

Land Management in Bangladesh:

A Legacy that Demands Change

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Land Management in Bangladesh:

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List of Abbreviations

ADB	=	Asian Development Bank
BS	=	Bangladesh Survey
CIS	=	Cadastral Information System
CLO	=	Certificate of Land Ownership
CS	=	Cadastral Survey
DLRS	=	Directorate of Land Record and Survey
DTM	=	Digital Terrain Modeling
GDP	=	Gross Domestic Product
GIS	=	Geographical Information System
GPS	=	Global Positioning System
GOB	=	Government of Bangladesh
JL	=	Jurisdiction List
LAMS	=	Land Administration Management System
LDT	=	Land Development Tax
LIS	=	Land Information System
LM	=	Land Management
LMS	=	Land Management System
NGO	=	Non Government Organization
PARC	=	Public Administration Reforms Commission
ROR	=	Record of Right
RS	=	Revenue Survey
TA	=	Technical Assistance
UNDP	=	United Nation Development Program
ZSO	=	Zonal Settlement Officer

Preface

The issue of land management has become so important for the development of Bangladesh. Responding to the pressures of the world's most densely populated country Government of Bangladesh is working towards making land record management and administration systems more accountable, transparent and accessible to the public. Due to improper land management the number of civil litigation is increasing day by day. This is the main barrier for social and economical development of the country. Bangladesh governments are being re-structured to improve governance and to alleviate poverty, and this also applies to government departments associated with the land administration and management (like registration, cadastral systems). The structure of land administration and land record system in Bangladesh contains a deep root at weaknesses and dysfunctional properties. Therefore, developing a methodology for identifying and verifying records, management and administration is essential for reforming land management. Government of Bangladesh has been working to address these issues recently.

This research work tried to highlight the present situation and changes since the independence in respect of major land management practices. In relation to various aspects of land management, specific means of orienting the land management setup towards development, updating and modernizing the land record arrangements, initiating the land use planning and land management, documentation of land ownership, land valuation and taxation, modernizing land registration to support a land market and digitizing records of land users or owners and ensuring greater people's participation, simplification and rationalization of existing procedures, have been taken into consideration. At the same time, negative and unsuccessful land management efforts are pinpointed so that these may be avoided in future policy formulation exercises. For this, both primary and secondary data are used. Data are collected by both structured and unstructured questionnaires. GIS and remote sensing with other computer software are used for presentation and analysis of data. Certain recommendations have been made to suggest the electronic and computer assisted land management system for Bangladesh.

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Chapter - I: Background Issues

1.1 Introduction

Sustainable economic development is fostered by law and order and by efficient use of natural resources, specifically land. If we see the developed countries, we see that they have a unique balance in man-land ratio and their sustainable development is more or less dependant in appropriate land management. Specially they do not have any problem in managing land properties in terms of ownership. Their land management is well defined. On the other hand Bangladesh is experiencing progressive imbalance of man-land ratio and it is a constant threat. Population pressure on the rural homestead increase has already reached the saturation level. Urban sprints and expansion of unplanned settlement engulfs agriculture or forest acreage. The result being a total chaotic uneconomic land use pattern as well as land management.

Litigation related to land is very common in Bangladesh. Here judicial systems are overburdened with cases pertaining to litigation over land that hinders the development process and causes sufferings of the people. A growing population, old lands laws, poor coordination among land offices such as settlement office and registration office stretches the land transfer process. Moreover, usage of family based khatian and absence of legal binding upon Sub-Registrar regarding verification of ownership and title over land parcel before registration have made the existing land management system inadequate of supplying up-to-date and authentic land ownership records. Consequently, people's ownership and title over the parcels of land are not getting due protection from the state. That's why, common people have since long been demanding for a fair, reliable, transparent, accurate, and authentic land management. This situation claims urgent reforms in the existing system of preparation, maintaining and updating the land record or land management.

Land is a very valuable and scarce resource. People need land to grow food, to build cities, for investments as well as for housing. Therefore, access to land, rights over land, the management and administration of land as well as the settling of land conflicts are very important for human kind. Many international conventions and declarations underline the importance of land rights and land management to achieve sustainable rural and urban development.

Land is the ultimate resource, for without it life on earth cannot be sustained. Land both a physical commodity and an abstract concept in that the rights to own or use it are as much a part of the land as the objects rooted in its soil. Therefore, management of the land is essential for present and future. The role of land in the economy of each nation is not always obvious, but is of great significance. Without secure land rights there can be no sustainable development, for there will be little willingness to make long-term investments. There is a need to manage the wealth of every nation; at least 20% of whom gross domestic product (GDP) can come from land, property and construction. All countries need to determine the ownership and value of land and property, and to monitor and manage their use so that the value of these assets may be enhanced. In Bangladesh land dominates the life of almost every person. Land being the most inelastic and non-renewable resource, planned manages of land is extremely important for development and planned management of land needs quality land management system.

Bangladesh sustains a huge population in a small compact area. The economy of Bangladesh is an agrarian one and mainly depends on agricultural land. God gifts Land, which is more precious than life to a land owner. To possess the land without any trouble a landowner should have some basic knowledge as well as the concerning officials should have accurate knowledge. Therefore, land became a vital issues for Bangladesh. Our developments largely depend on the proper use of land. To meet the needs of the present time we must have a strong Land Management System(LMS), which is the pre-requisite for economic, social and administrative development.

When one deals with the land matter he has to address everybody who has land based property. Improper dealing with the matters relating to land creates a lot of social and

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economic problems. Proper land management is a pre-requirement for overall development in a developing country like Bangladesh. Like many other things we have inherited the system from the British colonial administration. Much has been said about the modernization of land management system in Bangladesh but hardly anything tangible has been done. A modern land information system will surely lead to a better and more effective land administration management in Bangladesh.

The ownership, value and use of land, although independent in concept, are interdependent in practice. Each attribute of land needs to be carefully managed to achieve this. There must be a good land record of ownership to ensure security of tenure; of value to ensure fairness in land and property taxation and equity in the compulsory acquisition of land for state purpose; and of the use of land to ensure effective resource management. This information can be obtained from the Geographic Information System (GIS) based land management system. A GIS based land management system is similar to a land register in that it contains a set of records about land. This system is based either on the property land parcel, which is the area defined by ownership; or on the taxable area of land which may be different from the extent of what is owned; or an area defined by land use rather than by land ownership, this may support either records of property rights, or the taxation of land, or the recording of land use.

GIS based land management system may also be used in a multi-purpose role to provide a wide range of land related information. In such cases, it is best if they are constructed around the proprietary land parcel, as this is the legal basis for all dealings in land. Where ownership has not yet been proved, as may be the case where the land is being restored to former owners, such multi purpose records can be built around the land parcel as defined by rights of use.

The GIS based land information system consisting of two parts: a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. It is distinguished from a land registration system in that the latter is exclusively concerned with ownership. Different countries interpret the term “GIS based land management” in different ways and this can lead to great confusion when

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analyzing systems. The common understanding is that it is a form of land information system (LIS). The term “land information system” is applied to a wide range of spatial information, including environmental and socio-economic data as well as data related to infrastructure systems and the cadastre. An LIS is not necessarily land parcel – based, unlike a juridical, fiscal or multi-purpose cadastre. Instead it may be an inventory of forest resources, or of soils, or of geology and may incorporate a variety of types of data. GIS based land information system is related with cadastre. A cadastre is more specifically focused on the ownership, value or use of land parcels.

In Bangladesh cadastre incorporates land registration and cadastre survey. The land registration deals with establishing lists of owners and all their properties. The information that cadastral stores for each property are: the name, the date of birth and the address of land owner, the description of the location of the property, the number its parcels, the size and area of each parcel, the district where the property is located, additional information about the property like title number, name of cadastral agency, the nature of ground use and all the rights and restrictions.

The cadastre survey, on the other hand, serves as a way furnishing the geometric description of each parcel. It consists of determining the parcel boundaries, the surface and the parcel co-ordinations. This spatial structure is usually stored in an analog cadastral map.

Generally, the cadastre system is the basis used for the protection of the property by means of title registration and cadastre plans. Each parcel and its owners are registered and all the spatial structures consisting of location, boundaries and contents are described in a cadastre map. Therefore, the cadastre system is seen as a land information system affording information on real estate of a property. It improves the land management whether in urban or rural areas. In urban areas, it is becoming a fundamental framework for planning, assessment and collection of rates and taxes. In rural areas, the claim to ownership increases the investment in agricultural lands and the property business. For its unique power an appropriate cadastral system should be designed and established by and for a particular country. That is why GIS based cadastral system is very much essential

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for Bangladesh. The cadastre system can be established for fiscal purposes, for protection of property rights or for a multi purpose system.

The land management system of Bangladesh is not satisfactory and is very outdated. In the recent past different projects have been completed and implemented on land managements for land record, administration, reform and use. But a very few have been achieved from these projects for land management development. Cadastre in Bangladesh is the fundamental tools for land administration, management, reform, use and also a tool for solving many disputes resulting from land. The outdated and mismanaged cadastre systems to same extent are hampering the development of this agronomy society and economy. Therefore, time has come to use the GIS based land information system.

1.2 The Motivation for the Problem and its Formulation

The motivation for this research emerged mainly from the following facts: (1) Responding to the pressures of the world's most densely populated country Government of Bangladesh is working towards making Bangladesh land recording systems more accountable, transparent and accessible to the public. Therefore, the Directorate of Land Record and Survey (DLRS) of Bangladesh is trying to device some urgent solutions for the cadastre and the coordination among different ministries. In that context the DLRS has created proposals for remodeling the land record system. (2) Another important matter to consider for the land management development and its use in Bangladesh is to help of solving the land related litigations in different courts, which are mainly arising for claims of land ownership. So that people can solve their problem in a very short time and may help for social and economical development. (3) There are serious lack of inter organizational coordination in managing the land management system in Bangladesh in respect of land administration, tax collection, data presentation, data uses and survey. So a device should be formulated for inter organizational coordination arrangement. (4) Within the circles of the Bangladesh Public Administration, there seems to be an arrangement that the inefficiency brought about by the lack of cadastre, along with the present in definition regarding cadastral development, are incompatible with the

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standards of developed countries. (5) The conditions of the land management system in Bangladesh are far behind of satisfactory level and contain systematic weaknesses and dysfunctional properties.

The Cadastral Survey (CS) of Bangladesh provides mapping of every parcel of land indicating geographical location and identification number; land information regarding ownership, quantum of land and rents payable and preparation, publication and maintenance the record of rights as a proof of occupancy right of the tenants (Belijur Rahman, 2003). However, it is very old and backdated and few measures have been taken for its systematic update. The present set up of land administration in Bangladesh is built around three core functions- land settlement or survey, land registration, and record keeping for taxation. The linking of cadastre with other inventories of information on land has not been accomplished in Bangladesh (neither in urban nor in rural area), not even with the Land Registry. The present situation of land management in Bangladesh is thus a set of inter-related problems of inter-organizational, educational, technical and in some cases political nature. Frequently, real property rights are a subject of dispute. Government is trying to introduce the Certificate of Land Ownership (CLO), but this has become a serious matter of dispute, also among land management personnel. From the above scenario it can be presumed that this is the high time to look at the whole land management system of Bangladesh.

Real property rights secure tenure, and good governance cannot exist without able civil servants and complementary skills in the private sector. Such officers have to be available 'on location' where people need them and operate as an independent and skilful third party, who assures that the complexities of property transactions are duly performed. Transactions also need to be recorded in cadastre and land registries, that is: national land information systems with central and local (District and Thana) components, which must be kept and developed as information technology permit. Officers, information systems, procedures, and rules constitute an infrastructure, which is needed for a functioning institution of real property rights.

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1.3 Problem Situation

The causes of land conflicts are many and involve many factors. Solving land tenure conflicts and finding possibilities for reconciling differing interests must therefore follow respective cultural-specific norms and guidelines and include institutions on different levels. The chances for success at finding solutions are low if the influence of power groups on the law leads to the manipulation of constitutional authorities. If legal claim and the legal reality with regard to the ability of autonomous and advanced technology based institutions are blatantly far apart from one another, and if those immediately affected cannot participate enough.

Spectacular, violent conflicts over land have a high degree of interest for the media around the world as opposed to the forgotten daily disputes over arable land, land for construction, pastures, rights to use the forest and water rights. The conflicts hinder an efficient sustainable land use, undermine existing social relationships and enforce the disbelief of the afflicted due to government failure.

The uprising in Chiapas, Mexico, the land disputes in Brazil with more than 1000 deaths in the recent past, the outbreaks of violence in Ghana, Senegal or Niger and the frequent use of force in the Philippines as a result of land reform demand fundamental political and international approaches for solutions.

If 40% of the households in Nicaragua are involved in acute or simmering conflicts over land titles and disputes and if conflicts between the locals and the immigrants over boundaries between “adat” and “public law” smolder in Indonesia, then there is a need for action. Contributions for de-escalation must be offered and permanent and more stable authorities trusted by both sides should be strengthened. In Mozambique, an African transforming country, multileveled land conflicts hinder economic and social development.

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The importance of land cannot be overemphasized in Bangladesh where the vast majority of the people live on agriculture. Therefore, it is more imperative that the administration of land will be efficient, reliable and accountable. The inherited land management system in Bangladesh is centralized and not at all integrated. Present land management system is totally depends on cadastre system. The cadastre mapping system was introduced in our sub-continent in between 1540 and 1875. A tremendous change in the field of survey had taken place in this period. Land survey system introduced by Sher Shah. After invention of *Theodolite* the great *Triangulation Survey* was conducted by the *East India Company* for preparation of maps of Sutanati area of the then Calcutta by the appearance of the legend personality of the survey world **Major James Rennell** while he took over the charges as the Surveyor General of India. This was the remarkable incident in the history of survey in the sub- continent. Mapping of different river ways by **Mr. Rennell**, introducing plan table survey, revenue survey, Diara Survey and lastly Cadastral Survey (popularly known as CS) was done at the time in between 1875 and 1940. The CS was carried out in the then Bengal from 1888-89 to 1940. In this survey different kinds of simple survey instruments were used. Some of them are Granter's Chain, Optical Square, Metal Scale, Ivory Scale, Flat Ruler, and Divider and Sight Vaneetc. The same types of instrument are also being used in Bangladesh now a day in running the cadastral survey map preparation. There is no change in preparing and reproducing a cadastral map (in Bangladesh we called it as mouza map). The old system is till prevailing in our country. The '*khatian*' (code number related to ownership of a particular land area) surveyed is also known as CS or *Zila khatian*. CS records consist of land ownership of the landlords, the general public and the government land. CS records are kept with the Zila (District) Collector's Office and the Assistant Commissioner's (Land) Office (DLRS, 2003).

