in the marketing of GI (Frank & Krek, 1999). The pricing policy is there to encourage the achievement certain goals (Harris, 2000). High price can block the access to data while low prices will not cover the high costs of collection and maintenance.

The global changes in the role of the government lead us to consider the cost recovery when pricing geographic data. The guidelines for charging the GI by governmental organisations can include:

- The cost of collecting, processing, analysing and production for the official use should be paid for by public funds.

- Any information, which is published for public use in both the electronic and printed forms should normally, be marketed and priced to cover the total costs for additional processing.

The first concern for the future policy is how to offer the needs of the customer and the second is to how to create a policy that can cover the costs of data producers.

5.6 Human resources development

The development of human resources is one of the main components of NSDI. It is important to coordinate the education and training efforts as a part of the input for developing a geographical information strategy. The development program can include both education and continuous training activities. The education is important to build an in depth academic knowledge while solid training is necessary to create the professional capability to implement the technology and to respond to acute short-term needs. Several types of institutions including universities schools and professional education centres can provide academic programs. The training can also be implemented by commercial private sectors. Areas of education and training should be broad and within the spatial oriented sciences such as geography, surveying, mapping, remote sensing, planning, environment and earth sciences. The proposed education and training programs should cover the needs for a wide range of jobs such as operators, administrators, managers, system analyst, programmers and modular.

The contents of the curricula should pay attention and be designed to fit the needs of the local society. Furthermore, it is important to emphasise the need for research programs and education activities that can support the improvement of NSDI and develop user capability to utilise the more advanced GIS applications.

The diversity of the academic activities of the spatial data and GI science programs in the various institutes in Palestine provides the advantage for the future integrated nation-wide education program.

The surveying at the university level can be in PU, geography at the university level will be best at Birzeit University in the west Bank, and at Islamic University in Gaza. The best potential for community technical colleges seems to be at QC and Annajah University. Other universities and colleges can embed GI science courses as optional.

6. Summery, Conclusions and recommendations:

6.1 Summery

GIS is a social and political process that takes place and time frame within cultural subject (Heater & Masser, 1995). The assessment of the spatial data activity in Palestine has emphasised the urgent need for developing these activities in both the public and private sector. These efforts should concentrate on the activation of coordination activities, the sharing of data to avoid the wasteful duplication of efforts, the clarification of responsibilities, institutional and mandate arrangements, increasing investment, improving the quality of data and developing human resources to increase access to the data. The development of NSDI in the framework of the national geographic strategy can lead to supporting human life and evolving the coordination of the geospatial data activities. The governments political support is critical to foster the coordination and to create commitment. A flexible legal mandate and a simple structure of coordinated mechanism can provide the ability to develop NSDI in this changing world. The availability of the tradition of cooperation besides raising awareness will contributes to the major success. The metadata should be a priority for the production to create some thing out of the initiative very quickly. It is advised to take the advantage of Internet as a network for communication. Incentives and encouraged coopertion are required to launch partnerships. The policies and standards have to allow accessibility, foster the sharing of data, encourage the development of private sector and support innovation. Finally, the human resource development has to be given distinguished attention.

6.2 Conclusions:

Similar to other developing countries, The GIS experience in Palestine has shown that social aspects for implementing NSDI are important and need serious consideration. The social interaction and relation between people are the bases for the coordination of activities between GIS players that have different backgrounds, goals, and personnel attitudes. The marginal Social interaction activities combined with the official work can facilitate to a large extent the creation of an environment of trust and cooperation. As Harvey (2001) has discussed it is important to build trust between the key players in NSDI to facilitate an interaction that leads to real fruitful coordination. It is found that incentives to promote sharing

and coordination of the spatial data activities is required on a national level. The survey has drawn attention clearly to the lack of awareness of both the government and non-government organisations to the value of GI in Palestine.

The study emphasises Masser's (1998, 1999a and 1999b) conclusion that coordination and core data sets require the most effort for the establishment of NSDI.

The future is for a global spatial data infrastructure and that every country has to prepare to make use of the new emerging phenomena for the better environmental management of human life.

6.3 Recommendations:

It is recommended to establish educational programs to activate the sharing of spatial data on a national level. At the same time, such programs can be based on real pilot partnerships that enrich national spatial data coverage.

The incentives for interdependency and interagency cooperation are required to support efforts of NSDI in developing countries.

Delegation of the technical responsibilities for the technical people can facilitate coordination and the sharing and keeping away the effects of lobbies and centres of power in the developing countries. The integrated investment of the private and public sector is recommended to encourage market development and to lead to a mature spatial data industry. But, the private sector will require distinctive efforts of encouragement and policy support to grow up and contribute to the national economy.

However, It is necessary to assess the consequences that result from the regional or international policies on NSDI in Palestine. The most impressive effect may from Israel for two reasons; firstly it is the real power that controls access to GI, secondly Israeli GI industry is mature, so it has a great direct effect on the local market in Palestine.

For the future it is important to keep re-evaluating the role of the government and the growing globalisation of GIS. For the government it is important to consider privatisation tendency, deregulation and market testing. It is recommended that the government of Palestine at the mid term evaluates the possibility of modernising its business to provide better services for customers by establishing a joined up e-government that depends on the NSDI.

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