

**THE DESIGN OF A  
RE-ENGINEERING  
FRAMEWORK FOR LAND  
INFORMATION  
MANAGEMENT  
IN JAMAICA**

**M. D. SUTHERLAND**

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## PREFACE

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**THE DESIGN OF A RE-ENGINEERING  
FRAMEWORK FOR LAND INFORMATION  
MANAGEMENT IN JAMAICA:  
A Response to Contemporary Land-Related  
Objectives**

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## PREFACE

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## **Abstract**

Jamaica is the third largest island in the Caribbean basin with an area of approximately 4411 square miles (2.7 million acres) supporting a population currently estimated at approximately 2.4 million (expected to reach 3 million by the year 2000). This, along with industrial and commercial expansion, has resulted in an intense competition for land, urban sprawl, urban blight, crime, scattered development, inefficient use of space, and the inadequate provision of housing and community [Government of Jamaica, 1994b].

The need for the implementation of land related policies to solve these problems is evident. Timely, up-to-date, accurate, complete and comprehensive land information is needed to support these policies. To obtain this information, the Government of Jamaica (GOJ) depends on its departments and agencies that manage land information. Over the years, however, GOJ has periodically experienced great difficulty in obtaining the information it needs from these organizations. The Jamaican public has also had the same difficulty in obtaining necessary land information.

GOJ is aware of the problems and has implemented a number of projects and programs to address them. Also, looking into the future of its land information management (LIM), GOJ has formulated some LIM objectives that it has targeted for realization by the year 2000. To date objectives remain as statements, i.e. GOJ has declared the direction in which it wants to go, but not how it is going to get there.

This thesis is designed to give GOJ a framework within which to achieve its LIM objectives: the design of a model to re-engineer LIM in Jamaica. The model is based on the concept that GOJ's land information system (LIS), which is comprised of the human and technical resources, and the organizing procedures of all its LIM organizations, must be made efficient in order for GOJ to achieve its stated LIM objectives.

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# CHAPTER 1

## INTRODUCTION

*Every society has an irreversible history, a historically determined present, and a future. The future, like the present and the past before it, is determined by the outcome of individual and collective human action within the historically given social reality; and of course the independent evolution of the natural environment.*

[Beckford and Witter, 1980]

### **Introduction**

A land information system (LIS) has been defined as a combination of human and technical resources, together with a set of organizing procedures, which results in the collection, storage, retrieval, dissemination and use of land data in a systematic fashion [McLaughlin, 1983]. A LIS facilitates land information management (LIM) in an environment of users, sources and other systems [Nichols, 1993]. LIM is concerned with decisions made regarding the effective use of land information to achieve an objective or a set of objectives [Dale and McLaughlin, 1988].

The Government of Jamaica (GOJ), in the pursuit of the achievement of its own set of objectives that depend on land information, has often found that its LISs were not efficiently delivering land information in the timely, accurate, up-to-date and complete manner that was required for it to effectively implement its land related policies [Government of Jamaica, 1994b]. An investigation into Jamaica's human and technical resources, organizing procedures, and environment of users and systems that form its LIS reveals why these land information related problems exist and sets the stage for the focus of this thesis: the re-engineering of LIM in Jamaica.

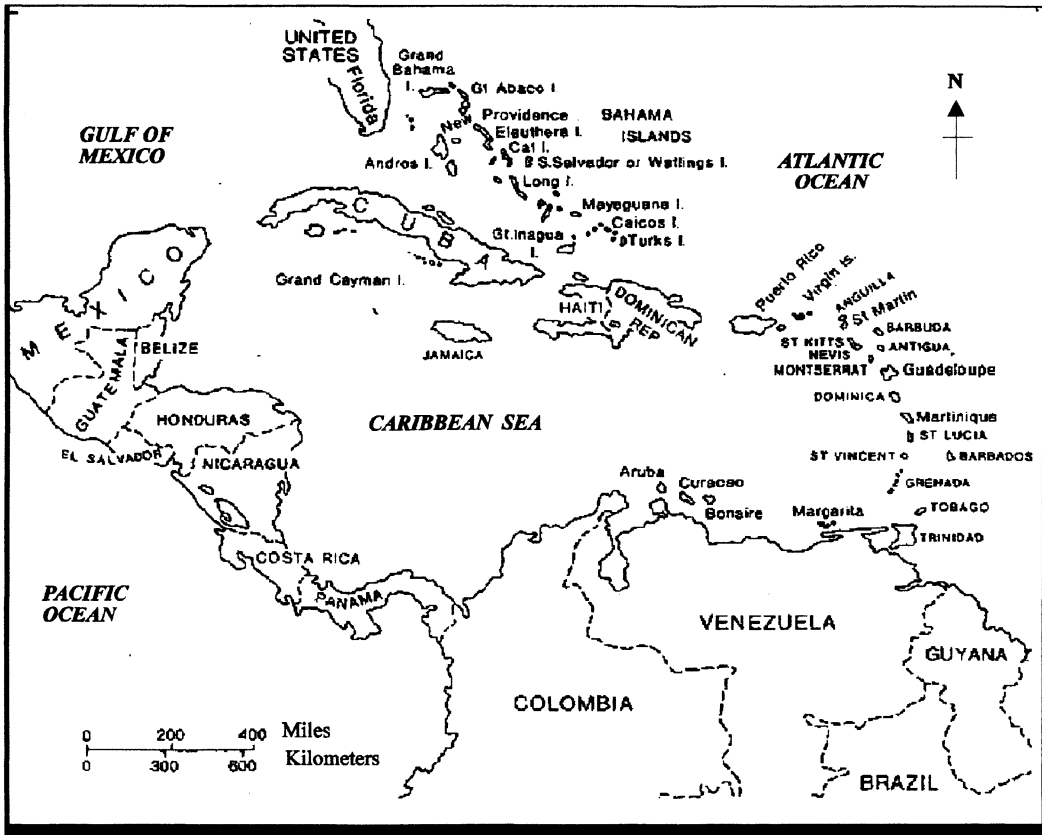
The following sections covering the geography of Jamaica, the population impact on its land management, and associated land information management problems, are designed to introduce the reader to Jamaica, to slowly expose the LIM problems and to

define the arena in which to apply solutions. It is at that point that the scope and objectives of this thesis will be revealed along with the methodology employed in designing a solution to the island's LIM problems.

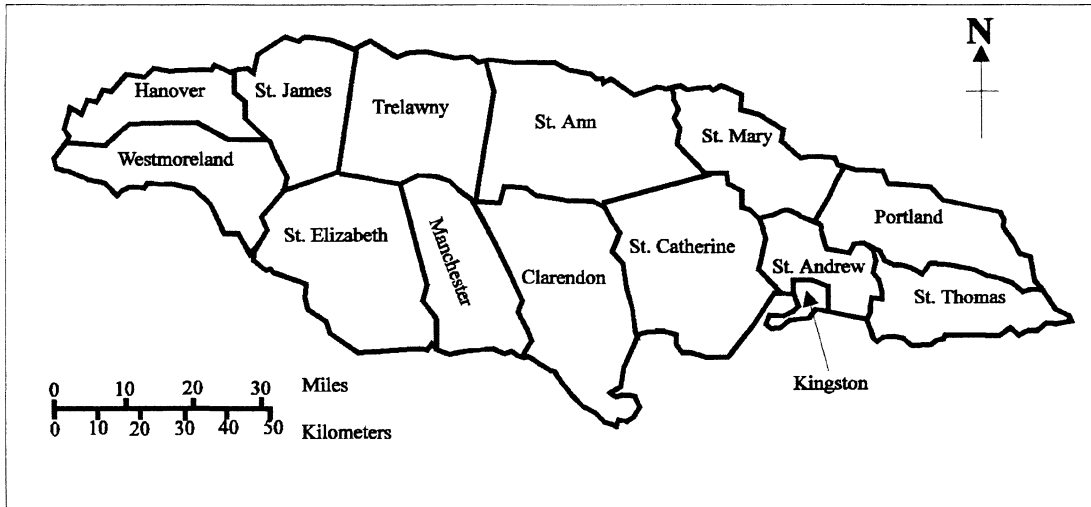
## **1.1 Geography of Jamaica**

Jamaica, the third largest island in the Caribbean basin, is situated approximately 90 miles south of Cuba and a little more than 100 miles west of Haiti [Figure 1.1]. The island has an area of approximately 4411 square miles (2.7 million acres), measuring 146 miles from east to west and 51 miles from north to south at its widest points. Like all the other islands in the region Jamaica is the outcrop of a submerged mountain range. Blue Mountain Peak, at the eastern end of the island, rises to a height of 7402 feet above sea level and is the highest point on the island. The climate is described as maritime tropical and the island experiences an annual average temperature of 80°F [Trade and Travel Publications, 1992].