The conditions of cadastre system in Bangladesh are far behind of satisfactory level. Therefore, the structure of land administration and land record system in Bangladesh contains systematic weaknesses and dysfunctional properties. The Cadastre Survey in Bangladesh provides mapping of every parcel of land indicating geographical location and identification number; land information regarding ownership, quantum of land and rents payable and preparation, publication and maintenance the record of rights as a proof

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of occupancy right of the tenants (Belijur Rahman, 2003). But it is very old and backdated and very little measures have been taken for its systematic update. The linking of cadastre with other inventories of information on land has not been done in Bangladesh (not in urban or rural area) not even with the Land Registry. The present situation of cadastre in Bangladesh is a set of inter-related problems of inter-organizational, educational, technical and in some cases political.

1. There are several constraints on the presentation of cadastre map (mouza map). It is obsolete, manual and therefore prone to errors, and it is time consuming, less acceptable. The past cadastre system of Bangladesh based on *“Theodolite Survey”* and *“Traverse Survey”* still today the same system is being employed for survey purpose. At Present a great change has occurs in the field of methodology and technology of cadastre system. The Computer, Software, Plotter, Scanner and EDM have replaced the Gunter’s chain, Metal Scale, and Optical Square. Presently two types of land survey and mapping system are being followed over the worldwide. One is the total station and other is Aerial Photography. But these techniques are not using in Bangladesh for cadastre survey.
2. The sizes of our land parcels are very small. These small plots are again been divided into several plots because of our existing *“Law of Inheritance”*. There is a saying that the total area of our plot boundaries (*Ailes*) is equal to one third of our arable land of our country. This information gives a poor picture of our land system. Therefore, it is time to give priority and proper importance to having a detailed and informative map of each village or mouza of Bangladesh.
3. Some scholars opine that land administration and land record system are the root of most of the criminal and civil litigations in the country. That is why it is told that once the land record system achieves its perfection, the criminal and civil litigation will be of no subject matter of criticism. A transparency of judicial system will be a reality ensuring the right of properties of the people of the country if there is no defect in the system of record preparation of land. At present there is a need of creating an updated cadastre system, which will provide an important tool for identifying land documentation, names of the rightful owners, measure of the area, land tax collection and spatial data. Effective and accurate

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records and information are important on land distribution, ownership patterns, and essential for long term spatial planning and development.

4. The present land laws and supporting regulations are complicated and there is no effective legal framework in Bangladesh. The absence of an updated, systematic and universally accepted source of information on land resource availability and land rights is one of the principal barriers to the successful implementation of land reform programs leading to the effective adjudication of land disputes. The outdated mechanism for land registration, corruption and irregularities in the land survey are depriving the illiterate, poor, landless and minority people of ownership rights to their land. Even the government is being deprived of her “*khas*” land (government own land). Due to outdated cadastre there is also a general lack of public awareness on land resources and other problems. Most of the people are ignorant of procedures and regulations of land administration and management. There is also no cadastre for urban property in Bangladesh because of its complexity. The linking of cadastre with other inventories of information on land has not been done in Bangladesh – not with the Municipalities, not even with the Land Registry. Therefore, numbers of cases from land dispute are increasing day by day.

5. The present structure of land administration is built around three core functions - land settlement or survey, land registration, and record keeping. Land settlement identifies the utilization of land i.e. is the land being used for agriculture, housing, ponds, roads, waterways and all other information related to the land. The Settlement office, like most government offices, is located in two areas - one at the Thana level (lowest administrative unit) and the other at the Zonal level (larger region comprising several districts). Often it is found many discrepancies between the sets of records of the thana and zonal level with over writing, crossing out of details, writings in different ink on the same document, false distribution of shares, pages missing and so forth. Registration deals with registering land transfers and preparing the deeds. Record keeping records

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ownership rights to the land i.e. records the names of the owners. Registration and record keeping are based on information gathered from the land settlement. Although the present land administration are doing three core functions but there is no systematic linked and the information in one does not match the information in the others.

6. Recently the Government of Bangladesh in collaboration with development partners has taken the land reform and management projects, all of which do not cover the cadastre development. These projects include documentation of land ownership; improve land valuation and taxation; Improve land planning and land management; improve recording of land users or owners and also computerizing of both land records and maps. These projects do not include organizational development but there need a co-operation with other concerned bodies within the country. Theses projects are aimed at studying existing land administration systems, to recommend short-term interventions and long-term strategies for creating an efficient and responsive land surveying, documentation, recording and taxation system for Bangladesh. In particular, it has setup the tasks to develop LIS strategies for Bangladesh and to design and develop computer software '*Prototype*' of a LIS. There are no integrated land management studies in these projects. GIS and other software are being used in these projects.

7. Bangladesh Bureau of Statistics prepared Mouza map showing location of area along with the associated Statistical data. Here, a Standards Geographic Area Coding (Geo-code) System has been developed with view to identify the area uniquely and integrate various data series pertaining to a given area. Development of Standard Geo-code system also helped in developing an integrated and computerized Data bank up to Mouza level. With this map District Boundary, Upazila Boundary, Thana Boundary, Municipality Area, Ward, Union, Mouza, and Urban Area can be identified easily. Mapping and Geo-code are interrelated. While codes identify the area, the maps reveal the exact location and other geo-physical as well as socio-economic characteristics of the areas. At present this small area atlas of Bangladesh provides geo-code, name, area, number of

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household and population of every administrative units of Bangladesh. This maps does not provide other geographical data. Therefore, they are not using effectively for spatial planning. There is no proper land plan using cadastre in Bangladesh for spatial project. To have a good land use plan, it is essential to have a good land survey. The modern cadastre can be used for environmental, educational and development project purpose (such as transport logistic planning).

8. In Bangladesh the main cadastre user are Land Ministry, Law Ministry, the Directorate of land Record and Surveys, Land Reform Commissions, Ministry of Agriculture, Surveyors and common people. Land administration covering legal and fiscal cadastre and is run through the administrative units of the country where the administrative head representing the central government is responsible for land related matters. The six Divisions, 64 District and 476 Upazilla (Sub-District) are collecting revenue on the basis of cadastre mouza map. The collection rate to land revenue is very poor due to lack of proper cadastral system. The three element of information regarding real estate property-Cadastre, Land Registry, Fiscal Registry- are not systematically linked and the information is one does not match the information in the others. This impairs the efficiency of much administrative and technical work.

From the above scenarios it can be presumed that this is the high time to look at the whole cadastral system of Bangladesh. Technical, administrative and technological questions are the main solution of the above problems. These sorts of problem can be solved without any difficulties applying modern technology. The fundamental questions that effecting cadastre development in Bangladesh is related with administration, intuitional, financial and in some cases political. Therefore, we should look in these areas for the development of cadastre.

1.4 Sustainable Development & Land Management

Sustainable land management means managing land without damaging ecological processes or reducing biological diversity. It requires the maintenance of the following key components of the environment:

1. Biodiversity: the variety of species, populations, habitats and ecosystems;
2. Ecological integrity: the general health and resilience of natural life-support systems, including their ability to assimilate wastes and withstand stresses such as climate change and ozone depletion; and
3. Natural capital: the stock of productive soil, fresh water, forests, clean air, ocean, and other renewable resources that underpin the survival, health and prosperity of human communities.

Land is often managed for multiple benefits, such as agricultural production, biodiversity conservation, water quality, soil health and supporting human life. To ensure long-term sustainability, land managers need to consider economic, social and environmental factors.

Since colonial period land management has usually been focused on specific human requirements such as agricultural production, urban development, transport, industry, recreation or biodiversity conservation. Such single-purpose management neglects the multiple benefits provided by the earth and its living systems.

We now recognise the essential contribution of ecosystems in providing fresh water, clean air and healthy soils, as well as maintaining our unique biological diversity. Some management practices place enormous pressures on the land, damaging these 'ecosystem services', reducing biodiversity and degrading soils and waterways.

By the Land Management systems we can get each and every information related with land which can help for proper physical planning and which may lead Bangladesh in

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Sustainable development. So GIS based land management is very important for Bangladesh for its sustainable development

1.5 Field of Study

The population pressure is very high in Bangladesh and land-man ratio is very adverse. The economy is strongly land-based and agriculture contributing about 35 % of the GDP (Gross Domestic Product). There are serious problems in land record management in Bangladesh. The modern GIS can create an institutional environment in the land administration and land management of Bangladesh. In Bangladesh Land record is the process of managing the cadastral and other legal instruments for management of the land administration, tenure system and land use policies. Land record system of Bangladesh includes a series of activities relating to presentation and maintenance of land records. Preparation of land records covers the whole process of survey of land, preparation of maps, record of rights showing the share of the tenants mentioned in the right of property as well as the amount of land revenue fixed by the Government. Maintenance of records of right of the land is a continuous process maintained by the indigenous system of land administration. Therefore, needs have been arisen to development of the Cadastre in Bangladesh. This research project has a lot of scope in cadastre development (the design, implementation and uses of cadastre) in respect of Bangladesh. Cadastre is an important issue of the present time in concern of Land Survey System in Bangladesh.

The project will try to find what are the problems in GIS development of Bangladesh, with the objective of identifying the causes of non-development and development as well as identifying institutional issues related to the implementation and maintenance of GIS that are relevant to and potential use of GIS (in administration, jurisdiction, land registration and spatial designs for sustainable development) in Bangladesh.

1.6 Limitation of the study

Preparation and writing a research work is a hard task. Due to limited time and fund we could not collect enough data from the field officials and the beneficiaries of the land management system. Inadequate fund is also another constrain of the research. As the research is in Bangladesh context only one case is being considered as a model of the study. It is assumed that all the land management system for the whole Bangladesh is same. So if one or two case is study rigorously then that will be suit for whole Bangladesh. Land management is a vast subject and so many actors are related here. Therefore, it becomes impossible to take opinion of the every actor to find out the appropriate land management system for Bangladesh. Again to understand GIS based land management system need technical knowledge which has a serious lack in almost every actors of land.

1.7 Scope of the Study

Managing land has multidirectional activities such as long management reforms, law of land Reforms, highest uses of land & ensuring the ownership of the land in the social binding. Since the area is wide and vast, we kept our study limited only on GIS based land Management.

Land management will provide the necessary theoretical and practical background for future experts in this field. It includes topics such as land policy, land tenure systems, rural and urban development, land management, land administration, cadastre, land use planning, photogrammetry, remote sensing, Geographical Information Systems (GIS), Global Positioning Systems (GPS) and land conflict management. This research aims to qualify in interdisciplinary approaches to land management in a national. One is to play the role of land management in the broader context of good governance and sustainable development. Another objective is to provide with a profound knowledge of the many aspects of land management in the rural as well as in the urban context.

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For a better land survey system transparency and accountability should be ensured. To address the issue proper reforms of land survey system through a modern technology has been suggested. Modernizing the land record system through computerized will give transparency and accountability.

With a view to address such an urgent situation and fulfil the people's demand, this research, on the basis of the findings, has suggested a mechanism regarding how to manage land in a scientific way.

1.8 Literature Review

Throughout the Literature reviews it is found that most of the land related researchers have been focused on the political, social and economic dimensions of land tenure and land management (land policy, land tenure systems and access to natural resources in industrialized countries, developing countries and countries in transition), the various fields of application, such as land administration, land readjustment and land conflict resolution and major variables related to land analyzed land use pattern, land users and uses and environmental effects and history of land management. A very few have said about the modern land management system through GIS.

The studies conducted in cadastre in Bangladesh are scarce. A few projects have taken place for LM improvement. The Directorate of Land Record and Survey has a plan of modernizing their cadastral system, but so far only a few projects have been carried out in the name of land reform.

Like Bangladesh, many countries of the world including United Kingdom, Malaysia and Sri Lanka during the ninetieth century and first half of the twentieth century operated the system of family-based khatian and registration of deed not registration of title. This system operated effectively so long land ownership was restricted only to the wealthy and

incidence of registration of deeds was minimal. But with the advancement of society when land transactions started to be frequent and land's trade started freely, most of the countries in the world started moving to the system of plot-based khatian and registration of title not deed. Plot-based title registration system is currently being operated in a number of countries of the world including Indonesia, the United Kingdom, Australia, Malaysia, Singapore, Thailand, Hong Kong, New Zealand, Sri Lanka and so on. Currently the World Bank, Asian Development Bank and other multilateral and bilateral agencies propose to modernize the land administration system in over forty countries of the world including Bangladesh by implementing plot-based record and title registration system.

In line with other countries of the world, the Government of Bangladesh has long recognized the serious problems associated with its present arrangements of recording rights in land and the impediment it represents to the progress and growth of the national economy and the mistrust and misery it caused to the people of the country. The GOB, therefore, wanted to bring about changes in the arrangements of land ownership records. Such intention of the GOB has been reflected in the following reports:

1. The report of Enquiry Committee on Land Revenue Administration Problems, 1974
2. Muyeed Committee Report of 1989 on Reorganization of Administration;
3. The Report of the Land Record and Settlement Evaluation Committee, 1989;
4. The Report of the UNDP and FAO on Improved Land Records, 1991 and
5. The report on Modernization of Land Administration, 1995-99

Recommendations of all these reports were to place the responsibility of land transfer under a coordinated management and under the Ministry of Land exclusively. As some vested quarters are opposing implementation of the above recommendations, the GOB moved for modernizing the land administration in Bangladesh. With the technical assistance of ADB (Asian Development Bank), the GOB undertook a 3-phase project for

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land administration reform in Bangladesh. The first phase of this TA project that commenced in late-1995 and concluded in mid-1996, helped Ministry of Land:

- (a) to study the existing land administration system in Bangladesh;
- (b) to pinpoint critical short term interventions; and
- (c) to design pilot scale interventions in the area of :
 - i. Cadastral Survey;
 - ii. Map and Khatian Printing;
 - iii. Computerisation of Land Records ; and
 - iv. Land Development Tax (LDT) reform.

It identifies that any reform in the land administration system in Bangladesh needs high-level policy direction. So, after completion of the first phase of the project, a national seminar was jointly organized in August 1996 by the Ministry of Land and the ADB in order to have a clear-cut direction regarding the focus of the necessary reforms. In that seminar the Prime Minister of the Government of the People's Republic of Bangladesh stated:

"In a world where many States have issued land ownership certificates with state guarantee, the people of Bangladesh are still languishing under land related litigations and harassments. Can we not devise a system of issuing state guaranteed certificates and land rights to our people? I believe that we are capable of developing an authentic, transparent and accountable land administration system in this country. I hope that the on-going modernization of land administration project will achieve the much-desired changes".

After having clear direction of the Prime Minister to devise a system of issuing state guaranteed certificates of land rights to the people of Bangladesh, the 2nd phase of the project commenced in the early-1997. It concluded in mid-1998. Its main focus was on the use of pilot activities to test the use of modern technologies and methodologies. During this phase Land Administration Management System (LAMS) prototype software was developed to support the pilot projects and required equipment was purchased for

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operation of the pilot activities. The trial survey operation was conducted in three pilot mouzas, namely Patrun and Mahmud Nagar under Dhaka district and one mouza named (Hazipur under Moulavi Bazar district by applying modern technologies including application of:

- ❑ total station;
- ❑ electronic field book;
- ❑ Global Positioning System (GPS) receivers; and
- ❑ laptop computers with surveying and mapping tools and so on.

After completion of the 2nd phase of the TA project the Ministry of Land and the Asian Development Bank jointly organized a national workshop in May 1998. There was a consensus in the national workshop that modernization of the current land administration in Bangladesh is urgently needed. The aim of the modern land administration should be, inter alia, to introduce a system of plot-based land record and registration of title instead of registration of deed.

In a similar vein, the Public Administration Reforms Commission (PARC) proposed:

1. To introduce a plot-based conclusive land ownership record in the form of a certificate of land ownership; and
2. An integrated land administration system under which Sub-Registrar will register the land ownership document only after proper verification of ownership of the vendor.

According to PARC there should be:

1. Simplification of form and language for preparing the documents;
2. Placement of Assistant Commissioner (Land), Sub-Registrar and Assistant Settlement Officer (ASO) in the same vicinity; and
3. Amendment of all laws and rules for introduction of Certificate of Land Ownership (CLO) and modernization of land administration in Bangladesh.

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The call for a system of accurate, authentic and transparent land ownership record that was first made in 1996, a seminar has been recognized and reiterated in every meeting, seminar, workshop and discussion held on land administration over the past few years. At this backdrop the 3rd phase of the TA project has been commenced in early-1999 with the following objectives:

1. To identify relevant laws, rules or other legal instruments; and
2. To suggest modifications thereof or new laws for facilitating the issue of CLO and suggesting institutional changes for effective implementation of the CLO-driven system.

Recommendations incorporated in the final report of the 3rd phase of the TA project, include, among others, draft legal and institutional framework for introduction of plot-based land record system.

1.9 Objectives of the Study

The broad aim of the study is to provide an analytical basis for shaping an appropriate land management system in Bangladesh. The study also focuses on to generate relevant new data, information and analysis, which, hopefully, will benefit researchers, trainers and practitioners in the field and help them in better discharging their responsibilities. The specific objectives of the study are as follows:

1. To delineate the present situation and changes since the British period in respect of major land management practices;
2. To establish the GIS based land management practices;
3. To suggest how land related information can be used for sustainable development; and
4. To highlight out how land information system can be modernized through GIS to meet the demand of the time.

Chapter - II: Data and Methods

2.1 Methodology

This paper is mainly based on primary and secondary datasets. The data were collected through Global Positioning System (GPS) survey, basic data of the landowners, discussions with the relevant documents and field staff, consulting relevant books, paper cutting and in-situ personal experiences. The methodologies of this research consist of critical perusal of secondary sources and a case study of a mouza, covering the Directorate of Land Records and Survey (DLR S) hardcopy materials.

The methodology, therefore, encompasses the following issues:

1. Critical perusal of secondary sources including books, articles, report, unpublished thesis, maps, official records, achieve materials etc.
2. Primary data collection through GPS survey, observation, field interviews, administration of questionnaires among selected respondent in those areas which lack substantial data/information and case study
3. Developing datasets using GIS and Remote Sensing approaches for ensuring the quality and the reliability of the database. These approaches also highlight the performance of state-of-the-art computer based data-automation technology.

Determining the criteria for the selection of cases is a critical aspect of the project. A set of cases, which are too similar, may lead to conclusions with a limited scope. A case, which is too similar, may provide useful conclusions because they would compare sufficiently to the Bangladesh case.

2.2 Geographical Information System

The development of GIS increased gradually. The importance of GIS increased in the field of land management and natural resource management. At present in our country the use of GIS/LIS (Land Information System) has introduced

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Every country in this competitive world wants to achieve development and for this development proper planning is necessary. For the prosperity of a country there need coordination between planning and development. In the present world of information for planning and development GIS is being used. GIS is using for project preparation, implementation, scrutiny, monitoring and evaluation. For its swiftness in decision making this technology is being popular day by day. For a sustainable and durable development GIS can be a dependable tool.

Often for planning the land use need to be changed. In this case GIS can play a vital role. In Bangladesh there are four city development corporations, four city corporations and 143 municipalities (source: Bangladesh Bureau of Statistics 1994). These organizations take various development activities like - land development, road construction, sewerage constructions, area identification for business and industries, create park, playground for recreation, identify area for hospital and school etc. for this work they still follow traditional methods but due to rapid urbanization these need to be changed quickly. The traditional methods take many times where as GIS can give quick result in these regards.

2.3 Methods of Data Collection:

The study is mainly based on the primary and secondary sources of data. The secondary sources however are supplemented by primary source. The sources include discussions with senior officials of the Ministry of Land, AC (land), Settlement Officer, Owner of the Land, Lawyer. Various books & reports, relevant land laws, instructions issued by the Ministry of Land, contemporary literatures on land management and Internet were also reviewed for data collection. Primary data were collected through GPS survey. The following questionnaire is a classical example could be applicable for dataset development at plot level of a particular mauza. The following sample of field questionnaire was used to collect the relevant data.

A sample of Field Questionnaire

Plot Level Village Survey in 2005 (Mauza Map Based /Mainly for Settlement Area)

Plot Serial Number:

Name of Plot	Age	Sex	Occupation	Years in Village

If Migrants- How many years ago and from where?

Village:

Para (New Name/Old name-if any):

Mauza Name:

Sheet number:

Code:

Plot/Daag Number -

CS:

RS:

(Plot location must be marked on the supplied Mauza Map or Sheets)

Category	1951	1961	1974	1981	1991	2001	2005
Land-type (H, MH, ML, L, VL)							
Local Topographic Name (e.g. Naal, Chala, Tek, Byde, Beela)							
Duration of Inundation (Months, e.g. July-Sept)							
Number of Ghars	A. Pucca Roof						
	B. Tin Roof						
	C. Other Roof						
Number of People living on the plot							
How long family members have been living on this plot (oldest one)							
Ownership (Private/ govt/ khas/ Commercial etc.)							
Land value ('000 taka/Per Decimal) Note: we will count inflation later on							
Main Influencing factors for change /no- change of Land-value/Land-use							
Main Profession (in general for the inhabitants (agriculture, fishing, industry, service etc)							

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Social Class of the inhabitants of the plot in general (H, MH, ML, L)							
Land use (every detail) (current land use must be drawn clearly on the provided map during field work)							
Vegetation/agriculture (Homestead garden / Forest and Crop 1, Crop 2, Crop 3)							
Any Remarkable Infrastructure/s (e.g schools, bridge, deep tube well)							
Utility lines (Electricity, Gas, Sewerage etc)							

Did any problem occur during data collection? If yes, PLEASE specify:

--

2.4 Methods of Data Analysis at Plot Level

There are several methods to be used for the project. The primary and the most important technique was to develop a dataset as GIS attributes at the plot level. The data were collected for this from both primary and secondary sources. To match this data with the georeferenced images, we had to follow several steps to integrate both. Later it was calculated to show the X-Y coordinates and centroids of each plot of the GIS attributes. The main foundation of the datasets was a participatory approach, and using this method a map of the case study mauza is being digitized. Later the data were integrated with remotely sensed images. Here the main steps are discussed.

2.5 Developing Datasets for a Mauza Map

Mauza maps are very suitable for adopting modern approaches such as GIS systems and the advanced mapping technologies. Every plot is marked with a plot number, and every mauza has been on the Jurisdiction list or has had a Geocode number since the beginning. For integrating all the information from the primary, secondary, GIS and image interpretation techniques, a comprehensive dataset was developed for each plot during the

field survey. Here, we will give a brief description by way of illustration. We collected field data on the land values of plots for 1951, 1961, 1974, 1981, 1991, 2001 and 2005, but in order to make the Table size small, we will give the example of 1951 and 2005 only. We have considered Bara Oalia Mauza of Savar Upazila. In Bara Oalia mauza there are 1547 plots and, based on each attribute table, an enormous number of maps could be drawn. But we have used only maps which are absolutely necessary for this project.

The attributes are based on the following:

- (1) **GIS Attributes:** Examples are given in the rows (1 to 4) as Area, Perimeter, Internal_ID (Oalia_) and User_ID (Oalai_ID). Area has been calculated in metres. Therefore, the area is in metres² and length is in metres. The internal ID is given automatically during cleaning and building a polygon while the ID was allocated based on the plot (daag) number.
- (2) **Avenue Script:** The X Y coordinates have been calculated (rows 5 and 6 of Table 6-2) from the Arc Avenue Language Scrip based on the Lambert Conformal Conic projection parameter for Bangladesh. The X Coordinate indicates Longitudinal Graticules while the Y Coordinates are Latitudinal Graticules. The adjoining XY position is the location of a centroid of a plot or polygon.
- (3) **Field Data and Experience:** We conducted a very intensive field survey mainly for two reasons: one, to get the plot information from the field which cannot be extracted from the RS image directly, for example, the name of a village (row 8), the location of any local infrastructure and the name and type (row 9), school names, NGOs, bridges and so on; two, to interpret the image based on the field experience. For example, We had no idea how to interpret complex land types in Savar, but after ground truthing, it became very straightforward as to the meaning of any pixel of an image. This experience also helped me to apply my knowledge for the historical CORONA and aerial photo interpretation.

- (4) **Survey Attributes as Daag (plot) number:** In Savar the two major mauza surveys (CS and RS) were implemented in 1915 and 1975, based on plot level surveys in the earlier decades. All the plots were marked with a unique plot ID. In the GIS attribute table, I used both the CS daag number (1-1288) and RS daag numbers (1-1547), because 17% of the total land has been fragmented in this time. Using GIS, maps are now visible with unique Ids, with compatible attributes. For example, the CS in 1915 daag 1232 is now RS 337. So we can use both pieces of information at the same time. This helps monitor the history of a plot and its owners. In a few cases, the villagers were not ready to tell us their plot/daag numbers as they thought we came from the government to acquire their land. We circumvented this problem with the help of local *matabbars* (leaders) so that they could put their trust on us. A request for a plot number by an unknown person is a very sensitive issue in rural Bangladesh.
- (5) **Land Types:** Bangladesh has various land types based on inundation conditions. As already mentioned, these are: highland, medium highland, medium lowland, lowland, very lowland. We have used a code for each plot in numeric, land type name and the local topographic name.
- (6) **Land Unit Calculation:** Land area per unit was calculated based on Decimal (the term is widely used locally and does not carry same meaning of decimal in English) unit. In general, the GIS develops its database in metres, but we converted these into local land record measurement units. For example, the area of a plot is locally maintained in Decimal (one 26th part of a *Bigha*) land, so we converted the metres² into Decimal. The standard land measurement units and their conversions in Bangladesh are in the following Table - 1.

Table - 1: Table shows the common land measurement units in Bangladesh.

1 Decimal = 40.468564 metres ²	26 Decimal = 1 Bigha
1 acre = 4,046.8564 metres ² = 4840 yard ² = 100 Decimals;	
1 hectare = 10,000 metres ²	1 km ² = 100 hectare

Source: Information collected from the local Amins, 2005

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- (7) **GIS Attributes from Remote Sensing:** Information interpreted from image data was added to the GIS database. The plot datasets have been made more practical after adding new land system parameters by interpretation of aerial photography, CORONA and high resolution IRS-1D satellite images. Here we have appended several types of information, such as land use, for instance, the location of settlements with homestead vegetation, forested plots, water bodies (e.g. rivers, *khals*, *beels*, *pukurs*), infrastructures of JU, *katcha-pucca* roads, *eyeels* and extent of land types, and the boundaries of soil series. These values were recorded as a decennial series.
- (8) **Secondary Data Sources:** We used secondary data to make the plot-to-plot information systems a base line for environmental and development data. This was included with the help of remote sensing. For example: the Bangladesh Soil Resources Development Institute has identified various soil series based on the micro-climate of the soils at the upazila level. We added this information from the upazila level to the plot level. This could be helpful for local farmers as a soil nutrition and management guide for the better understanding of agricultural land at the plot level, which has never been explored before.
- (9) **Land Value Data:** The data acquired regarding land values has a massive social and development significance in the study area. We verified the land registration data, from the land registration documents of the local people /land owners, those who helped me spontaneously, local land *daalal* (brokers) and local representatives or members of grassroots union councils. Through interviewing key persons, We got significant information on land values and how the focus of land has changed regularly, and which factors have been important. We got a very detailed picture of land values in taka, since 1951. In order to avoid the inflation within the mauza boundary, We used a percentage method where the value of a village is considered as a constant of 100.000 from (rows 25 and 26) 1951 to 2005. It was then very easy to map the high land values areas and to make comparisons between decades. Using participatory methods, we classified the land value zones of each village (rows 19 and 20). Here, the local villagers classified their land by their own understanding of land values. Land prices were collected at a per Decimal rate (rows 21 and 22) from the

field as well as from the land registration office. We also calculated the total values of particular plots based on per Decimal values (rows 23 and 24).

10) Population and Households: Using visual observation during the field work, we judged the rough social status of a household for 2015. The method was very simple, *pucca bari*, *tinner bari* and *katcha bari* were generally classified as high class, middle class and low income class respectively. However, it was not straightforward in some areas. For example, some high class families prefer to stay at *tinner bari*, even though they have all standard facilities in their house. In that case, personal judgments have been used. It is of course embarrassing to ask any household head about their income since such questions are treated with suspicion. The number of households and total population in a plot were also collected (see Rows 29 to 34).

(11) Crop Calendar: This was the most important factor for centuries in the study area as the total economy was dependent on the primary economic activities, mainly agricultural products. From the field based study we have developed a comprehensive crop calendar with transitional history of individuals of the study mauza. It has had a significant variety of agricultural and local fruit production, either for three seasons, or for two seasons or for a single season. The seasons are *Prak-kharif* (March-May), *Kharif* (June-October), and *Rabi* (November-February). We spoke to elderly farmers in order to draw out the cropping practices of past decades and also the farmers working *in situ*.

Hundreds of additional columns can be added as attributes of GIS from the field survey to the remote sensing interpretation techniques. With the help of these databases, an in-depth understating of land transformation can be monitored, evaluated and the local complexity of land and its interaction with population pressure assessed.