Jamaica is divided into fourteen parishes with the smallest parish and capital being Kingston [Figure 1.2]. The other parishes are Saint Catherine, Clarendon, Manchester, Saint Elizabeth, Westmoreland, Hanover, Saint James, Saint Ann, Saint Mary, Portland, Saint Thomas and Saint Andrew. Kingston and Saint Andrew have been administratively joined into what is now known as the Corporate Area. The island is also divided into three counties: Cornwall, Middlesex and Surrey. The Government of Jamaica (GOJ) is structured after the Westminster model with local government authorities, a House of Representatives, a Senate and a "Cabinet with Ministerial officials operating on the twin principles of collective and ministerial responsibilities" [Nettleford, 1970]. The British monarch, represented locally by a Governor General, is currently the head of State. A Prime Minister heads the parliamentary executive.



*Figure 1.1*  
*The Caribbean Area*



*Figure 1.2*  
*The parishes of Jamaica*

Land is a limited natural resource which cannot be easily increased, at least at low cost [Kituuka, 1983]. In Jamaica it is a very expensive commodity. The Government is aware that land is a finite resource which must be treated as a national asset and used for the sustainable development of the country. Studies have revealed that 80 percent of Government's administrative decisions are related to, or impact on, land in one form or another. Research into such issues as agriculture, settlement patterns, industry, mining, forestry, coastal areas and fishery, conservation and recreation has revealed the need for rational land use that depends on effective land management, and national development supported by reliable land information, effective management structures, appropriate legislation, and development control [Government of Jamaica, 1994b].

Agriculture is not achieving its full potential in satisfying local consumption or export demands. Human settlements need to develop in an orderly manner so that the desired amenities can be provided. Industrial use of land needs to be made efficient in conjunction with protection of the environment. Mining is an important national income generator and should be beneficially exploited while not allowed to negatively impact on the environment. Forest areas need to be developed and maintained in relation to policies of sustainable development. The fishing industry is an area that is under-exploited and in need of development. Demands on land to provide the basic socio-economic amenities must be balanced with the need to preserve and conserve the environment, and so provide for Jamaicans a "balanced and satisfying way of life" [Government of Jamaica, 1994b].

## **1.2 Land Related Laws**

Jamaica has a great number of laws that impact upon land in many ways. These laws are the legal mechanisms through which the society interacts with the land in terms of land use, natural resources conservation, real property transactions, taxation, physical

infrastructural development, disaster mitigation and management, housing, and mining among other things. Some of these laws include the:

- a. *Beach Control Act* [1956].
- b. *Bauxite (Production) Levy Act* [1978].
- c. *Crown Property (Vesting) Act* [1960].
- d. *Conveyancing Act* [1889].
- e. *Disaster Preparedness and Emergency Management Act* [1993].
- f. *Forest Act* [1938].
- g. *Facilities for Titles Act* [1955].
- h. *Housing Act* [1968].
- i. *Land Acquisition Act* [1947].
- j. *Land Authorities Act* [1951].
- k. *Land Development and Utilization Commission Act* [1966].
- l. *Land Surveyors Act* [1944].
- m. *Land Taxation Relief Act* [1959].
- n. *Land Valuation Act* [1957].
- o. *Local Improvement Act* [1914].
- p. *Mining Act* [1947].
- q. *Natural Resources Conservation Authority Act* [1991].
- r. *Registration of Titles Act* [1889].
- s. *Registration (Strata Titles) Act* [1969].
- t. *Restrictive Covenants Act*
- u. *Town and Country Planning Act* [1958].
- v. *Urban Development Corporation Act* [1968].
- w. *Water Resources Act* [1994].
- x. *Watersheds Protection Act* [1964].
- y. *Wildlife Protection Act* [1964].



### 1.3 The Population's Effects on Land Information Management

The current population is estimated at approximately 2.4 million with approximately 90% being of West African origin, while the remaining 10% is comprised of Chinese, East Indian, Christian Arab, British and other European Minorities [Trade and Travel Publications, 1992]. Holzberg [1987] describes the general socio-economic relationship among the races by saying:

*Most apparent is the fact that color correlates with social class. The "blacks" (Afro-elements) and others of dark complexion (East Indians) constitute the majority of the lowest economic stratum, while the "whites" make up the majority of the highest economic stratum.*

In the following quotation Holzberg [1987] gives the reason for the stratification:

*The dominance of the white minority is attributed to the historical impact of colonialism, slavery, and plantation society, when the interests of the black majority were subordinated to those of the white minority. This subordination came about not only because of the commercial success of the white owned sugar plantations, but also because the whites had the political support of the colonial government, the protective weight of military force, and the "grace of God."*

Supported by Government incentives that promote capital intensive industry, production for export, and foreign investment, the whites are a powerful interest group that has "successfully translated their economic power into political favors" [Holzberg, 1987].

After the Second World War, "significant participation in business by groups such as Chinese, Syrians, Jews, browns and a few blacks ... has eroded the business monopoly of the small group of whites who inherited property and wealth in the plantation system" [Stone, 1973]. The majority of the blacks however remained at the bottom of the economic scale, having access to higher education and upward mobility blocked by their low economic station. Even today the majority of the blacks, although the racial majority, remain at the bottom of the economic scale, bearing out the general transmission of economic status of families from generation to generation as explained by Cumpster [n.d.]:

*... the son of a wealthy man finds it easier to enter those occupations which need more money capital than does the son of a poor man, and the son of an educated man finds it easier to acquire an education than does the son of an illiterate. A family, therefore, tends to remain on one social level from one generation to another, rather than rising or falling according to the innate ability of its members.*

In the 1970s Stone [1974] estimated the level of functional illiteracy to be about 50 percent of the adult population. The relevance of this will be made clearer when the joint historical development of Jamaica's socio-political and socio-economic effects on land tenure, land use and land management is discussed in Chapter 2.

Social reform instituted in the 1970s, including land reform and free education to university level, attempted to address the situation [Holzberg, 1987]. Land reform has had limited success due to the economic constraints of the poor, extensive competition for finite land, and inefficient administration of the land reform programs. Free education opened the door to academic and economic development for the majority of the population, but low remuneration in Jamaica which caused the flight of the educated to the greener grass of developed countries has negated much of the benefits. Recently the free education policy has been discontinued because the Government is not able to continue the subsidy, but as the poverty of the majority of the population continues unabated this has a number of implications on the society as a whole. Jamaica's land management and land information management have been affected, as will be shown in the following paragraphs.

Population growth is rarely static, and in Jamaica the growth is positive, estimated to reach 3 million by the year 2000. A projection of a person/land ratio of 1:1 acre is expected to be reached by the year 1998. This, along with industrial and commercial expansion, has resulted in an intense competition for land. Urban sprawl, urban blight, crime, scattered development, inefficient use of space, and the inadequate provision of housing and community facilities have resulted as a consequence [Government of Jamaica,

1994b]. Furthermore, there may be as many as 600,000 persons, approximately 26 percent of the population, who are currently squatting on public and private lands [Robinson, 1994]. This is an indication of the extent of the landlessness which continues to exist. Those without property in land are generally the source of land misuse, scattered development, discontent and crime. Eckholm [1979] states:

*Lacking more prudent means of making a livelihood [sic], land-hungry farmers clear forests that are badly needed for ecological protection or wood production. Hilly watershed areas are denuded and farmed until topsoil washes away; downstream, water flows are disrupted, flooding worsens, and rising silt loads clogs waterways.*

From this it can be observed that poverty of the masses directly affects Jamaica's need for land management, resource conservation and development, and a secure way of life.

If education is not free, or economically accessible, and the majority of the population is poor, then the general level of education of the populace can be expected to be low. Since the population is the source of the employment pool, this impacts on the quality of the labor force. This affects every organization that depends on the available employment pool to construct its work force. The flight of the educated to richer nations only serves to worsen the situation. The remaining qualified personnel tend to gravitate towards the private sector because of the higher levels of remuneration. This leaves the public sector with a work force of generally lesser levels of education [Government of Jamaica, 1994b].

It is estimated that the Government of Jamaica owns over 50,000 parcels of land comprising approximately 405,000 hectares [Satchell, 1990] held by more than 20 entities, making it the largest owner of real property in Jamaica. Furthermore, there may exist as many as 60 Government ministries, departments and agencies which deal with land related matters [Government of Jamaica, 1994b]. These facts also make the Government the manager of most of the land information in Jamaica.

As the Government of Jamaica becomes aware of the use of modern computer technology in all areas of information management, much digital equipment and software has been, and is being, purchased by the Government in an effort to solve its land information management problems. However, a certain level of education is required to effectively manage digital technology, and this is where the low level of the population's education and their lack of specialized training affects the quality of Jamaica's land information systems and therefore its land information management. This situation is further aggravated by the fact that the very low levels of remuneration in Government agencies, inadequate organizational structures, and a bureaucracy which tends to award promotion on the basis of years of service, prevent the recruitment or retaining of better qualified personnel.

#### **1.4 The General State of Current Land Information Management**

Before 1987 there was not a coherent policy or vision regarding a national LIS. The result was that over the years the land data resources of the island's land information organizations developed in isolation. Organizations tended to be guilty of wanting their own independent solutions resulting in a lot of duplication of effort and unnecessary expenditure [Manley, 1994]. Many organizations have had their procedures automated with the help of international funding agencies like the United Nations Development Programme (UNDP), International Development Bank, Inter-American Development Bank (IADB) and Canadian International Development Agency (CIDA) among others. For Jamaica this is a natural tendency since as a developing country with very limited resources it cannot by itself fund most, if any, of these projects.

With no national vision communicated to these funding agencies, which normally supply consultants as well, a multitude of isolated, project-oriented hardware and software

solutions were implemented together with sometimes incompatible data structures and various standards for referencing land data. The main problem with this situation is the inability to share data needed to formulate and implement national land policies.

Manual management of land information normally involves the storage, processing, retrieval and dissemination of land data from and through the media of paper folders and bound books. The manual systems of many of Jamaica's land information organizations are decades old, inefficient and poorly kept [Clarke et al., 1994] making the retrieval of summary data a laborious and sometimes impossible task. The Government is, at times, hard pressed to know the total extent of its land resources. A high staff turnover rate, understaffing, unqualified staff, and inadequate storage space negatively affect the situation. Automation would solve some problems but reorganization and staff retention would also help in the interim.

Since 1988 various land titling projects have been undertaken which have positively affected, to some degree, organizational structures, staff recruitment and training, automation of some processes due to the acquisition of digital equipment and software, and, production of goods and services. These moves, though increasing the national potential for development, have however been limited to a few organizations which include the Lands Department, Survey Department and Office of Titles. Furthermore, staff training in these organizations has generally outpaced the necessary reorganization of structures and procedures needed to attract and keep qualified personnel and make efficient use of the equipment acquired. Many trained staff members return to work only to find that the organizational structure is not ready to accommodate their increased potential, and their skills are not utilized. In many instances they become unmotivated and some seek employment in the private sector or in foreign countries, thus wasting money spent on training. On the other hand, Government organizations continue to implement isolated digital solutions or maintain manual systems of varying degrees of efficiency, or inefficiency.

On a brighter note, the current Government is apparently well aware of the land information needs of Jamaica. The creation of the Cabinet Land Policy Committee, which has responsibility for the Land Information Council of Jamaica (LICJ) [Office of the Prime Minister, n.d. a], is definitely a move in the right direction. Policies have been, and are being, formulated to deal with land information management, land resources and land use, acquisition and divestment, land management, environmental management, land tenure, taxation, and development incentives [Government of Jamaica, 1994b]. Details on the Land Policy Committee will be discussed later in the Chapter 4.

## **1.5 Summary**

We have seen from the foregoing that Jamaica is a developing country with the normally attending economic, social and political problems. Population growth, housing, and commercial and industrial development generate stiff competition for the land. New policies have been, and are being, formulated in an effort to balance the social and economic use of the land. What is to be noted at this point is that a lot of the policies are currently only proposals that will depend on political will, funding, administrative efficiency and reorganization, technical and administrative networking, and staff motivation to succeed. On the other hand, a number of databases that have been developed, or being developed, are seen as potential hubs in a national LIS. The fact that there is the potential for political administrative change (and thus policy change) every five years due to elections must also be taken into consideration.

## 1.6 Thesis Scope and Objective

This work proposes the design of a model to re-engineer land information management in Jamaica. The model is designed to provide viable options for managing the country's land information, span political interests, and fit into the island's aspirations to bring itself into the 21st century. The objective of the model design is to organize Jamaica's LIM resources in such a way that up-to-date, accurate, timely and complete land information is placed at the disposal of GOJ (regardless of which political party is in power) so that land-related policy decisions may be supported.

The model emphasizes the use of re-engineering techniques to create change conducive to better performance in Jamaica's LIM environment. Re-engineering techniques are applied to the business processes, human resources, and technical resources of Jamaica's LIM organizations in order to make them more efficient in managing land information. The assumption is that more efficient LIM organizations should produce more reliable land information to support the country's land-related objectives.

The design of the model, however, is influenced by and responds to specific LIM objectives outlined by the Land Policy Committee [Government of Jamaica, 1994b] to which the author was exposed as a member of the Land Information Council of Jamaica (LICJ). Some influence also comes from the author's experience since 1978 as an employee of Jamaica's public sector dealing with land administration. It is the purpose of this work to provide a feasible framework that includes the most important parameters that must be considered if the stated LIM objectives are to be attained. This thesis demonstrates that if the stated LIM objectives are to be met then there are a number of actions which **must** be considered.

## **1.7 Research Methodology**

This thesis is based on research done during the period May 1994 to March 1995. Information was gathered from a review of relevant books, legislation, papers written by academics and consultants, Jamaican Government documents, photographs, newspaper and magazine articles, and maps. Information was also obtained from recorded and unrecorded personal interviews, telephone conversations, and personal observations acquired through site visits. Personal interviews were conducted with all levels of personnel involved with Government land information in Jamaica, from those involved in LIM policy formulation to clerical officers involved with day to day operations.

Two trips were made to Jamaica during the periods May to August 1994, and February to March 1995. The first trip identified the objectives and functions of the major players in Jamaica's LIM environment. These included those organizations dealing with fiscal and legal cadastral information, and those organizations which maintained various land related thematic information. The organizations researched also included private sector organizations which could significantly figure in any plans to develop Jamaica's LIM. The second trip was necessary because of changes made to GOJ ministries and departments in January 1995. The changes did not affect the basic functions of departments but affected the names of ministries and the relationships between ministries and departments.

## **1.8 Thesis Organization**

The following chapters are organized in a manner to logically reveal Jamaica's LIM problems and to provide background for the model design presented in Chapter 6. The following describes the basic contents and focus of the ensuing chapters:



**(a) Chapter 2.** Chapter 2 outlines some of the causes of the problems to be solved by Jamaica's LIM mechanisms and why effective LIM is essential in that country. The chapter also reveals the link between Jamaica's LIM problems being experienced today and the historical development of the island's land tenure systems.

**(b) Chapter 3.** Chapter 3 describes the current LIM situation in Jamaica in terms of the objectives, functions, organizational structures and problems of a sample of twenty-three Government organizations involved with LIM. The potential of two private organizations to support Jamaica's national LIM objectives are also outlined.

**(c) Chapter 4.** Chapter 4 also describes the current LIM situation in Jamaica, but the focus is on Jamaica's efforts at implementing projects, programs and land related policies in order to achieve its LIM objectives. The aim of the chapter is to identify the direction in which Jamaica wants to go in terms of LIM and to determine the requirements necessary for the country to achieve its LIM objectives.

**(d) Chapter 5.** Chapter 5 introduces the concept of re-engineering and outlines how re-engineering may be applied to effect the changes to the status quo in order for Jamaica to achieve its LIM objectives. The options that must be considered are outlined.

**(e) Chapter 6.** Chapter 6 presents a design of a model framework for re-engineering LIM in Jamaica. The design is based on the LIM objectives identified in Chapter 4 and the options discussed in Chapter 5.

**(f) Chapter 7.** Chapter 7 contains a discussion of the previous design, demonstrating why the model is a feasible one. The chapter contains conclusions and recommendations.

## CHAPTER 2

### **THE DEVELOPMENT OF LAND TENURE IN JAMAICA: Why Land Information Management is Necessary in Jamaica**

*Many of the international community's widely shared goals - the elimination of malnutrition, the provision of jobs for all, the slowing of runaway rural-urban migration, the protection of productive soils and ecologically vital forests - are not likely to be achieved without radical changes in the ownership and control of land. It is a delusion to think that the needs of the world's poorest people will be met without renewed attention to politically sensitive land-tenure questions. It is an even greater delusion to think that the dispossessed of the earth will watch their numbers grow and their plights worsen without protesting. The issue of land reform will not go away.*

[Eckholm, 1979]

#### **Introduction**

The development of Jamaica's land tenure systems is closely linked to its historical social and political development. In Chapter 1 it was shown that the social relations among Jamaica's population, which affects land use, land resource management, and the quality of the work force supply (which is a vital resource for national development, and which impacts on Jamaica's land information management), developed in tandem with the development of land tenure patterns. The following quotation of Eckholm [1979] concurs with this joint development:

*Throughout history, patterns of landownership have shaped patterns of human relations in nearly all societies. They have also helped to determine the possibility and pace of economic change ... Some tenure patterns have manifested and solidified social inequality while others have promoted social mobility or even something approaching equality. Some tenure patterns have blocked technological progress while others have encouraged it.*

The historical development of Jamaica's land tenure systems is therefore worthy of attention in order to understand **why** the development of land information management is

necessary to aid in the solution of land management, resource development, land use and social problems.