Chapter - III: Land Management in Bangladesh

3.1 Land Management in Bangladesh:

Land management can be defined as the process of managing the use and development of land resources in a sustainable way. Land resources are used for a variety of purposes which interact and may compete with one another; therefore, it is desirable to plan and manage all uses in an integrated manner. Some definitions of Land Management are given below:

1. The grazing of livestock is sometimes used as a way to control weeds and undergrowth on an area of land. For example goats and sheep are used to eat dry scrub in areas prone to wild fires in order to remove combustible material and reduce fire risk. (Source: encyclopedia.laborlawtalk.com/Livestock)
2. The activities associated with the management of land as a resource from both an environmental and an economic perspective. (Source: www.landadmin.co.uk/Resources/Res_Glossary.htm)
3. Land management can be defined as the process of managing the use and development of land resources in a sustainable way. Land resources are used for a variety of purposes, which interact and may compete with one another; therefore, it is desirable to plan and manage all uses in an integrated manner. (Source: en.wikipedia.org/wiki/Land_management)

The concept of land management varies from country to country. Here, concepts of land management according to some countries are given below:

1. Land Management and Land Tenure are important prerequisites for sustainable urban and rural development. (Ecuador)
2. Land Tenure is closely linked to Resource Tenure. (Columbia)

3. Land Management has to reserve space for public infrastructure such as traffic systems. (USA/China)
4. Access to Land = Access to Shelter (Republic of South Africa)
5. Land Tenure systems are closely related to social and cultural aspects of a society. Together they become visible in urban architecture and construction. (Nepal)
6. Land, water and forest rights not only define ownership, but also regulate their access and use. (Russia)
7. Speculation on land – people mark “their” properties in the surroundings of a growing capital. (Mauritania)
8. Urban agriculture might be an indicator for non-functioning land markets; it also allows many people to improve their living conditions. (Hungary)
9. Functioning land markets: cause or consequence of economic growth? (Hong Kong)
10. Land use planning at village level as part of sustainable natural resource management – another aspect of land management. (Burkina Faso)
11. For many people, access to water is as important as land rights, e.g. for cultivating rice or watering live stock (China/Niger)
12. Land Readjustment in Germany (Source: <http://www.landentwicklung-muenchen.de/master/index.html>, Date : 8.06.05)

In Bangladesh generally land management includes:

1. Securing property rights in land and buildings
2. Updating and maintenance of cadastral systems
3. Taxation of real property assets, including real estate appraisal
4. Land use planning, and environmental monitoring
5. Public administration issues (centralization-decentralization; coordination; privatization;..)
6. Education and research in these fields

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The major themes of land management in Bangladesh context are:

1. Processes relating to change in land titles, such as land records preparation and updating, land transfer registration, land mutation, etc.
2. Land based dispute adjudication/resolution
3. Management of state land and water resources consisting of distributable /leasable resources, such as agricultural and non-agricultural land, water bodies, hatts and bazar, minor minerals etc. and non-distribution/non- leasable common property resource such as grazing land, forestland, pathway, open water bodies.
4. Government intervention in land use through regulation, direct participation, taxation, consolidation and acquisition for development purpose.
5. Land revenue/Tax and other sources of land –based revenues
6. Land management organizational setup and its vertical and horizontal linkages and
7. People's participation in land management, particularly through the involvement of NGOs, peasant association, local government bodies etc.

3.2 Land Records System in Bangladesh

The Directorate of Land Records and Surveys (DLRS) is entrusted with the responsibility of carrying out cadastral surveys and the preparation and maintenance of the record of rights (ROR) in respect of every parcel of land in the country. With the passage of time, the organizational structure of the Directorate changed considerably to meet new requirements. In recent times, some of the recommendations of the 1989 Evaluation Committee on Land Records and Surveys Management were implemented.

According to the original plan, 22 Zonal Settlement Offices (covering 2 or 3 districts) at the district headquarters and 460 Thana Settlement Offices were supposed to have been established. As of now, only 12 Zonal Settlement Offices and 209 Thana Settlement Offices are functioning. At the lowest level is the Thana Survey and Settlement Office. It

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is responsible for the maintenance of the register of the record of rights. It also prepares maps and records in respect of one or more villages covering approximately 2 square miles in each union of each thana in every dry season (November to May). Junch (checking) work, map correction, amalgamation and splitting up of jamas (interest) are done by the permanent surveyors and their supporting staff.

A Thana, on an average, covers 125 square miles. An average area of 25 square miles should be covered by the preliminary operation of survey and settlement in the thana during each field season. Subsequent work should be completed and records finally published during the non-field period of the year. It is to be a regular and continuous process. So it should be possible to revise the maps and the record of rights of the whole thana within a 5-year period. The settlement staffs are also to collect valuable personal and agricultural statistics in respect of the landowners during the field operations. Thus, subsequently, an accurate set of agricultural statistics could be prepared.

The Zonal Settlement Office is headed by the Zonal Settlement Officer (ZSO). He, along with the Additional Settlement Officer, disposes all appeal cases filed by the landowners. The hearing of the appeal cases takes place at the thana headquarters. The appellate officers go over to the concerned thana according to a prepared schedule. The responsibility of the Zonal Settlement Officer includes traverse survey of all mouzas (revenue village) when required. He is to draw up his traverse programme in such a way that mouzas included in field seasons are invariably taken for preliminary record writing and local explanation work in the next field season. The ZSO is also responsible for printing the record of rights (ROR) at the Zonal Settlement Office level. Previously, these records used to be printed centrally. However, maps will continue to be printed centrally.

The headquarters of the Directorate of Land Records and Surveys has been reorganized with the creation of the post of one Director (Administration) and some other mid-level posts. The office of the Diara Settlement Officer has been re-designated as Settlement Officer (Diara and Urban Operation) and he is responsible for conducting survey and settlement operations in the riverine areas and in the major urban centres like Dhaka,

Chittagong and Khulna, where frequent changes of ownership and plots take place. The existing settlement press has been relieved of its responsibility of printing the record of rights, as this has been delegated to the Zonal Settlement Offices.

After the abolition of the Zamindari system in 1950, compensation assessment rolls were prepared hurriedly but the maps could not be updated at that time. So, a programme of divisional settlement operations was undertaken during the 60s in a phased manner. At present, divisional settlement operations are being carried out in 10 zones. During the last 25 years it has been possible to complete the divisional settlement operations in 3 zones only. It took about 12-15 years to complete the whole process of divisional settlement operation in a (old) district. At present divisional settlement operation is nearing completion in (old) Dhaka, Pabna and Mymensingh districts. Settlement operations were started in 10 zones (each zone represents the area of former districts) since FY 1986-87. They are at various stages of completion, from 65 percent to 25 percent. Settlement operation also began in the Chittagong Hill Tracts but due to resistance from local people it was postponed. Divisional settlement operations have been completed in 3 districts, namely Rajshahi (1967-1983, Chittagong (1970-1992) and Kushtia (1976-1988). Diara survey of various coastal areas was started in 1963-64, and it is a continuous process. This is being monitored and supervised by the Dhaka Settlement Officer.

In Bangladesh there are about 40 million land holdings (to be represented in Khatians), divided into almost 100 million fragments/plots. There are about 80,000 maps to be maintained, mostly of a scale of 16:1 mile (larger scale in urban areas), showing the position of all plots and forming an integral part of the cadastre. Since the commencement of the revision settlement operation in 1965, about 5.5 million Khatians have been finally published. There are about 1150 survey teams in the DLRS to prepare maps and update the record of rights. Each team prepares records of 1.5 mouza maps, equivalent to 1875 plots or 750 Khatians on an average in each field season (6 months). At this rate it would take about 46 years to update the maps and khatians of the whole country, but by that time the products would become obsolete and useless.

There are two parts in the preparation of the record of rights. The first part is to draw a revised mouza map showing changes in location, area and characteristics of land. The second part is to prepare the Khatian (cadastre) indicating the ownership, area and character of land. These two parts together are called the record of rights. The phases followed in the survey and preparation of record of rights are traverse survey, plot to plot survey or Kistwar, demarcation of boundary, Khanapuri (preliminary record writing), Bujharat (local explanation), attestation, draft publication, hearing of objections, appeal, final Junch (checking), printing and publication of Khatian. At present the landowner is heard individually when survey is conducted and records are prepared. There is as yet no scope for involvement of People's organizations/farmers' organizations/local government organizations and NGOs.

The DLRS currently has 4958 full-time and about 4,100 part-time survey staff on its payroll. During 1989-90, it was possible to publish about 800,000 Khatians. The average cost per Khatian is about Tk.400. The backlog in printing of Khatian is estimated at 4.0 million and about 12,000 maps are ready for printing at present. The backlog of Khatian printing has been reduced to some extent by using private presses. But this has increased the recurring cost and security difficulties. The backlog of map printing has been reduced to 5,000. A backlog has also been identified in survey and settlement processes, particularly in the stages of attestation, objection, appeal and final checking of Khatians. That is happening due to shortage of officers with revenue powers to resolve the disputes (in particular, Assistant Settlement Officers) and low quality of supervision.

There are severe problems in carrying out zonal survey schemes in 4 to 5 greater districts in a year due to the scarcity of experienced workers, antiquated methods and obsolete equipment. In the absence of skilled and experienced workers, newly promoted officials are being given the highly technical tasks of drawing maps and Khatian compilation. The field workers are low-paid and it is very difficult for them to resist the temptation of bribes. Also they are not always secure. Extortionists collect money from the Amins by intimidation. Much of the litigation arising from 'accreted land' could have been averted

had the Diara settlement operation been completed. The present manpower assigned to Diara settlement is not adequate for completion of this task.

The present settlement press was established in Dhaka in 1960. It can print only 200,000 Khatians a year, although the demand is much higher. The press is not a modern one and it has got only one offset machine which can print maps and forms and another machine only for printing forms. These are electrically operated. Other machines are manually operated. The press suffers from shortage of manpower. It has to print 55 types of non-standard forms also, which was earlier done by the Bangladesh Government Press. Each Khatian is printed separately and only ten impressions are needed. So, one plate cannot be used more than once. This needs a lot of manpower and mandays. If computer printing could be introduced, the capacity of the press could be increased manifold. Various donor agencies like FAO, UNDP and ADB are now involved in the land records modernization efforts in Bangladesh but there is little initiative and innovation from within.

Land records are managed by both the Collectorate setup and the DLRS. Land records are prepared by the DLRS and then they are handed over to the Collector (DC) and thana and union land offices for land management. These records are partially kept updated as a consequence of sale and transfer through the mutation process. If the land records could be fully updated by the Collectorate officials, there would be no requirement for revisional settlement. Efforts have been made to develop a linkage between the activities of the DLRS and the Collectorate setup at the Thana level, but with little results so far.

The Directorate of Land Records and Survey at present employs 4,958 (Class-I-75, Class-II-230, Class-IV-3,266 and Class-V-1,387) people. Besides there are about 4,100 temporary staff (mostly surveyors, chainmen, etc.) who are employed only during the field season (November to May). Though the number of staff has increased, the actual number is still far short of the sanctioned strength. Senior positions (Class-I) of the Directorate are filled by officers from the administration cadre. They are frequently transferred from one government department to another (every 3 years or less) and this gives them the opportunity of having a wide base of experience for their career.

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development. But it also limits their understanding of the basic activities and problems of the DLRS. This situation does not either encourage the officials to develop a commitment to the success and achievements of the Directorate. Long-term work strategy suffers from a lack of consistency due to frequent changes at the top level of the DLRS.

At the lower level, the junior survey Amins actually responsible for all survey work and preparation of ROR at the field level, are mere temporary employees. They are employed only in the dry season. While some of them may be committed to their task, the insecurity of service combined with low pay and allowances adversely affect their morale, performance, accuracy and reliability. Also, given very little support from the Directorate, they have to depend on the local elite for board and lodging during the field season. Thus their work is more often influenced by the vested interest groups. The mid-level management also suffers from some kind of frustration since there is no prospect of promotion for them beyond a certain level and that prevents them from developing imaginative and creative ideas. Extra field allowances that used to be provided have been stopped, undermining their morale.

Training facilities for both officers and staff are lacking in the DLRS. There is an arrangement for ad-hoc training of the officers of the administrative cadre who are later on deployed at the upper management level. The training facilities available for the staff (surveyors and Kanungos) are highly inadequate. There are no qualified surveyors, cartographers, photogrammetry specialists and computer programmers in DLRS. The people working in the areas are merely technicians.

It has been indicated earlier that it takes a long time to recycle the whole revisional settlement operation. The land records which have been prepared through revisional settlement operation are reliable. But the continuous changes taking place in the meantime, render these useless. At present, the records are prepared only according to plots of land. In order to prepare records according to persons, additional efforts have to be made by the DLRS.

It has been mentioned earlier that the ZSO is responsible for carrying out the zonal survey and settlement operation. The ZSO is of equal status (Deputy Secretary) to the Deputy Commissioner. Thus, when the DC goes out to the field he can only supervise the work of the ASO or surveyors as and when required and report it to the DGLRS. The TNO in his jurisdiction can also supervise the work if any complaint is lodged by members of the public and report it to the DC or the ZSO. The DC and the TNO generally do not supervise the work of the survey and settlement officials unless they are specifically asked to do so by the DLRS or the Ministry of Land as they do not have time for this work. It is mandatory for the officers of the DLRS to inspect the field work very frequently.

Kanungo	-	all the working days during field season.
ASO	-	More than 20 days during field season.
Charge Officer	-	18 days in the field.
Zonal Settlement Officer	-	10 days in the field.

Most of the litigations of both civil and criminal nature arise from land disputes. These disputes occur mostly due to lack of good and upto-date land records.

The top positions of the DLRS, from Director-General up to Deputy Director, are generally manned by the officers of the administrative cadre. There is no provision for filling these posts from the promotee officials. The posting of administrative cadre officials at the top level of the DLRS is considered a regular phenomenon. But many administrative cadre officials do not like to work in the DLRS as the task is arduous and lacks glamour and prestige.

The Directorate of Land Records and Survey has earned notoriety for corruption and inefficiency. It has been mentioned earlier that the lower-level staff are temporary and employed only during the survey season. They do not have any career prospects, and as a result they try to make as much as they can through corrupt practices. Only a handful of the supervising staff, the Kanungos and officers are not involved in corruption. Powerful

landowners also try to induce the officials to do them some undue favors. For example, a landowner with co-sharers in a particular parcel of land would like to get it recorded in his name, depriving the other co-sharers by bribing the surveyors. Or it may be the other way round, i.e. the co-sharer would like to get a particular land recorded in his name by bribing the surveyors. There may also be corruption at the stage of attestation and objection hearing; the objective is to get a parcel of land recorded illegally.

Generally the staff of the DLRS are not interchangeable with the Collectorate staff. But at the time of need the Kanungos and Surveyors can be placed under the Collectorate setup and vice versa. Although this kind of mobility is desirable for acquiring expertise in all types of land related work and for promotion, given the high compartmentalization it would be difficult to operationalise this on a regular basis under the existing circumstances.

Now the Zonal Settlement Offices have been given some authority. For example, printing of the record of rights, which was earlier done centrally, has been delegated to the Zonal Settlement Office.

The present recording system reflects present and past land use and changes thereon in a very general way. The Khatian mentions the plot number, Khatian number, classification of land, area of land, crops grown, the name of the owner and contains some other information on agricultural activities. So the change in land classification over a certain period of time can be ascertained from these records. The classification is considered important because it is to be taken into account in assessing land revenue.