## **2.1 Historical Development of Land Tenure Patterns**

### **2.1.1 The Period 1494 - 1655**

On his second voyage to the new world in 1494, Christopher Columbus became the first European to set foot upon the island of Jamaica which he then claimed for the Spanish Crown. Spanish occupation did not however begin until 1509, and because the gold sought was not found, the Spanish colonists operated cattle ranches and grew sugar and tobacco for local consumption [Henriques, 1953] utilizing the slave labour of the indigenous Amerindian Arawaks [Satchell, 1990]. The Arawaks quickly died out under brutal oppression; their population decreased from an estimated 60,000 to 74 after a little more than a century [Cundall and Pietersz, 1919]. They were replaced by African slaves.

### **2.1.2 The Period 1655 -1866**

In 1655 British forces seeking to claim territory in the West Indies attacked and routed the Spanish from a weakly defended Jamaica, after failing to take heavily fortified Hispaniola. At the time of conquest all lands were vested in the British Crown who made grants by letters patent to settlers, especially to soldiers who had taken part in the conquest [Henriques, 1953], in exchange for an annual quit rent payment. The size of these grants ranged from 40 to 3000 acres and land was granted in fee simple which meant that the holdings could be passed on to heirs. Land reverted to the Crown if there was non-payment of the quit rent, if there was non-service to the Crown, or if the holder died intestate and without a heir [Satchell, 1990].

There was at this time two classes of settlers, the small holder (40 - 100 acres) and the estate owner. The average size of an estate was 1,000 acres. The granting of these large tracts of land to individual farmers resulted in hundreds of acres being unused. Unused land at the time was estimated at over one and a half million acres [Henriques, 1953].

Tobacco was one of the earliest crops planted in this agrarian society but sugar cane became the primary crop when it was realized that large returns could be made. For sugar cane to be profitable, large acreages are needed. The grants of 40 to 100 acres failed and small white farmers were soon displaced by what was to become the planter class. This era saw a pattern of consolidation of small holdings into large estates worked by slaves brought from Africa. The slaves were allowed to maintain small provisions in the hilly or marginal areas of estates [Satchell, 1990]. The average area of these provision plots was about half an acre [Hurwitz and Hurwitz, 1971]. The economy became dominated by the sugar estate [Henriques, 1953].

After emancipation in August 1838, the land holding pattern changed with the appearance of large scale squatting, free villages, and the purchase of land by former slaves. Squatting occurred "in inaccessible places in the hills" [Henriques, 1953]. Free villages were created by lands being bought by "non-conformist missionaries" [Henriques, 1953] and sold or leased to former slaves in small lots. Lands bought by former slaves were estimated at the time to be about 19,300 holdings of less than 10 acres and 7,900 between 10 and 50 acres [Satchell, 1990]. This situation existed along with the continued operations of large estates, small farm holdings and Crown lands.

However, the great majority of the population remained landless or in possession of marginal holdings, as planters fought against the establishment of a peasant proprietor class by refusing to sell land in small lots [Henriques, 1953]. The ownership of land was a criterion for having a vote and so was closely related to the question of political power

[Robotham, 1981]. Hurwitz and Hurwitz [1971] adds an economic motive for the planters' unwillingness to see the newly freed slaves become land owners when they wrote:

*Of all the former slaves, those who had become independent farmers were most hated ... The Jamaican planters and their allies were strongly opposed to an independent Negro peasantry, for they wanted a large pool of labourers available to work the estates. The greater the pool, the lower the wages. Thus they sought to squeeze the peasant out of existence.*

Land, or the lack of it, was also a contributing factor in social unrest such as the Morant Bay rebellion in 1865. Although an estimated 1.8 million acres were idle unowned land, the planters and the colonial authorities made it almost impossible for the black masses to buy land [Robotham, 1981]. High taxes, unemployment, reduced wages, insecurity of tenure, sharp price increases and oppressive justice added to the pervasive landlessness which produced misery and caused the former slaves to signal their discontent in rebellion [Black, 1958; Robotham, 1981].

### **2.1.3 The Period 1866 - 1869**

The years between 1866 and 1869 were the formative years of Crown Colony Government which introduced new mechanisms and policies to improve a disorganized state of land tenure. Some of these measures included the passing of the Land Registration Law [1867], leasing land to squatters and the sale of Crown land in small parcels [Satchell, 1990]. The Government, influenced by the potential for social unrest, adopted land settlement schemes in an endeavor to provide the landless with holdings which would at least provide them with the means for subsistence. Abandoned lands were taken over and lands were also bought. The lands were subdivided into lots which were rented or leased on favorable terms to those who could afford it [Henriques, 1953]. During this time the Lands Department was established.

Loss of preferential treatment for Jamaican sugar on the British market devastated the planters. Estates formerly worth thousands of pounds were sold for a few hundred

[Hurwitz and Hurwitz, 1971]. Many large sugar estates were abandoned as agrarian capitalist became disinterested because returns on the major export crops (tobacco and sugar/molasses) were thought to be unattractive. Land remained idle and illegally occupied by all classes [Satchell, 1990].

#### **2.1.4 The Period 1870 - 1879**

With the land tenure situation still in a state of disorganization the government of the day moved to fully implement its land policies. These took the form of the ejection of squatters by government and private land owners and the redistribution of repossessed land by way of leases, sales and grants. The Island Secretary's Office (later called Island Records Office) was reorganized and restructured to facilitate recording, revision, and safe keeping of all public records and deeds which had the effect of reducing the number of searches necessary to ascertain title deeds to land and the time of transfer [Satchell, 1990].

This time period was also characterized by the purchasing of large land holdings by foreign nationals and the continued waning of sugar on the international market. Here again the pattern of concentrating land into large holdings re-emerged [Satchell, 1990].

#### **2.1.5 The Period 1880 - 1889**

The 1880s were characterized by the rapid growth and expansion of the banana industry in the north-eastern and some southern parishes. Bananas were formerly cultivated by small settlers but then the development of a lucrative trade with the US encouraged the entry of large plantations into the industry. Abandoned sugar plantations in eastern parishes were acquired intact and placed under banana cultivation as the sugar industry saw further decline due to beet sugar competition on the European market. Land, previously seen as an encumbrance when returns on major crops were unattractive, was now seen as the basis for wealth [Satchell, 1990].

In 1889 *Registration of Titles Law* [1889], based on the Torrens system developed in Australia in 1857, was enacted. This enactment was supposed to enable the quicker, easier and cheaper transfers of holdings [Satchell, 1990]. The *Registration of Titles Law* [1889] (later to be known as the *Registration of Titles Act* [1889]) operated in parallel with the deeds registry system at the Island Record Office, and continues to do so even today.

### **2.1.6 The Period 1890 - 1900**

In the 1890s the banana industry was consolidated and land of large acreages was concentrated in the hands of a few land owners. Attempts by the Government of the day to implement policies to facilitate the growth of small settlers met with extremely limited success as the best portions of Crown lands were already leased or sold. The remaining portions of Crown lands were mountainous and infertile (Blue Mountains and Cockpit Country). Land holdings were again concentrated in the hands of a few [Satchell, 1990].

The Government in 1895 instituted the Land Settlement Scheme [Satchell, 1990]. The Land Settlement Scheme was characterized by the subdivision of government land into low cost allotments which were sold to settlers on the basis of a down payment on the sale price and semi-annual payments on the balance over a twenty-five year period. On the completion of all payments of the due installments and legal fees, the government was obligated to provide the settler with a registered title under the *Registration of Titles Law* [1889].

### **2.1.7 The Period 1900 - Present**

Many political changes were to take place in the twentieth century, mostly caused by the masses demanding more access to land, better wages and working conditions, and the right of self determination. The 1930s saw violent protests by the working class and

the formation of the two major political parties: the Jamaica Labour Party (JLP) and the Peoples' National Party (PNP) [Black, 1958]. The following quotation from Hurwitz and Hurwitz [1971] describes the land tenure situation in 1938:

*Two-thirds of the total farm land was in holdings of 200 acres or more in size. This land was held by 900 holders or less than 1 per cent [sic] of those owning farms. about 300,000 persons, including dependents, were directly associated with land-ownerships. Most of them were peasant holdings smaller than 10 acres ... and were too small to support a family at a minimum standard of living. Almost a million people did not own any land.*

The colonial government continued its land policy of encouraging the registration of all lands under the *Registration of Titles Law* [1889] and the repossession of all unpossessed and unclaimed lands [Satchell, 1990]. However many of the land transactions were registered at the Island Record Office or not at all and only a small portion of land transactions were registered under the *Registration of Titles Law* [1889]. Apparently the benefits of quicker, easier and cheaper transfer of holdings that was supposed to accompany the introduction of the *Registration of Titles Law* [1889] was either not a reality or was not effectively communicated to the population. Today the high costs associated with transferring land under the *Registration of Titles Act* [1889] is a disincentive in the use of this facility, and the cheaper facilities of the deeds registry at the Island Record Office is still extensively used as a means of securing rights in real property. Redistribution of land continued under the Land Settlement Scheme. Table 2.1 shows a sample of the 1943 land tenure situation in terms of the proof of title in real property held by the population.