Previously the land recording system did not contain information on tenancy because the landowner was the direct tenant under the state. But with the promulgation of the Land Reforms Ordinance, 1984 it has become binding to uphold the rights of the Bargadars (sharecroppers). As part of the procedure the tenant's rights on a particular parcel of land as a sharecropper are to be recorded in the draft Khatian. But this is not happening to any

significant extent at the ground level because of pressure from the rich and powerful landowners.

The land records may be distorted at various stages, i.e. plot-to-plot survey, preparation of records, objection and Junch (checking) work. The staff and officers entrusted for processing the work during these stages are responsible for such distortions in land records. Both the actual possession of the land and the documents held by the owner are to be considered during the recording operations. In cases where persons with similar documents claim ownership, the person in possession of the land gets priority.

At present the common man does not have access to information on land records. The land records are maintained in the Tehsil office (Union Land Office). Though they have different registers with different kinds of information, the common people are not allowed to look at these registers. However, on payment of a small fee, the common man gets a certified copy of the ROR and mouza map. Although the laid down procedure for this is simple, in reality both time and 'extra money' are needed to obtain these.

3.3 List of Documents are Required for Land Records

Documents to be produced by the owner or person having an interest in the plot in support of his claim are as follows:

- (i) Khatian or parcha of the last survey and settlement operation;
- (ii) Khatian subsequently prepared, as a result of mutation, if any;
- (iii) The deed of purchase in original or certified copy thereof, if ownership is claimed through purchase;
- (iv) In case of purchase by auction, the sale certificate and the certificate of delivery of position;
- (v) If acquired from the Government or statutory corporation/authority, the deed of lease or allotment;
- (vi) In the case of a court's order, the decree/order of the court;

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- (vii) In case of ownership through a Will, the Will and probate granted by the District court;
- (viii) In case of gift, documents in support of the gift;
- (ix) In case of exchange, the exchange deed;
- (x) In the case of enlisted vested property, the order release from the category of vested property,
- (xi) In case of inheritance, the faraize or amicable partition agreement;
- (xii) If ownership is acquired in any other way, the documentary evidence thereof;
- (xiii) Rent receipts; and
- (xiv) Documents of possession, if any.

3.4 Problems with the Present Land Ownership Record

Present arrangements of land ownership records can not cope with present day demands of the Governments as well as the people of Bangladesh. As we all know the present demand of the clientele is a Land Ownership certificate. It is because under the present arrangements, land ownership record is based on the following vital documents:

1. Record of Rights (ROR) consisting of plot-based map called mouza map: records of ownership and /or possession thereof called khatian prepared by the Settlement Officer under the provisions of section 144 of the State Acquisition and Tenancy Act 1950 and Tenancy Rules 1954-55;
2. Mutated ROR prepared and maintained by Assistant Commissioner (Land) under the provisions of sections 116, 117 and 143 of State Acquisition and Tenancy Act 1950; and
3. Registered Deed prepared and maintained by Sub-Registrar under the provisions of Registration Act 1908 and Registration Rules 1973.

None of these documents is conclusive. These documents are prepared and maintained by three different departments independently – ROR by the Department of Land Records and Survey

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(DGLRS), Mutated ROR by the AC Land Office and Registered Deed by the District/Upazilla Registration Office. The DGLRS and AC Land Office function under the direct control and supervision of the Ministry of Land and the Registration office under the Ministry of Law, Justice and Parliamentary Affairs. Due to poor coordination among these three departments, documents are never contemporaneously updated. This lack of currency and accuracy together with the diversity of the record sources and the absence of a statutory provision for ensuring conclusiveness in any one of the record sources makes the three sources practically irreconcilable.

Under the present registration system, the amount one needs to pay for registration of land transfer in the form of duty, tax and fees is altogether as good as 27.25%¹ of the land value that discourages registration and encourages an informal land market – where land is held and enjoyed by one without documents. On the other hand, title to land is not registered under the present registration system. Because the Registering Officer, as per Registration Rules 1973, is not responsible for verification of the right and title of the plot of land for which he is registering the legal document. He is rather responsible for verification of payment of stamp duty, capital gain tax, transfer fee and registration fee, for identification of the buyer and seller and for the entry of the documents in the 'Book 1'.

As a result, a registered deed does not prove who genuinely owns the land; it only records an isolated transaction. It gives the opportunity of false registration. The degree of false registration is rampant in urban areas as there is no legal bar to do so. It results in selling of one plot of land to multiple buyers or selling of land by the fictitious owner. Under the present system after a deed is registered in the Sub-Registry office, the Sub-Registrar is supposed to send Land Transfer Notice to AC (Land) office regularly so that AC (Land) can update the record (i.e. *the Khatian*). But, in practice, this does not occur. What occurs practically is that after a 3-4 month interval, LT (Land Transfer) Notices are sent in bundles to AC (land) office and AC (land) does never update records on the basis of such LT Notice as the records (i.e. *the khatian*) do not usually, due to backlogs in

¹ 10% stamp duty, 2.5% Registration Fee, 1% Municipal or Local Government tax, 7.5% Source Tax, 0.5% Immovable Property Transfer Tax, 2% District Council Tax, etc.

Settlement Operations (resulted from inefficient work practice, antiquated equipments and out-dated procedure and processes) reflect the name of the seller. In addition, under the present system AC (land) office is not required to provide any information about the mutation cases to the Sub-Registrar office. Due to lack of effective supervision and presence of corrupt practices, few mutation causes are carried out properly by following rules and procedures. Furthermore, there is no scope, under the present system, of making correction in the mouza map immediately after the mutation case is finalized by the competent authority. As a result, neither AC(land) office nor Sub-Registrar office even nor the Survey and Settlement Office is, under existing land ownership record maintenance system, in a position to maintain a complete set of current and accurate information pertaining to any parcel of land. What records they are maintaining now can no way be termed as up-to-date land ownership records. This means that under the present long, complicated and demeaning system the land ownership records are not up-to-date. It cannot satisfy the demands of the government as well as people of Bangladesh.

3.5 A Brief History of Mauza Maps

According to GoEP (1962), Hussain (1995) and Debnath (2000), in 1701 during the time of King Akbar of Indian subcontinent (*Bharat-barsho*), the land survey, record, mapping and modern revenue collection system were introduced for the first time under the Mughal Empire. This was widely known as Todar Mall's settlements. The system lasted about two centuries. At that time, revenues were collected directly from the farmers or tillers of the soil. The decline of the Mughal Empire began to change Bengal's history after 1757 and within years, in 1765, the East India Company established the foundation of British revenue jurisdiction in the provinces of Bengal, Bihar and Orissa. As an immediate impact of the power transition, one-third of the population of Bengal died due to a devastating famine in 1769-70 (Bangla Calendar: 1176, still locally remember as *Chhiattor-er Manantor*), so the East India Company was unable to collect the expected revenue directly from the insolvent and skeletal farmers. They decided instead to appoint local intermediaries (*jamindars*) in order to force extra revenues indirectly, and also they wanted to stay away from direct conflict with the farmers.

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On 23rd March 1793, the terms of the Decennial Settlement of 1789-1790 were made permanent by Lord Cornwallis, with the result that the permanently settled states, including Bengal, become liable for no further increase in Land Revenue and, in order to increase revenues dramatically, the *jamindars* were declared to be the proprietors of the soil for ever as intermediaries. The *jamindars* were liable to pay the agreed revenues to the East India Company and no excuse such as drought, flood or famine was to be accepted for non-payment. This was known as the notorious 'sun-set law'.

Meanwhile, based on the century-old Todar Mall's comprehensive survey of land, it became increasingly difficult efficiently to administer the Permanently Settled areas, and the help of the Revenue Surveyor was called in to settle, once and for all, the limits of estates and to make such maps of them as would eliminate the possibility of future disputes. The government generally fixed the rent for a limited term of years or else farmed out the estates to suitable persons who settled tenants and collect the rents. This usually necessitated what is known as a '*riyatwari*' or field-by-field survey. During the period 1845-1877, the *thakbastor* or demarcation survey was conducted which was based on eye-sketches with rough magnetic bearings. The general rule was to place *Thak* marks at measures intervals of 200 to 300 feet round a boundary and to place *dhuis* (large mud pillars of 5 feet high) at principal bends in the village boundaries and at all village triangulations. These were shown on *Thak* maps and were used later as rough guidance for the Revenue Surveyors between 1846 and 1878. The maps were known as *Khasra* Maps. The objectives of the *Khasra* Operation were to (GoB, 1917):

- Make accurate maps of the village boundaries and sometime the estate boundaries;
- Survey the topographical details that occurred with and around villages;
- Compile certain statistical data required for the general administration purposes;
- Make maps of each village (e.g. 4"=1 mile) and 1"=1 mile for Parganas.

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The detailed boundaries were mapped either by ordinary plane table survey or by offsets to the traverse or by direct transfer of Thak boundaries. Based on the above survey, the modern Cadastral Survey (CS) maps (16"=1 mile) up to plot level were developed by finally replacing Todar Mall's system in the late 19th century, commencing from 1888, using traverse survey. The cadastral work showed the proper position, the actual limits of all cultivators' fields or such sub-divisions or amalgamations of these fields as may be required by the rules framed for the Settlement work which was to follow (Hussain 1995) and so on. These highly accurate large-scale maps, later popularly known as 'mauza maps', made in the field were reproduced mechanically for revenue collection purposes by the then district settlement department and, finally, since then these are the 'unique and invaluable land record contribution' of the British Empire during the 200 years or so colonial period.

The East Bengal State Acquisition and Tenancy Act, 1951: After the independence of Pakistan from the British Rule in 1947, the East Bengal State Acquisition and Tenancy Act was passed by the East Pakistan Legislative Assembly on 19 May 1951 to abolish the brutal *Jamindar Protha* (landlord system). Among others, the main provisions of this historic law were (GoEP, 1962):

- All rent-receiving interests from those of Jamindars, Talukdars and other intermediaries to those just above the actual tillers of the soil were abolished;
- Further subletting of the lands by the ground tenants was prohibited;
- A ceiling on holding of land was imposed (maximum 33 acres i.e. 100 bighas), beyond which excess lands would be vested in the Government.

Immediately after the independence of Bangladesh, under consideration of the poor economic and social conditions of the villagers in 1972, *raiya*s (tenants) having 25 *bighas* (8 acres) of land or less per family were each exempted from paying any rent or tax (GoB 1972).

Since 1951, all mauza maps have been maintained by the Land Records and Surveying Department and mainly used for efficient revenue collection. In the Pakistan period, after implementing the State Acquisition Act, 1951, all mauzas were updated and resurveyed in the 1960s. These were later known as the Revenue Survey mauza maps. The most recent survey was conducted in the 1990s and still it is not implemented in Bangladesh. This survey is known as the Bangladesh Survey (BS), so the century-old CS maps are still used as the base line corroboration for Revenue and Bangladesh Surveys.

Mauza maps are regarded as invaluable spatial-historical documents and assets which can be integrated with high resolution satellite images and aerial photos with the help of DGPS based ground control point data and can be considered as a milestone for the map-image amity to understand the very dynamic deltaic land systems in Bangladesh. These mauza maps play a significant and detailed role for further study and also help to map the impact of land transformation at mauza level. Digital conversion of these maps can also help in land reform, management, development, planning and environmental monitoring systems in the country.

Chapter - IV: Case Study of Land Management using Geographic Information System

Based on the previous discussions, it is to be noted here that the land management system can only be managed properly using GIS or Computer Assisted System approaches. In this context, this chapter will highlight the relevant issues regarding automation. Before that we need to know the various aspects of a mauza. Bara Oalia Mauza has been considered as a case example as discussed before.

4.1 Anatomy of a Mauza Map

What does a mauza map look like, what kind of information does it contain? Figure A is an ideal example, where we can see a number of mauzas with their names. Oalia Mauza is located in the middle of the map with plots boundaries shown. Some mauzas on this map are very big and some are small, with very irregular boundaries reflecting local topographic features. The mauza map shows (Figure 1.1) plot numbers at 16"= 1 mile scale, but not road or land use pattern, or inundation conditions.

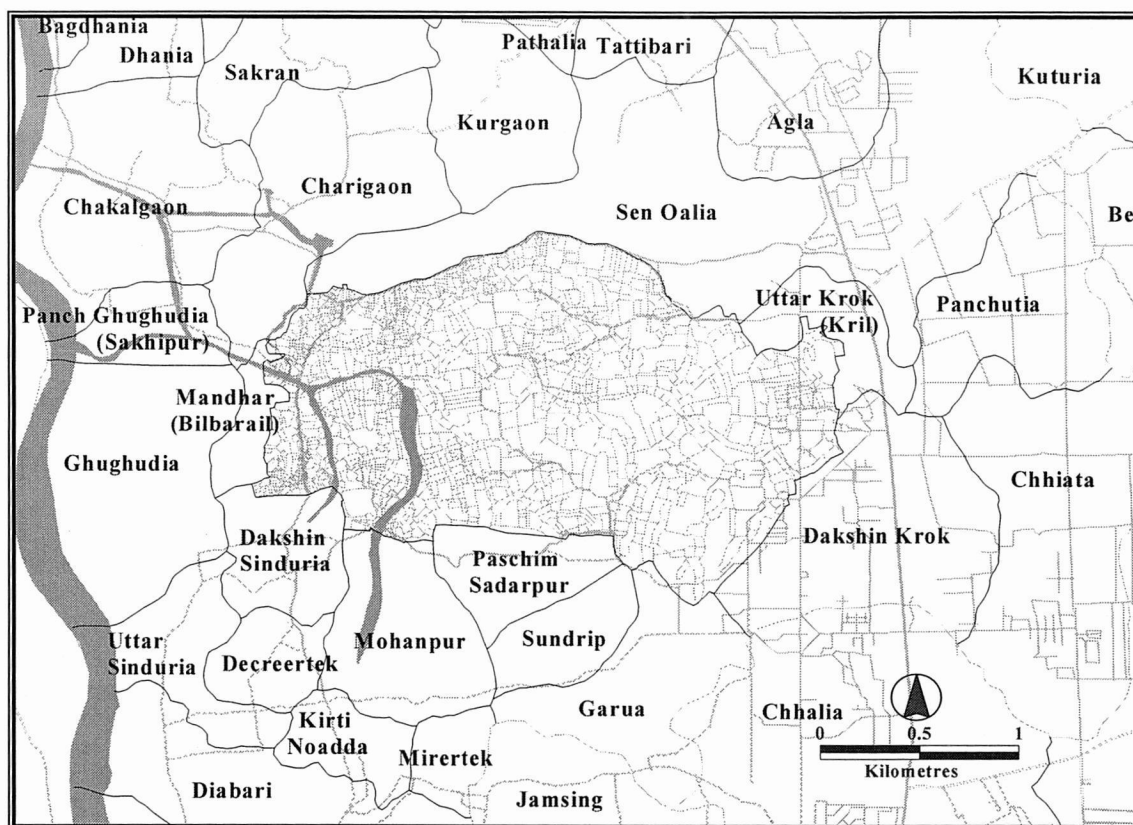


Figure 1: Bara Oalia with surrounding mauzas located between the University and Banshi River. The mauza shows plot boundaries, with the smaller and fragmented plots located in the western chars and bigger plots in the eastern chalas. The time of plot survey was the 1960s and at that time, the mauza's progress was influenced by the Banshi river as seen in the west. But in the east a lot of small road networks are visible; these are the phenomena of the recent decades. We can also see the different sizes and shapes of various neighbouring mauzas with their names.

4.2 Geo-corrections and Data Attributes

As there is no coordinate or graticule system in the mauza map, but without these parameters the use of automated mauza is impossible. Until the early 1980s, there were no way of understanding the location of a mauza in terms of graticule and grid. The following examples (Figures 1, 2, 3 and 4) are important to understand the basic outline of a GIS based automation outcomes. GPS can play a vital role to geocorrect the mauza maps, if local positions are surveyed accordingly. High resolution satellite image can add the contextual background of a mauza, if they are overlaid properly. Table - 2 shows the basic information of a mauza where all supporting and auxiliary information are

included. Detailed field survey of a mauza can help to map the boundary of the villages and paras located in the mauza. Moreover, information at plot level gives a very special weight of the land ownership datasets.

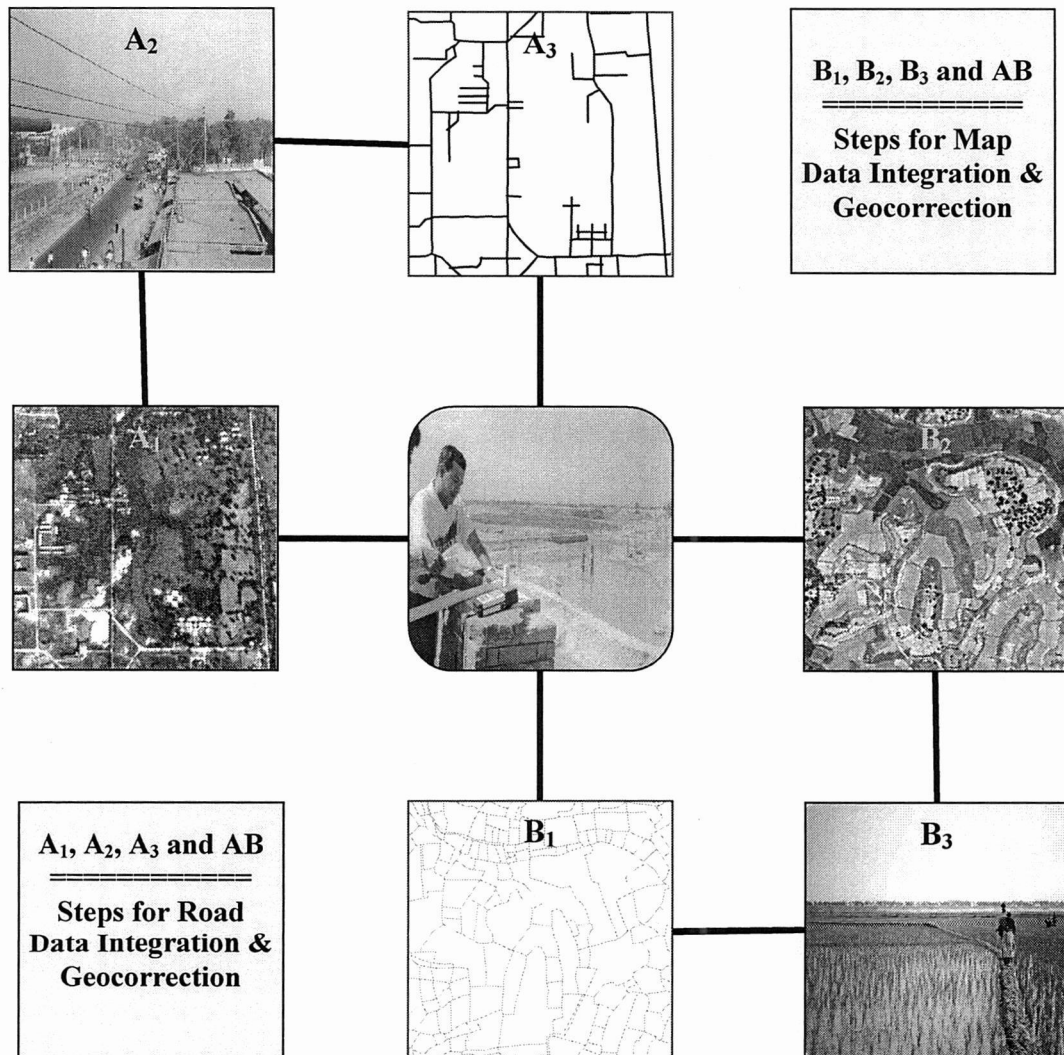


Figure 2: Major steps are followed for geo-correcting the mauza maps and prominent features like road with the help of Global Positioning Systems. Here A₂ and B₃ indicate the field investigation, A₁ and B₂ are the images used for identifying a particular feature, and B₁ is the mauza map of 1975 and A₃ is a road layout captured by the DGPS approaches shown in the AB frame. Group A is relevant to the Road Network positioning and Group B is responsible for mauza map geo-referencing.

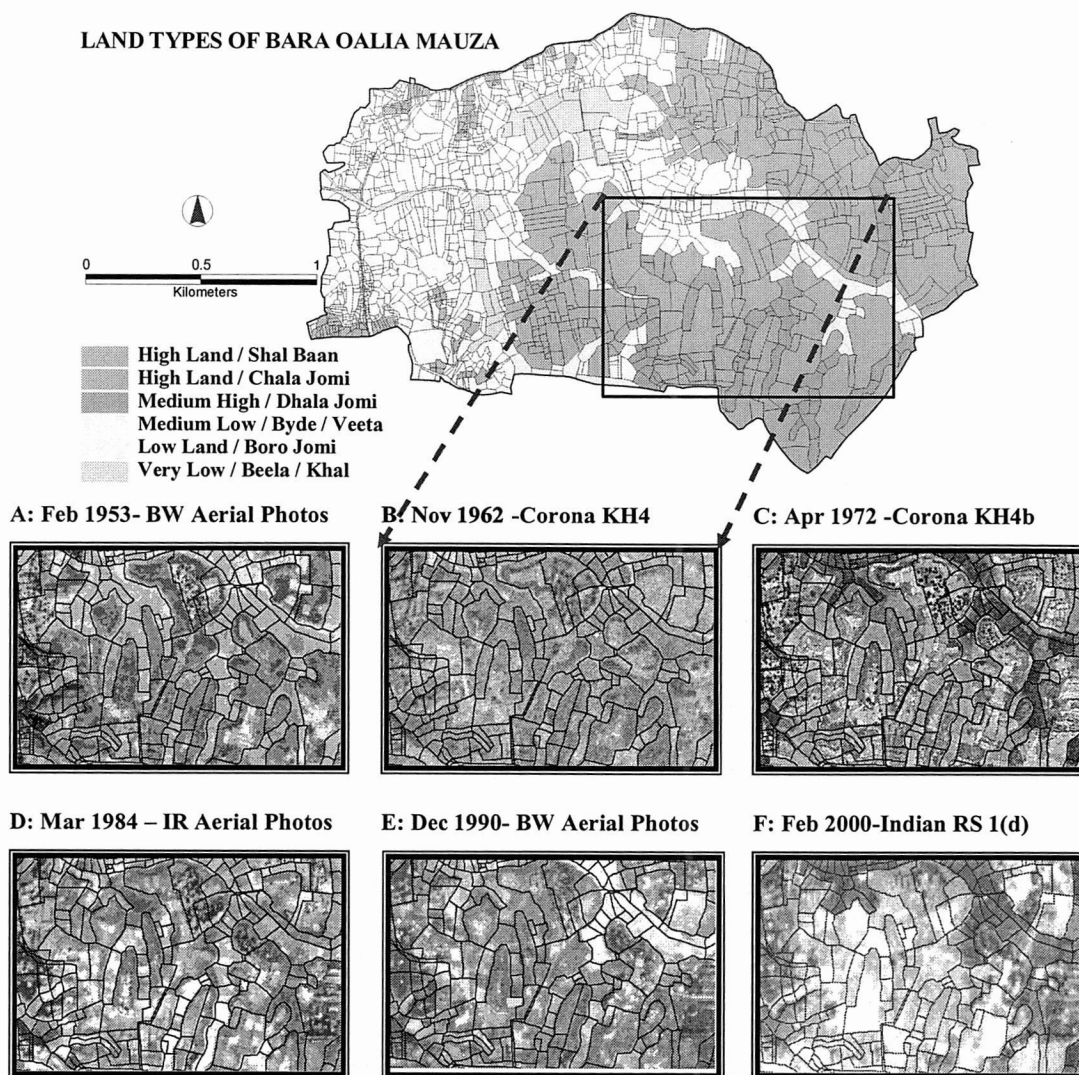
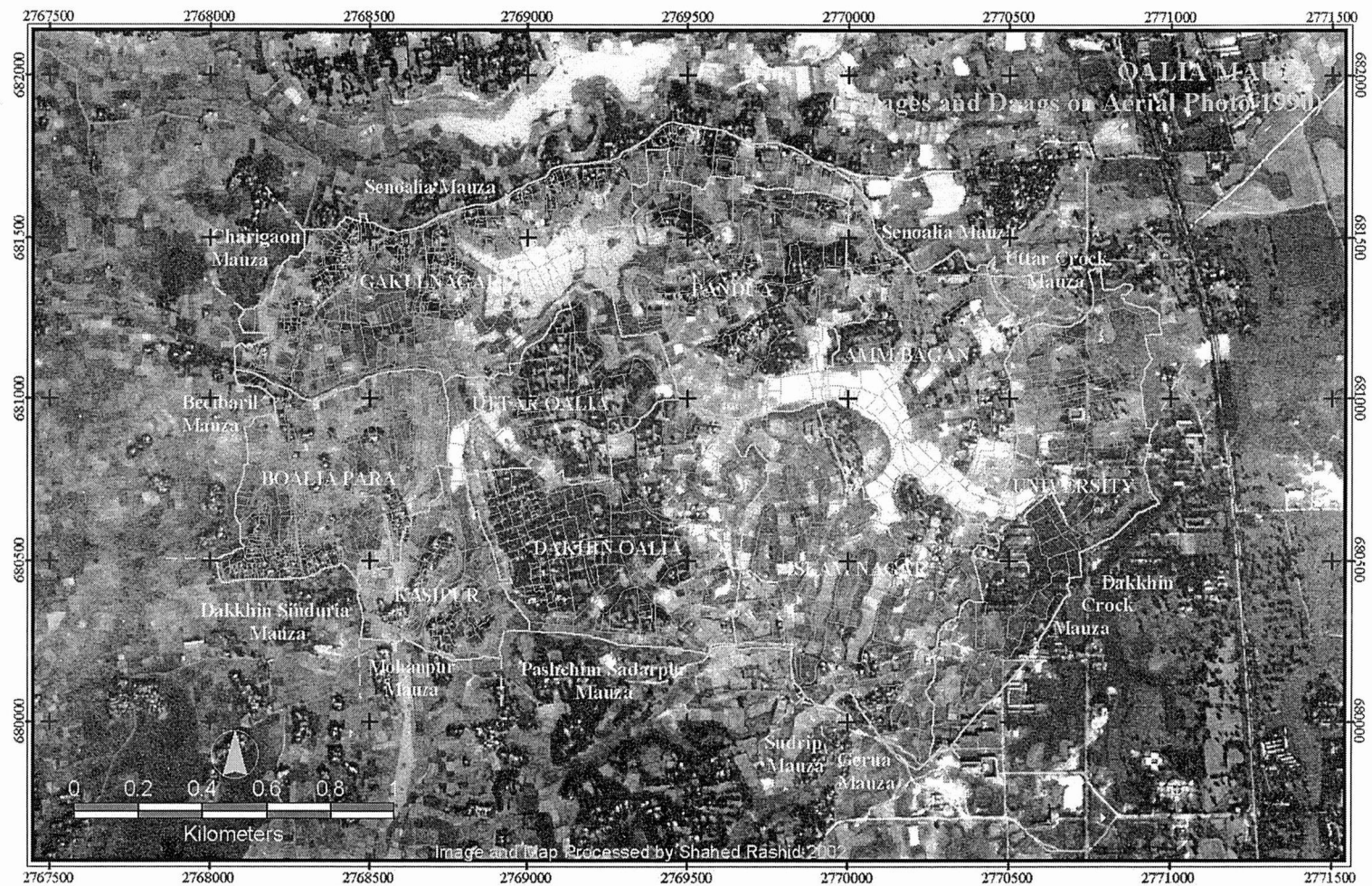


Figure 3: Vital features of land types, land use and land cover are straightforwardly identifiable using the interpretation chart of the remote sensing images for the plot level mauza maps; including their changes over time (reduction of resolution and distortion during printing do not show the actual representation of the images).

Table - 2: Statistical Summary for the Bara Oalia Mauza

Parameters	Data and Information		
Graticules	90.244006° E 90.273041° E 23.879119° N 23.899184° N		
LCC Grids in metres (m)	2,768,018m E to 2,770,974m E 679,849m N to 681,856m N		
Total Number of S.A /R.S Plots (State Acquisition/Revenue Survey)	1,547 (Known as <i>Haal Daag</i>)		
Total Number of C.S. Plots (Cadastral Survey)			
Total Area	3,737,846 metre ² or 3.737 km ² or 92,212.16 Decimal or 922.12 Acres		
Average plot size	2,416 square metre (59.61 Decimal)		
Adjacent Mauzas (clockwise direction)	Senoalia (North); Uttar Crock and Dakkhin Crock (East); Gerua, Sundrip, Pashchim Sadhapur, Mohanpur (South); Dakkhin Sinduria, Beelbaril and Charigaon (West).		
Villages of Bara Oalia Mauza (including area covered in percentage)	Amm Bagan (11%), Kasipur (5%), Boalia Para (9%), Pandua (12%), Dakkhin Oalia (13%), University (12%), Gokulnagar (17%), and Islam Nagar (14%), Uttar Oalia (7%)		
Total Population Data Based on Census Surveys (Excluding Jahangirnagar University Part)	1951=1,130, 1981=2,572, 1961=1,692, 1991=4,443, 1974=2076 (field-based) and 2001=6,553		
Land Types (including area covered in percentage)	Highland with 1951 Shaal Baan (26%) Highland without 1951 Shaal (22%) Medium highland (7%) Medium lowland (18%) Lowland (23%) Very lowland (4%)		
Total land values of Bara Oalia <i>Mauza</i> in Bangladeshi Currency <i>i.e.</i> in Taka (2002 exchange rate was Tk 90 per £1) and also shown the mauza's Land Price Index (base year 1951 = 1)	1951 1961 1974 1981 1991 2001	267,422 Tk. 664,495 Tk. 4,344,974 Tk. 15,220,830 Tk. 711,207,007 Tk. 3,369,674,485 Tk.	1 Tk = 1 Tk 1 Tk = 2½ Tk 1 Tk = 16 Tk 1 Tk = 57 Tk 1 Tk = 2,660 Tk 1 Tk = 12,601 Tk



Source: Fieldwork, 2001 and Integrated Aerial Photos, 1990

Figure 4: Bara Oalia Mauza on a 1990 aerial photo showing its villages and environs. The villagers helped to draw village boundaries from a CORONA image.