Jamaica gained political independence on August 6, 1962. Thereafter, the national land policy would change according to the political ideology of the government currently in power. As far as the political parties are concerned, today as then, both are committed to land reform [Hurwitz and Hurwitz, 1971]. The Land Settlement Scheme was modified and amended in order to give those without formal property rights more access to land,



and land lease programs were also introduced, all with varying degrees of success. Land also continued to be sold and acquired by the government on the open market.

**TABLE 2.1**  
**TITLES HELD BY 808 OCCUPIERS TAKEN AT RANDOM**  
**IN THE PARISH OF SAINT ELIZABETH, 1943 (After Nettleford, 1971)**

<u><i>Proof of Title Held</i></u>	<u><i>No.</i></u>	<u><i>% of total</i></u>
Purchase Receipt and Diagram	13	1.6
Purchase Receipt only	399	49.3
No title	122	15.1
'Gift'	81	10.0
'Inheritance'	28	3.4
Valid title	74	9.2
Will	16	2.0
Diagram only	15	2.0
Tax receipt	25	3.1
'Documents'	25	3.1
Family land	10	1.2

The Land Settlement Scheme is currently managed by the Land Valuation and Estates Department (an amalgamation of the former Land Valuation Department and the former Lands Department). This only became effective in March 1995, but before that the Land Settlement Scheme was managed by the then Lands Department. By the late 1970s it became apparent that inefficiencies in the structure and operation of the then Lands Department were causing the objectives of the program not to be met. By 1978 only approximately 20,000 of 56,000 allotments made under the Land Settlement Scheme had titles issued under the *Registration of Titles Act* [1889] [Satchell, 1990]. Three government initiatives of note were instituted in an attempt to bring the land situation under control: the National Land Policy Committee, the Jamaica Land Titling Project and Operation PRIDE (Programme for Resettlement and Integrated Development Enterprises). These three entities will be discussed later in the Chapter 3.

**TABLE 2.2**  
**NUMBER OF PARCELS OWNED BY GOVERNMENT ENTITIES**  
**(After Land Valuation Department, 1994)**

<u>GOVERNMENT ORGANIZATION</u>	<u>NUMBER OF PARCELS OWNED</u>
National Water Commission	147
Commissioner of Lands	21,015
Minister of Housing	16,925
Unassigned	59
Administrator General	260
Ministry of Agriculture/Land Authority	790
Other Ministries/Government Departments	10
K.S.A.C	216
St. Thomas Parish Council	135
Portland Parish Council	61
St. Mary Parish Council	52
St. Ann Parish Council	157
Trelawny Parish Council	97
St. James Parish Council	103
Hanover Parish Council	56
Westmoreland Parish Council	302
St. Elizabeth Parish Council	127
Manchester Parish Council	154
Clarendon Parish Council	122
St. Catherine Parish Council	147
Coffee Industry Board etc.	4
Urban Development Corporation	1,237
National Housing Corporation	80
National Housing Trust	247
JIDC/JAMPRO	91
Jamaica Railway Corporation	65
Forest Industry Development Company Limited	57
Other Statutory Bodies	247
	-----
TOTAL	42,963
	-----

Currently the land tenure systems prevailing in Jamaica include free-hold, leasehold, lands being squatted on, and lands owned by the state. State land (Table 2.2) is estimated to be 37% of the land surface (approx. 405,000 ha.) [Satchell, 1990]. Out of Jamaica's estimated 600,000 land parcels, approximately 380,000 Certificates of Title have been issued [Clarke et al., 1994] under the provisions of the *Registration of Titles Act* of 1889 and the *Registration (Strata Titles) Act* of 1969 administered by the Office of

Titles. The remaining approximately 220,000 are either administered under provisions of the *Conveyancing Act* [1889] managed by the deeds registry system of the Island Record Office, or continue to be devoid of any registered evidence of title.

According to Section 25 of the *Registration of Titles Act* [1889], title may be registered as qualified or absolute. A person registered as a proprietor with absolute title holds the land in fee simple subject to any relevant encumbrances, liabilities, rights and interests. A person registering as a proprietor with a qualified title holds the land with all the rights of absolute title except that the estate, rights or interests of any other person registered on the title may be enforced. A prescribed application form, proof of paid taxes and supporting declarations from independent declarants are needed to support registration. Lands may be described by plan or metes and bounds, but "any parcel registered with metes and bounds description would have to again be subjected to the first application process when a plan for the parcel is submitted for registration" [Robbins, 1990].

The possession of a certificate of title under the *Registration of Titles Act* [1889] is perceived by the agricultural sector as important, since it directly relates to the security it provides in accessing loans from lending institutions to promote agricultural development. Lending institutions tend to prefer certificates of title as security for loans instead of registered deeds. Additionally, "security of land possession motivates farmers to increase and diversify their fixed investments in crops, cattle and equipment" [Government of Jamaica/United Nations Development Programme, 1989] which would improve Jamaica's agricultural output and strengthen its rural sector. The land market is also likely to positively stimulated as it has been "proven" that titled lands tend to increase in value and purchasers are more likely to participate because of the security of tenure [Government of Jamaica/United Nations Development Programme, 1989]. This increase of market activity would result in more revenues for the Government by way of taxes and transaction duties.

A deed brought to the Island Record Office for registration is first assessed for fees after a check is made to ensure that the names and addresses of the grantor(s) and the grantee(s) are present. A check is also made to ensure that the document is witnessed by a Justice of the Peace, and that the stamp duties are paid. No check is made to ascertain if more than one sale is made at the same time for the same property. The document is then photocopied, examined and endorsed. After a while the document is bound in a Liber (book). The original is returned to the owner. Registered Deeds are indexed by the names of the grantors and the grantees and the public pays a fee to do a search [Brown, 1994].

## **2.2 Summary**

All through the historical social and political development of Jamaica the dominant land tenure pattern has been the freehold ownership of large parcels by a minority of the population. Attendant with this was a general lack of formal rights in real property by a majority of the population, or the ownership of small parcels by the peasantry. This trend is still present today with Robinson [1994] reporting that maybe as many as 600,000 persons may be squatting on public and private lands. This section of the population without formal rights in real property is reported by Campbell [1995] to be consuming "thousands of kilowatt hours of electricity and millions of gallons of water monthly" without the utility companies being able to collect for the services. The utility companies officially provide services and keep records for legal tenants only but the squatters seem to have found ways and means [Campbell, 1995] to circumvent the system. The costs that are not written off by the utility companies are usually borne by the paying public. With the section of the population without formal rights in real property being generally the source of land misuse, scattered development, discontent and crime [Eckholm, 1979]

Jamaica is in need of efficient land management to try and rectify the situation. Efficient land management relies on reliable land information.

Land registration systems in the form of a Torrens type title registration under the *Registration of Titles Act* [1889], and a deeds registration under the *Conveyancing Act* [1889] manages the legal land tenure situation. However a significant portion of lands are not accounted for.

Land reform in the form of land settlement schemes and land lease projects have been, and are still being, undertaken by successive governments. However, as stated by Eckholm [1979] "even where feasible, land-settlement schemes cannot absorb more than a small fraction of the tide of potential farmers." Land is not free, and even if reasonably priced will exclude a great majority of those who cannot afford the reasonable price. Furthermore Jamaica still has to balance social reform with economic, commercial and industrial development, all of which make demands on the limited land resource. In discussing the normal outcome of the competition for land, Beckford and Witter [1980] state:

*Perhaps the greatest pressure has been felt by the peasantry: pressure from plantations, from mining, and from tourism, all competing with the poor peasant for the limited land base that Jamaica possesses. Peasants only managed to maintain a subsistence level when competition was not intense and when new income opportunities arose.*

Effective land information management supporting the policy objectives that rely on land information is therefore urgently needed to solve some, if not all, the problems.

## CHAPTER 3

### **CURRENT LAND INFORMATION MANAGEMENT: Organizations Involved with Land Information Management**

*The essence of a land information system is providing the ability to link a multitude of land related attributes, often from many different sources and maintained by many different agencies, to a unique geographic location or area ... [there is] a substantial need for compatible land information systems to improve land conveyance procedures, to furnish the basis for equitable taxation, and to provide much-needed information for resource management, infrastructure management, and environmental planning.*

[US Department of the Interior, 1990]

#### **Introduction**

"Land information is a vital national asset that supports many governmental activities" [US Department of the Interior, 1990]. It is needed for the management of land use, and the application of digital technology to improve the benefits of land information management is "recognized as evident" [Enemark, 1992]. This chapter looks at agencies of the Government of Jamaica (GOJ) whose objectives and functions have an impact upon Jamaica's land information management (LIM). The information contained herein was obtained through research carried out in Jamaica during the periods May 1994 to August 1994, and February 1995 to March 1995. The second period of research was a necessary response to changes made in January 1995 by GOJ to ministries, agencies and departments.

This chapter will describe each LIM agency as it was before January 1995 as well as subsequent changes. Any impact the changes may have had on Jamaica's LIM environment is also examined. Finally the problems being experienced by Jamaica in producing timely, up-to-date, accurate and complete land information are discussed.

Two private sector organizations that can figure positively in Jamaica's land information management are Telecommunications of Jamaica (TOJ) and Mona Informatix Limited. Telecommunications of Jamaica provide local and international telephone and other telecommunications services. Mona Informatix Limited is a private limited liability company owned by the University of the West Indies. These companies are included in this research as examples of non-government organizations possessing enormous digital processing capabilities, and which can play very important roles in Jamaica's current and future land information management.

Certain facts constrain what is reported in this chapter. There may be as many as 100 or more land related laws [Government of Jamaica, 1994b], consequently, only a fraction are mentioned. With as many as 60 Government ministries, departments and agencies which deal with land related matters [Government of Jamaica, 1994b], only those which represent the major players in LIM were researched and described. Details on each organization vary in degree and is a reflection of levels of cooperation and availability of relevant information.

### **3.1 Jamaica's Public Sector LIM Organizations**

There may be as many as 60 Government ministries, departments and agencies that are responsible for some aspect of land and land related activities in Jamaica. The result has been conflicts in implementing social and infrastructural development; and delays in planning and development processes due in part to overlaps in responsibilities and functions. Studies have revealed that 80 percent of Government's administrative decisions are related to, or impact on, land in one form or another [Government of Jamaica, 1994b]. The situation is summed up in a statement made by US Department of the Interior [1990] in that land information exists "but cannot always be used effectively because it may be of

poor quality and it may not be organized or managed to take advantage of its full potential."

This section describes the objectives, functions, organizational structures and problems of Jamaica's LIM organizations. The agencies are described both as they were before the changes made by GOJ in January 1995 and as they function presently.

### **3.1.1 Land Administration Division**

The Land Administration Division was established in 1860 when all lands that were then held by the British Crown were transferred to the Commissioner of Lands [Ministry of Agriculture, 1991]. At that time the Division was called the Lands Department. Up until January 1995 the Division was part of the then Ministry of Agriculture but now it is a part of the new Ministry of Environment and Housing [Blair, 1995]. Also, in March 1995 the Division was administratively merged with the then Land Valuation Department to form a new agency called the Land Valuation and Estates Department. However, the objectives, functions, and structure of the Division remain the same. For the purpose of this thesis the Division will still be referred to as the Land Administration Division.

The Division is headed by the Commissioner of Lands whose responsibilities are spelled out in the *Crown Property (Vesting) Act* [1960]. Under the Act the Commissioner, who is declared a corporation sole, has the power to acquire, hold and dispose of the vested land, but not without the "general or special authority in writing" of the Minister of Environment and Housing who today is responsible for Crown Lands. Lands that were previously vested in or held by the Chief Secretary of the former colonial regime are also vested by this Act in the Commissioner of Lands. The Commissioner therefore acts as custodian of all government lands except those vested in the Minister of Housing, the Accountant General, the Administrator General and those statutory institutions, like the Urban Development Corporation (UDC), which have the power under



law to acquire, hold and dispose of property. Lands are acquired, held and disposed of on behalf of certain Government entities who are not able to legally own land. It is generally accepted that the Commissioner of Lands holds and administers the most land in Jamaica. Ownership is estimated to number in excess of 21,000 parcels [Land Valuation Department, 1994] in addition to approximately 32,500 parcels [Clarke et al., 1994] being transferred to settlers under the Land Settlement Scheme.

The Land Administration Division carries out its mandate by performing the following main functions within the constraints of the *Crown Property (Vesting) Act* [1960]:

- a. Valuing land and buildings for purchase or lease by or on behalf of the Government.
- b. Negotiating the purchase or lease of land and buildings on behalf of the Government.
- c. Acquiring land and buildings under the *Land Acquisition Act* [1947].
- d. Maintaining all records of land purchased, rented, leased etc. by or to the Government.
- e. Preparing, processing and maintaining all legal documents relevant to lands and buildings sold to or on behalf of the Government.
- f. Administering the Government's Land Settlement and Land Lease Programmes.

Apart from the Commissioner and Deputy Commissioner of Lands, the functions of the Land Administration Division are carried out by a Legal Branch, Accounts Branch, Valuation Section, Drawing Office, Allotment Branch and Registry. Most of the staff at the lower level is temporary.

The Legal Branch is responsible for preparing, maintaining and processing all legal documents, as well as advising the Commissioner of Lands on legal transactions. The Accounts Branch maintains accounts receivable and payable on behalf of the Commissioner of Lands; it is also responsible for preparing the Land Administration

Division's financial contribution to the annual budget. The Valuation Section prepares and checks the valuation of buildings and land that are the subjects of transactions entered into by the Commissioner of Lands. The Drawing Office prepares, maintains and processes preliminary subdivision plans, arranges for the survey and re-survey of State lands and land being acquired by the State, and interacts with Parish Councils for the approval of final subdivision plans. The Allotment Branch is responsible for processing the sale and lease of lands under the Government's Land Settlement and Land Lease Schemes. The Registry maintains and stores all files, currently paper folders, including those that serve to track the progress of sales, purchases, leases, rentals, personnel and equipment.

The Land Administration Division's filing system is in poor condition [Clarke et al., 1994] with inadequately maintained files, records not kept up-to-date and a filing system that requires the laborious searching of bulky files and books in order to ascertain summary information. A high staff turnover rate coupled with the fact that staff is inadequately trained, qualified and motivated has resulted in the loss of the knowledge of procedures and content that has further aggravated the situation. Consequently the Division is hard-pressed to determine the true extent of its land holdings.

Under a Government of Jamaica/United Nations Development Programme (GOJ/UNDP) project two personal computers, operating under DOS in a stand alone environment, were installed together with software solutions targeting payroll and land settlement accounts. This move improved the Accounts Branch's reporting capability, at least for those accounts that were moved to the automated system. However, summary reporting on land tenure, use etc. remained in need of dire attention.

Today, the land information system of the Division is the target of a Government of Jamaica/Inter-American Development Bank (GOJ/IADB) land titling project which has further trained staff, installed more sophisticated computer hardware and software solutions (currently in the testing stage), and carried out physical infrastructural

modifications. The current hardware and software situation is described Chapter 4 where the land titling projects are described in detail.

### **3.1.2 Survey Department**

In 1938 the then Surveyor General's Office was divided into a Land Administration Division, and a Survey Department to be responsible for the survey and mapping functions of the Government [Government of Jamaica, n.d.]. The Survey Department therefore:

- a. Prepares topographical maps on which planning and development are based.
- b. Executes boundary surveys of public lands for legal purposes.
- c. Checks, in accordance with its statutory function under the *Land Surveyors Act* [1944], plans prepared by Commissioned Land Surveyors for the purposes of land registration and the transfer of title.
- d. Prepares charts for the safe navigation of Jamaica's harbors and coastal waters.
- e. Coordinates aerial photography for Government agencies.
- f. Operates a limited land information system.
- g. Houses the National Air Photo Library.
- h. Supplies aerial contact prints upon request, as well as copies of maps and plans.
- i. Coordinates a dense network of points which will form a framework for the integration of all surveys and mapping.

A surveyor must first obtain a licence (commission) from the Land Surveyors Board issued under the *Land Surveyors Act* [1944] in order to carry out cadastral surveys in Jamaica. The Board is made up of the Director of Surveys, Registrar of Titles and two Commissioned Land Surveyors appointed by the Land Surveyors Association of Jamaica [Government of Jamaica, n.d.].

The Director of Surveys, who used to report to the Permanent Secretary in the Ministry of Agriculture and now reports to the Permanent Secretary in the Ministry of

Environment and Housing, oversees the functioning of the Survey Department. The functions of the Department are performed by four main divisions, namely: Cadastral, Topographical, Administration and Support Services [Government of Jamaica, n.d.]. The Survey Department, which is one of the entities that are the focus of the Jamaica Land Titling Project, has a temporary project unit: Land Information System [Clarke, 1994].

The Topographical Mapping Division is responsible for the production of the topographic map series (at scales of 1:50,000, 1:12,500, 1:2,500 and 1:10,000) and the geodetic control associated with those processes. Topographic processing was done with analog equipment such as the Wild A7 and B8 topographical plotters [Davis, 1994] and the process entailed the acquisition of aerial photographs, photogrammetric interpretation of those photographs and cartographic production and printing. Contracts have been signed for the acquisition of soft-copy photogrammetric solutions which is image based. Under this process the information is scanned, correlation and Digital Terrain Model (DTM) production is done digitally and output is sent to a raster plotter located in the Land Information Unit [Clarke, 1994].