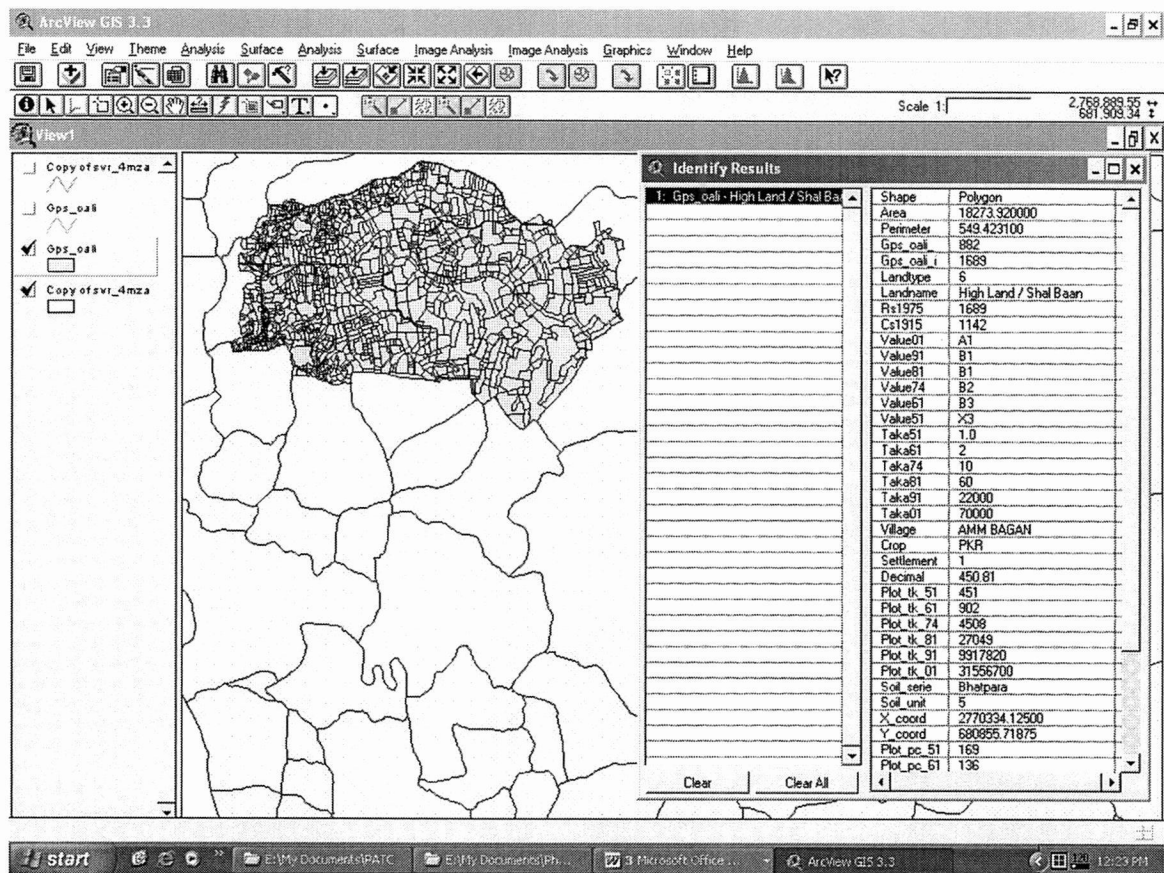


Figure 5: Using Arcview GIS Software, the basic information of a mauza have been illustrated to understand the overall context of a mauza and its relevant attributes. In the left part the information regarding GIS themes are shown; while in the middle part the map itself give a total view of the Bara Oalia mauza. In the right column, the attributes linked with a mauza map have been exemplified.

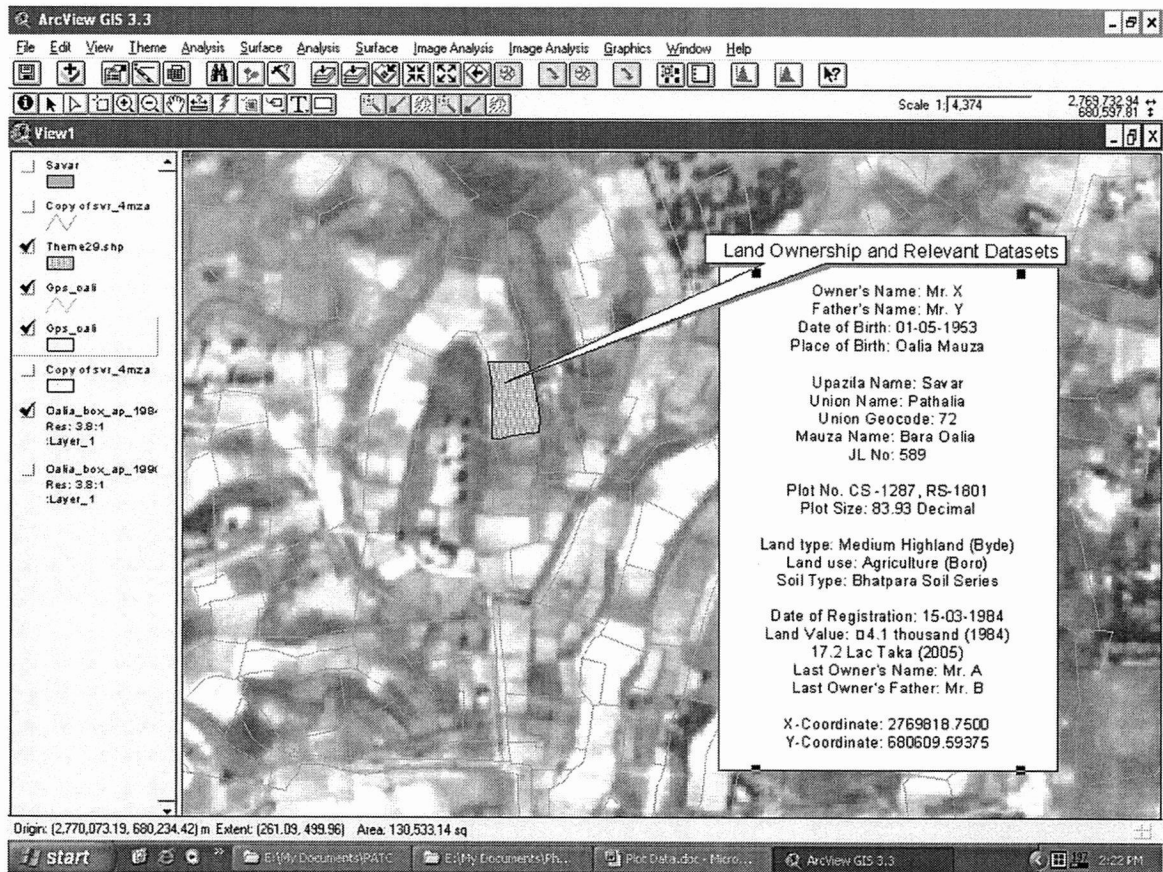


Figure 6: GIS and Remote Sensing data have been integrated in this image with a detailed statistics of a land owner. A single plot has been selected and a data link has been shown in a window box. This sort of information can immediately gives an instant and meaningful way of land ownership data management system.

4.3 Benefits of Plot based Land management system.

Indicative benefits of moving from the existing cadastre system to a proposed plot-based Land management in (GISLM) will be as follows:

1. Reduction of land related litigation and simplified and less expensive resolution;
2. Less duplication of effort in preparing and maintaining multiple ownership registers;
3. More efficient functioning of the property market;
4. Fairness and equity in revenue collection activities;

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5. Informed decision making in land and land related matters;
6. Improved use of land resource;
7. Improved property valuation – enabling land to be used as collateral to obtain bank loan;
8. Improved and accurate economic reporting leading to improved credit rating and cheaper international finance;
9. More investment in Bangladesh by multilateral companies;

Through implementation of the proposed Land management in GIS system in it's entirety, the GOB would be able to generate substantial amounts of money, not just from the fees earned from the operations of the land registry, but by other means, including:

1. Improved collection of LDT due to enhanced efficiency brought by full participation and a market based assessment;
2. Increased and more equitable stamp duty and transfer tax collection due to 100% participation in the registration/recording process and reduction of under valuation and associated fraudulent acts;
3. Informed decision making by the GOB in its dealing in land including acquisition and sale, purchase and rental;

Above all, the people's demand for a fair, reliable, authentic, transparent and accurate land ownership record system will be satisfied.

4.4 Field of Applications of Plot Based GISLM

The information that cadastral stores for each property are:

- The name, the date of birth and the address of land owner,
- The description of the location of the property,
- The number its parcels, the size and area of each parcel,
- The district where the property is located,

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- Additional information about the property like title number, name of cadastral agency, the nature of ground use and all the rights and restrictions.

According to Williamson (1997) who investigates on "the justification of cadastral systems in developing countries", the principal causes of the environmental degradation in the rural areas are:

- Inappropriate government policies,
- Migration and population growth,
- Clearing of forests,
- Modern farming technology and the development of the international markets.

The cadastral system is seen as a land information system affording information on real estate of a property. It improves the land management. The principal element of any modern cadastre is the digital cadastral map. The spatial objects of the digital cadastre can be property parcels, administrative districts, and plant zoning and civil networks. Digital cadastral map incorporated with GIS can be used in Cadastral map production, Soil survey, Civil engineering, Hydrological modeling, Sustainable development, Market analysis, Land resource management, Object based presentation and Digital terrain modeling.

Cadastral Use in Civil engineering:

Civil engineering activities that include road design, site planning of dams and open cast mining require DTM in order to accomplish the visibility analysis, the relief shadow analysis, the profile computation and the volumetric computation. All these activities include a set of data that can perform operations on digital cadastral map. Examples of such operations include combining layers to form new sites, classifying zones and choosing the appropriate site for civil projects. These projects refer to municipal planning and management activities such as school, political district, traffic analysis and managing

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of public facilities. This means that the government must use the digital cadastral map in order to find all aspects of legal situation of a piece of land, though it seems to be expensive. The use of cadastral systemic in civil engineering will be very much effective for Bangladesh.

Soil survey:

The digital cadastral map also serves the purpose of gathering soil data for performing studies on experimental agricultural farms. The soil data survey includes qualitative description such as texture class, color, geological formation, and legal information about every piece of land and landowner. They, in addition, include quantitative description such as porosity, thickness, soil profiles, and the surface of the area studied. This can be used for agricultural planning in Bangladesh.

Hydrological modeling:

The hydrological modeling is used to study water resource management and pollution control. It starts with studying the discharge of rainwater, ground water discharge, storage, filtration and evaporation. The data obtained from DTM and soil survey overlaid with cadastral layer and legal information in a digital cadastral map enable us to determine new aspects of land uses. This can be very effective in respect of Bangladesh.

Land resource management:

Bangladesh is experiencing progressive imbalance of man-land ratio and it is a constant threat. Population pressure on the rural homestead increase has already reached the saturation level. Urban sprints and expansion of unplanned settlement engulfs agriculture or forest acreage. The result being a super chaotic uneconomic land use pattern. Land is a limited resource and for Bangladesh it is very scarce. Land is the most fundamental of natural resources. Its particular use and management affect: -

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- The quantity and quality of production and employment associated with land both directly and indirectly.
- The degree of pollution/degradation of not only land but also water and air
- The integrity of the biological systems upon which human life depends
- The preservation of open space and
- The customs, character and way of life of communication and individuals.

When one deals with the land matter he has to address everybody who has landed property. Improper dealing with the matters relating to land creates lots of social and economic problems. For a better land survey system transparency and accountability should be ensured. To address the issue of proper reforms of land survey system through a modern technology is required because modernizing the land record system through computerized will give transparency and accountability.

Proper land management is a prerequisite for overall development in a developing country like Bangladesh. Like many other things we have inherited the system from the British colonial administration. Much has been said about the modernization of land management system in Bangladesh but hardly anything tangible has been done. A modern land information system will surely lead to a better and more effective land administration management in Bangladesh.

For proper land management of Bangladesh digital cadastral map with integrating natural resources is very essential. The result consists of attribute data such as land ownership and graphical data such as roads, building or public institutions that are linked through unique identifiers assigned to spatial units such as land parcels. Then the cadastral map facilitates in a systematic manner the collection and storage of data related to land resources. It defines where dangers can be caused by natural phenomena and where certain managements are permitted or forbidden. The aim is to regulate land use and environment protection and construction laws. By the use of cadastral system the following major themes of land management in Bangladesh context can be archived:

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- Processes relating to change in land titles, such as land records preparation and updating, land transfer registration, land mutation, etc.
- Land based dispute adjudication/resolution
- Management of state land and water resources consisting of distributable/leasable resources, such as agricultural and non-agricultural land, water bodies, hatts and bazar, minor minerals etc. and non-distributable/non-leasable common property resource such as grazing land, forestland pathway, open water bodies
- Government intervention in land use through regulation, direct participation, taxation, consolidation and acquisition for development purpose.
- Land revenue/Tax and other sources of land –based revenues
- Land management organizational setup and its vertical and horizontal linkages and
- People’s participation in land management, particularly through the involvement of NGOs, peasant association, local government bodies etc.

Market Analysis

Marketing leads with determining potential customers, reaching customers and maximizing sales through distribution channels (Beaumont, 1991). The important need of a digital cadastral map in market analysis is derived from the dynamic nature of the demand and supply of products and services. In digital cadastral maps, are located buildings, areas and owners, thus cadastral system can forecast various locations for competing stores, pricing and product performances of customers. On the other hand, the customary rights can be documented on a digital cadastral map because it documents all aspects of land.