The Cadastral Surveying Division supports the titling system "using the Torrens titling principle" [Clarke, 1994]. Plans submitted by private land surveyors are checked and certified as correct. There is a small cadastral index mapping program but according to Clarke [1994] this is not very active.

The Land Information System Unit was created under a GOJ/UNDP project and provided with digital equipment to allow staff to get used to solving problems with modern technology. Hardware installed included personal computers running under DOS, a plotter and a digitizing table. Software included PC ARC/INFO and Clarion Application Developer. The mandate of the Land Information System Unit is the creation of a technology environment that would allow the land related data residing in the Land Administration Division, Office of Titles and Survey Department to be more easily accessed by the general users.

The Land Information System Unit of the Department has continued to operate under the GOJ/IADB land titling project which has trained staff, targeted the installation of more sophisticated computer hardware and software solutions (currently in the testing stage), and has carried out physical infrastructural modifications. The current hardware and software situation is described Chapter 4 where the land titling projects are described in detail.

### **3.1.3 Office of Titles**

The Office of Titles exists to give certainty to estates in land and to render dealings with land more simple and less expensive. The functions of the Office of Titles, which operates a Torrens style system, are:

- a. Investigating applications to bring land under the *Registration of Titles Act* [1889].
- b. Investigating and registering dealings in land including, among other dealings creating or affecting interests in land:
  - i. Instruments of Transfer.
  - ii. Mortgages.
  - iii. Discharges of mortgages.
  - iv. Charges.
  - v. Leases.
  - vi. Rights of way.
  - vii. Transmissions.
  - viii. Applications to register land.
- c. Maintaining and servicing an index of caveats prohibiting the registration of interests in land.

- d. Investigating applications for registering new Certificates of Title arising out of subdivisions of lands currently under the *Registration of Titles Act* [1889] or, because the duplicate Certificate of Title has been lost.
- e. Administering the *Registration (Strata Titles) Act* [1969] dealing with the subdivision of land into two or more stratas.
- f. Maintaining a Register and related records to reflect the ownership of identifiable lands as an office of public records.

The New Certificates of Title, Memorandum, and Records Divisions, the Accounts and Personnel Branches, and the Registration and Despatch Units carry out the functions of the Office of Titles under the direction of the Registrar of Titles [Government of Jamaica, n.d.]. The Registrar of Titles who used to report to the Permanent Secretary in the Ministry of Agriculture now reports to the Permanent Secretary in the Ministry of Environment and Housing.

There are approximately 380,000 land parcels for which Certificates of Title are managed. Approximately 40,000 legal instruments, or dealings, are processed annually [Clarke et al., 1994]. The GOJ/UNDP project, carried out in the late 1980s, installed one personal computer with a specially designed application program running under DOS, to track documents flowing through the system [Clarke, 1994]. Stacks of legal instruments including mortgages, instruments of transfer, leases and other documents "are poorly filed in corridors and other informal spaces in the Registry" posing a risk of damage by fire, water and general deterioration, and from insects and rodents [Clarke et al., 1994]. The GOJ/IADB land titling project has trained staff, targeted the installation of more sophisticated computer hardware and software solutions (currently in the testing stage), and is carrying out physical infrastructural modifications in an effort to rectify the situation. The current hardware and software situation is described in Chapter 4 where the land titling projects are described in detail.

### 3.1.4 Land Valuation Division

The Land Valuation Department was established under the *Land Valuation Act* [1957] and commenced under the then Ministry of Agriculture and Lands in 1957. Until January 1995 it functioned as a department of the Ministry of Finance and Planning. Today the organization is part of the new Ministry of Environment and Housing. Also in March 1995 the Department was administratively merged with the Land Administration Division to form a new department called the Land Valuation and Estates Department [Blair, 1995]. However, the organization will be described in this work as the Land Valuation Division since the functions of the organization have not effectively been altered.

The *Land Valuation Act* [1957] "mandates the Commissioner of Valuations and his officers, to determine the 'unimproved' value of every parcel of land in the island, for the purpose of property tax administration" [Land Valuation Department, 1991]. The Division is one of the Revenue Departments monitored by the Revenue Board. The others are the Income Tax Department, The Collector General Department, and the Stamp Office. The Division functions by, among other things [Land Valuation Department, 1991]:

- a. Mapping and referencing every parcel in the Jamaica on a parish basis by identifying and discovering the ownership each parcel.
- b. Making a valuation of each parcel of land in accordance with the *Land Valuation Act* [1957] so as to establish the tax base.
- c. Determining the tax structure in accordance with property tax laws.
- d. Maintaining and updating the Valuation Rolls for all parishes, preparing briefs and giving evidence of Valuation Appeal Cases.
- e. Processing land tax relief cases under the provisions of the *Land Taxation Relief Act* [1959].

- f. Defining special development areas, mapping and referencing all properties within these areas, and preparing the 'base date' and 'development date' valuations for the imposition of capital gains tax and development duty in accordance with the *Land Development Duty Act* [1958].
- g. Dealing with complex transfer tax valuations referred by the Commissioner of Stamp Duties.
- h. Advising Government on the acquisition and disposal of properties.
- i. Making data from the Land Valuation Data Bank available to support Government's land reform programs.
- j. Contributing to development plans under the *Town and Country Planning Act* [1958] as a member of the Planning Authority.
- k. Providing advice on comparative rent restriction legislation; and issuing Certificates of Exemption under the *Rent Restriction Act* [1944].
- l. Providing information to Government agencies and private enterprises using the Land Valuation Maps with ownership coverage and land resource data.

The Land Valuation Division is headed by the Commissioner of Valuations who, in turn, supervises two Deputy Commissioners who are in charge of valuation and field surveys, and administration and special projects, respectively. There are four units: Northern, Southern, Central and Western which fall within the responsibility of the Deputy Commissioner, Valuation and Field Surveys. The Map Compilation, Valuation Roll, Rent Restriction, Research and Special Projects, Accounts, and Personal and Office Management Sections are within the responsibility of the other Deputy Commissioner [Land Valuation Department, 1991].

The identification of fiscal parcels is based on valuation mapping done on United Nations Development Programme (UNDP) 1:25,000 topographic series, and grid blocks representing 5000 square feet each. At present all maps are analog. Each parcel has a unique valuation number (code) which is a composite representing the map sheet, grid



square, enclosure and parcel parameters. The first three characters (or four in the cases of Kingston, Saint Andrew and Saint James ) represent the map sheet. Two characters represent the grid square. Three characters (or two in the cases of Kingston, Saint Andrew and Saint James ) represent the enclosure. Three characters represent the parcel parameter. The following is an example of a valuation number for areas outside Kingston, Saint Andrew and Saint James:

(Map) (Grid) (Enclosure) (Parcel)  
130 02 003 006

The following is an example of a valuation number for areas within Kingston, Saint Andrew and Saint James:

(Map) (Grid) (Enclosure) (Parcel)  
150C 2W 03 006

Digital data representing the Valuation Roll is maintained by an entity named Fiscal Services Limited on behalf of the Commissioner of Valuations [Land Valuation Department, 1991]. The following fields are maintained within each fiscal record:

- a. Valuation reference number.
- b. Parish.
- c. District.
- d. Owner's name and address.
- e. Occupier's name and address.
- f. Property address (location).
- g. Area of the parcel.
- h. Unimproved value.
- i. Lot or block number.
- j. Land use codes.
- k. Physical characteristics.
- l. Available services (eg. water, sanitation, telephone etc.).

m. Registered Certificate of Title or Deed Registry reference number.

At present Fiscal Services Limited maintains these records using COBOL programming software running on a DEC VAX platform managed by the VMS operating system.

### **3.1.5 Public Works Department**

Until January 1995, the Public Works Department was known as the Ministry of Construction (Works). The focus of the Public Works Department is still the maintenance of Jamaica's physical infrastructure like roads and bridges. The maintenance of Government buildings also falls within the responsibility of this organization. Every potential development, subdivision or building that is contiguous to a main road has to come to the attention of this division for processing [Smith, 1994]. Some flood damage control is also done [Gibson, 1994].

Land that is needed for the construction or expansion of roads is purchased by the Public Works Department through the Land Administration Division. The lands are then vested in the Commissioner of Lands under the provisions of the *Crown Property (Vesting) Act* [1960]. To date, "thousands" of land transactions for the purchase of these road lands remain incomplete, sometimes spanning decades, with final payment to the vendors remaining unpaid [Gibson, 1994; Smith, 1994]. There are many reasons for this, including the breakdown of communications between the Public Works Department and the Land Administration Division which does the legal processing and where the bottleneck appears to occur.