Sustainable Development

The principal objects of a digital cadastral map are property parcels, resource polygons, road and utility networks, topographic data, and census and electoral polygons. Then the creation, retrieval, and maintenance of these spatial objects are the fundamental to modern cadastral information system. The types of spatial objects that require maintenance are location, spatial extent, and attribute data such as ownership and land parcels. Therefore integrity of data should be maintained at every time an update is performed. If the size of a land parcel is changed, it would be necessary to change all attribute data that are affected by this change. The digital cadastral map enables users to issue data retrieval as well as requests visually because it permits a systematic way to store and to retrieve multiple values for the attribute data for a specific land parcel.

Urban Planning:

Digital cadastral map can be used in Urban Planning in cooperation with GIS. The development of GIS is increased gradually. The importance of GIS increased in the field of land management and natural resource management. Recently in our country the use of GIS/LIS (Land Information System) has introduced. Every country in this competitive world wants to achieve development and for this development proper planning is necessary. For the prosperity of a country there need coordination between planning and development. For a sustainable and durable urban development and planning development digital cadastral map and GIS can be a dependable tool. The following figure- 7 illustrates the usage of GIS for LIS and the figure 8 illustrate how cadastral data and GIS can be used for urban palling.

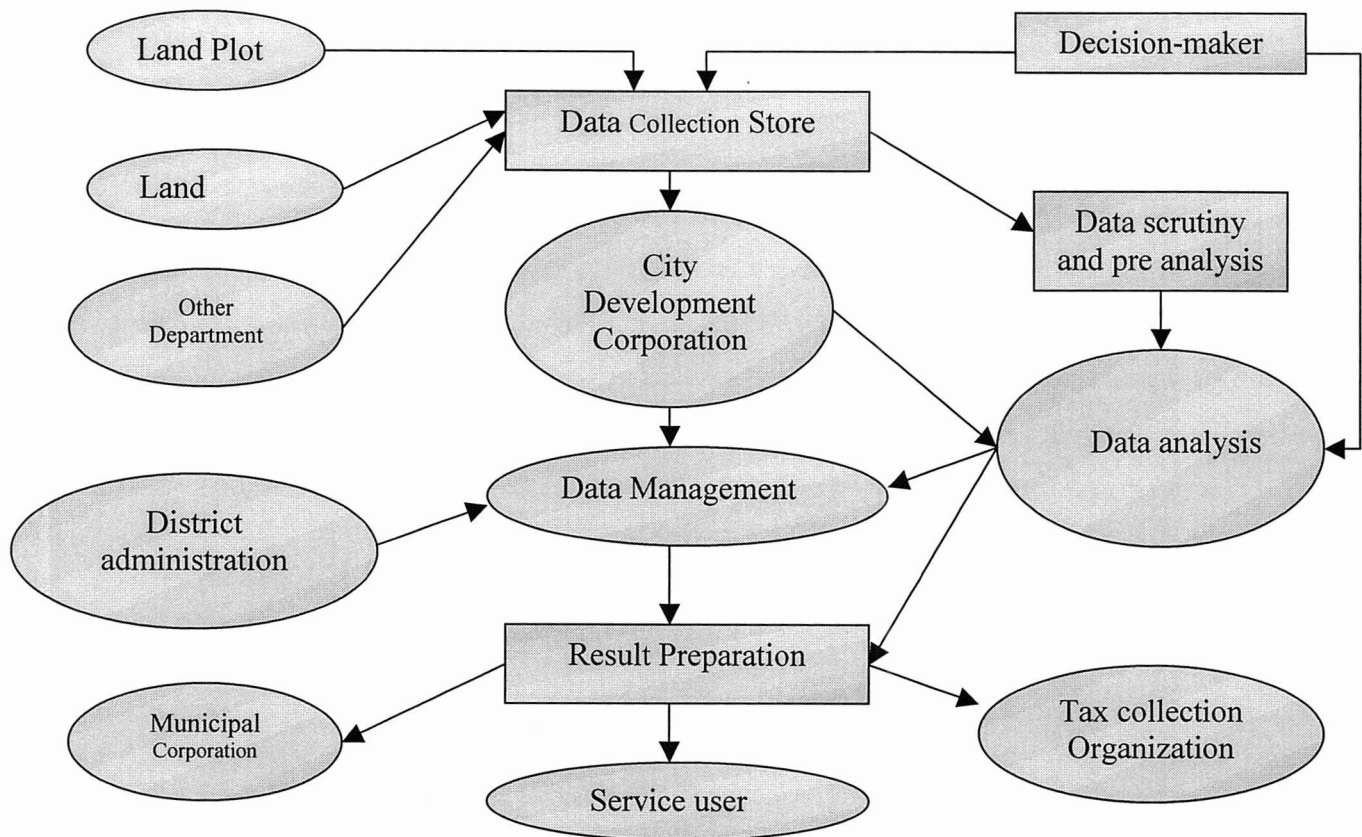


Figure 7: The use of GIS and LIS

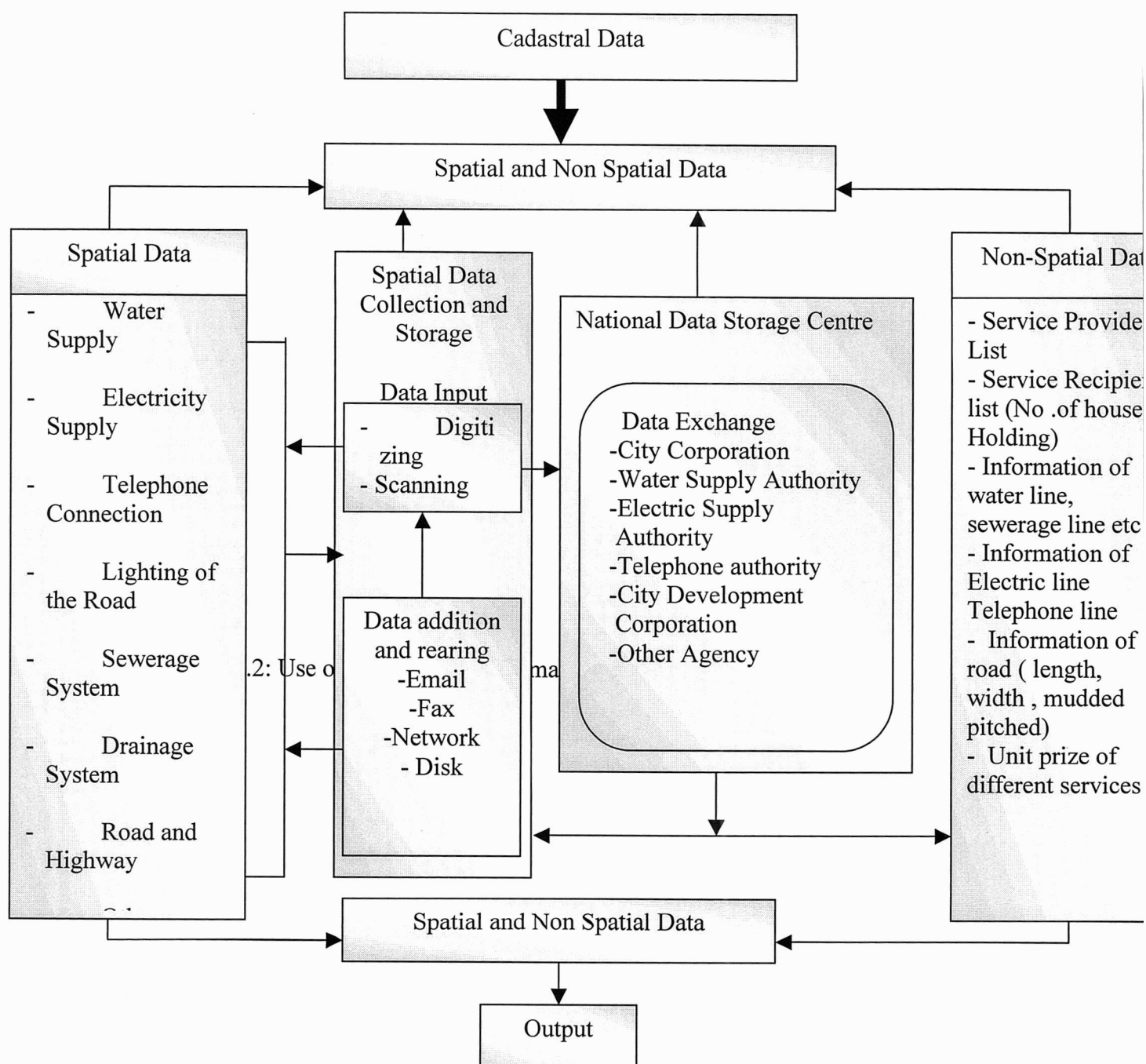


Figure 8: The use of LIS and GIS for Urban Management and Planning

Chapter - V: Concluding Remarks

5.1 Conclusion

Recently, the government of Bangladesh has become increasingly aware of deficiencies in their cadastral systems. It wants to take advantage of the new technology based on computerized information system in order to enhance the manner of working and to upgrade the skills of personnel.

The cadastral Information System can collect, process, analyze and edit the spatial information. It improves the management of natural resources and promotes an efficient production in sustainable manner. The major effect of this new system is the protection of land use rights and the establishment of security of tenure for users. For this the fundamental elements for the expansion will be cadastral mapping and cadastral registration.

A Cadastral Information System (CIS), which based on digital cadastral map can produce map and map data on cadastral unit are stored in the same database. The CIS supports not only the cadastral mapping or the land surveying and titling but also a variety of purposes such as identifying specific areas, determining limits of different status of land, sustainable development, social stability, land management and agricultural studies. The traditional cadastral system that is being used still in Bangladesh has the following limitations:

- It rarely delivers the solutions that managers want,
- It requires specialized personnel for analysis, design, programming, testing and
- It's very difficult to execute as described,
- It's taking too long time for maintaining

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The digital cadastral can reduce the barriers of the present cadastral system of Bangladesh. Compared with existing cadastral systems, the cadastral information system based on digital cadastral maps gives an overview of its uses and solutions. The CIS can be expanded to serve the purpose of sustainable development. Under these assumptions, the governments of Bangladesh may conduct various projects related to land planning and management. The CIS is the safe manner to integrate all projects in a same system. This has the advantage of being easily designed and implemented and incorporating the existing data because the model data will be formulated in a digital format.

The results of the project are the identification of the problems for which the Bangladesh Cadastre has not developed significantly; The identification of potential causes of development for the Bangladesh Cadastre; an understanding of key institutional arrangements that have proved efficient for implementation, updating the cadastre system; The streamlining and strengthening the information basis of land transactions, Reduce corruption associated with the process of land acquisition, Reduce public suffering which arises from the archaic and dysfunctional land administration process, Cut out much criminal and civil cases in the courts most of which originate in land disputes fostered by tempered or outdated land records, use the cadastre data for spatial planning and help in government distribution of land, water right, forest right and land use policy; e computerize land management system; The Multi-layered maps from stored data. Topological, political, sectoral and other kinds of maps may be produced and it will help in quick decision for any development purpose. Transparent map sheet can be produced and can be supplied on demand with a very short time; it will act as an evidence of right in land, proper assessment and collection of land revenues, minimize the land disputes, criminal and civil litigations, help prepare proper land use plan, help implement the land reforms measures.

These results may be applied to promote cadastral development in Bangladesh and, in a hypothetical scenario of future development, provide a basis for solutions for the more technical problems, such as definition of the data content of cadastre, model for an

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efficient updating system, strategies to motivate partners in the updating system, strategies to attract users/clients, future means of financing, and coordination with the Land Registry and Fiscal Registry. These results may also help to understand the situation of other developing countries where cadastral development has been encountering difficulties. A trained and skilled manpower is needed for the modern cadastre. The outcomes of this research may be used to train the people of the Directorate of Land Record and Survey. Due to introduced modern cadastre data protection law should be made and existing land laws are to be arranged as per requirements of the new change. This research can help for that.

The Article 42(1) of the Constitution of the People's Republic of Bangladesh has entrusted the GOB with the responsibility of protecting land ownership right of each and every citizen of the country, but the title and ownership of the land owners of this country are not yet protected. The courts are now over-burdened with the cases rooted from the disputes over the ownership of land. Peoples are frustrated with the present system of land administration. As political consensus, technology and good will that is required to change and bring a new system are there; one may hope that the present elected government of Bangladesh will move towards Authentic Land Ownership Documents-driven land record system in order to surely make land administration of Bangladesh in the 21st century accountable, responsive and transparent.

5.2 Recommendations

GIS based land management is required to be designed to address the misery of the landowners. As it is completely a new concept, strong political will and consensus among the major political parties must be there for successful implementation of this new concept. It is encouraging that there exists a political consensus for modernization of land administration in Bangladesh.

GIS based land management is entirely a state-of-the art process. There is no operational experience and no established practices. So, responsiveness of the management in solving issues timely and in consistent manner will be very much necessary for smooth

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functioning of the preparation process of Spatio-soft data bank. For this, an appropriate organizational structure needs to be developed under the legal coverage of the law to be enacted in the Parliament. The organizational structure should facilitate functioning of a well coordinated and transparent land record administration.

Successful implementation of the GIS based land management (GISLM) process will depend, among others, on the degree of commitment and level of skill of the workforce who will work in the process. So, the workforce who will be engaged to carry out the given functions in the implementation process must be dedicated and skilled.

The workforce who will work in the process should be properly trained and equipped so that they can facilitate the efficient introduction of GIS based land management through the transition phase and beyond. Training should be in all levels including informal and on-the-job training. Training component should be comprehensive so that it can give effect to the skills requirements of the introduction of GIS.

A comprehensive public awareness campaign should be made for community acceptance. Relevant information should be made available at all levels. The campaign should target all potential land holders and it be made through the television, film, radio, printing media, community meetings, etc. Operational benefits that GISLM will generate for the land owners/holders should be communicated to them so that they feel encouraged to participate in the process. While formulating campaign program, it should be kept in view that the more people know the system, the less they distrust.

Appropriate technology should be applied for smooth and successful implementation of the proposed new system of land record. To make the process speedy and to maintain accuracy in the prepared record digital technology will be better option.

For processing survey and mapping data (spatial data) and gathering ownership and other relevant data (textual data) in connection with land plot and Land Administration Management System (Software prototype system) LAMS database can hold the legal

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Land Record from which Certificate of Land Ownership will be issued. The system should be designed and built in such a manner that security safeguard remains in-built in it can record and update all future land transactions and dealings for each land plot.

The people of this country are habituated to the old system. They have no idea about the new system. They do not know what outcome the new system will bring for them and how. So, at the beginning of the transition process, the proposed system may be implemented phase by phase, preferably on a pilot basis. With the process when people will be fully aware of the benefits of the new system, technology including software will be updated and customized and the landowners will be confident enough about the new system, then and only then new system may be put into operation at a large scale.

Strong political will and consensus among the major political parties must be there for successful implementation of this new concept GISLM. It is encouraging that there exists a political consensus for modernization of land administration in Bangladesh.

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