The Land Acquisition Section is charged with monitoring the land purchases and the Land Survey Branch deals with the surveying of roads and bridges. The Land Survey Branch is in possession of an IBM compatible 486 66 Mhz personal computer purchased through the Administrative Reform Programme and which is used for surveying computations and drafting. Survey Department base maps are used, and data is overlaid

on them before digital processing occurs. Large scale plans are prepared locally. Digital data is processed using AutoCAD. Software (e.g., ARC/INFO) with the capability of analyzing survey data (e.g. rubber-sheeting and the topologic processing of polygons) was requested but the authorities decided to install AutoCAD instead [Smith, 1994].

A number of other problems were cited by Smith [1994]. Some of these include:

- a. The department's building was apparently being wired for the installation of a LAN but then this activity came to a standstill. The library containing plans of roads and buildings, such as health centers, hospitals and other Government buildings have been "abandoned for years now." A camera for processing microfilm has also been abandoned in the library "under dust."
- b. The Division is under-staffed and suffers from a high turnover rate which leads to loss of knowledge of procedures.
- c. Land information in the Land Acquisition Section is stored in paper folders and property books which are subject to mistreatment which can lead to the loss of vital information.
- d. There is difficulty in finding information in the filing system.

This led Smith [1994] to comment that "the local land information system is in shambles."

### **3.1.6 Housing Division (Ministry of Environment and Housing)**

Until January 1995 the Housing Division was known as the Ministry of Construction (Housing). The name "Housing Division" is used in this thesis to identify this section of the new Ministry of Environment and Housing. Regardless of the name change, the functions of the Division remain as they were before January 1995.

The Division is responsible for ensuring that housing schemes being constructed in Jamaica are so done according to regulations. The Minister in charge of housing is the second largest holder of land in Jamaica, estimated at almost 17,000 parcels [Land

Valuation Department, 1994]. The laws impacting on this organization include the *Housing Act* [1968], *Local Improvement Act* [1914] and the *Land Acquisition Act* [1947]. Private developers must come to the Division to have a development declared a housing scheme. The Housing Division appears no longer to be "in development so they have contracted private developers to do the housing," and these private developers uses the division to "get rid of red tape" [Hamilton, 1994]. Furthermore, the division "seem to provide land for development and other people do the other things like financing and so on" [Hamilton, 1994]. Land is however still being bought where reasonable prices are found. However, acquisition of land for low income housing is inhibited by currently high land prices.

The Housing Division still has a lot of work to do regarding the schemes that were developed by it. The Division is still responsible for providing Certificates of Title registered under the *Registration of Titles Act* [1889], and possibly the *Registration (Strata Titles) Act* [1969], to purchaser of houses and housing lots. Squatter settlements are also dealt with under the *Local Improvement Act* [1914]. Provisions of the Act prevent owners from issuing notices-to-quit to the squatters, and advise that the lands be bought within 10 years bringing the lands under the Act [Hamilton, 1994].

Land records are kept in books and paper folders. Boundary and subdivision plans are analog at scales of 1:50,000 and 1:100,000. All plans are checked by the Survey Department [Hamilton, 1994].

### **3.1.7 Forestry and Soil Conservation Department**

The Forestry and Soil Conservation Department (FSCD), set up in 1942 [Jones, 1994], has its main objectives defined as the management of government owned forest lands on the island, and the advising and assisting of private land owners on the management of private forest lands [Government of Jamaica, 1994a]. A number of laws

impact on this organization and include the *Forest Act* [1938], *Watersheds Protection Act* [1964] and the *Land Authorities Act* [1951] [Jones, 1994]. The FSCD has been mandated, in accordance with the government's forest land use policy, to:

- a. Manage the forest reserves and other government owned forest lands on a sustainable basis and to maintain the forest reserves mainly as reserves.
- b. Develop forest plantations for the continuous production of forest products.
- c. Manage, conserve and protect Jamaica's remaining natural forests in order to maintain and enhance the biodiversity of the country's flora and fauna.
- d. Provide extension services to farmers and rural women so as to increase the number of trees grown on farms for production and protection purposes.
- e. Promote and regulate forest related recreation and eco-tourism on government owned forest lands by coordinating activities with the National Park System.
- f. Provide data, maps and inventories of the forest estates and to develop integrated forest management plans on a periodic basis.
- g. Carry out forest related research so as to be better able to understand and manage the forests of the island.
- h. Promote environmental education programs so as to increase the awareness of Jamaicans to the importance of forests and trees.
- i. Collect fees and stumpage from the harvesting of forest products from government owned forest lands, while regulating the harvesting operations.
- j. Regulate the sawmill industry.

The FSCD is headed by a Director who reports to the Permanent Secretary in the Ministry of Agriculture and Mining (formerly the Ministry of Agriculture) through the Director of Technical Services. The Director sits on the board of the Forest Industry Development Company (FIDCO) which is a Government company involved with commercial forestry such as pine plantations and saw milling. Royalties are paid to FSCD

for lands used, and the two organizations work together on timber and environmental protection [Jones, 1994].

The lands managed by the FSCD are vested in the Commissioner of Lands. However, the organization maintains maps and plans of the forest areas at scales of 1:250,000 and 1:25,000. Base maps are obtained from the Survey Department and forest data is overlaid on them. A manual listing of the forest lands is also kept. The need for computers has been identified, especially to monitor the Trees for Tomorrow Project sponsored by the Canadian International Development Agency (CIDA). Entities which interact with the FSCD include the Coffee Industry Board, Coffee Industry Development Company, Rural Agricultural Development Authority, FIDCO, Natural Resources Conservation Authority, and non-governmental organizations involved with development work on forest lands [Jones, 1994].

### **3.1.8 Geological Survey Department**

Until January 1995, the Geological Survey Department (GSD) was part of the Ministry of Public Utilities, Mining and Energy. Today it is part of the Ministry of Agriculture and Mining. The Department provides geoscience information for its clients which include mining and exploration companies, prospectors, government agencies, geological institutions worldwide, universities, manufacturers of mineral products, architects and construction companies, real estate agents and developers, civil engineers, environmental consultants, and the general public. The mission statement of the Geological Survey Department outlines its role in the development of a comprehensive scientific understanding of the geology of the Jamaica so as to assist national, responsible exploration, sustainable economic development, public safety, environmental protection and the dissemination of geoscience information [Geological Survey Department, 1993].

The GSD is involved in the systematic geological mapping of Jamaica and the production of regional geological maps covering the distribution of geological structures and rock types [Geological Survey Department, 1993]. Some specific activities performed and services provided include:

- a. The facilitation of the investigation of potential geological hazard and disaster-prone areas.
- b. The identification and evaluation of economic deposits of industrial minerals for their profitable exploitation and marketing.
- c. The identification of all metallic minerals, except bauxite, for development and research purposes.
- d. The sale of geological, geochemical and geophysical maps.
- e. The chemical testing of all major elements for metallic and non-metallic minerals.
- f. Sample preparation, petrography, photogeology, engineering soil testing, and material testing.

In order to maintain maps in digital form, UNDP funds were used to acquire the first PC some time in or about 1985. Later CIDA funds were used to acquire "more appropriate equipment, but still not the thing you really need" [Rammelaere, 1994]. This turned out to be an IBM compatible 386 25 Mhz PC. Currently analog base maps are acquired from the Survey Department and digitized using AutoCAD running under DOS on PCs. The fastest machine currently owned by the GSD is an IBM 486 PC. Features such as Jamaica's coastline, major rivers, A and B class roads, and contour lines are digitized at a scale of 1:50,000. Coverage of geological features is also done.

GSD experienced much difficulty in trying to get digital land use and soil data from a source such as the Rural Physical Planning Division. Some of the problems included: personnel not knowing what was digitally available and lacking knowledge of their system; malfunctioning computer equipment; incompatible data formats; and the attrition of knowledgeable personnel. In the end nothing was gained and duplication of digital input

was effected. This situation points to the need for an infrastructure conducive to the sharing of data with organizations that are both source and client entities. However, the GSD was able to supply digital base maps to the Jamaica Bauxite Institute which is currently trying to establish a Geographic Information System [Rammelaere, 1994].

Apart from the GSD, the Jamaica Bauxite Institute, Petroleum Corporation of Jamaica, and the Geology Department of the University of the West Indies are the other major handlers of geological data. The latter is perceived to be competition in the handling of geological data [Rammelaere, 1994].

### **3.1.9 Rural Physical Planning Division**

It is the responsibility of the Rural Physical Planning Division (RPPD) of the Ministry of Agriculture and Mining (formerly the Ministry of Agriculture) to make agricultural and rural development plans at the national, regional and farm levels in accordance with the land use policy of Jamaica's Government [Ministry of Agriculture, 1993]. In order to accomplish this mission, the RPPD:

- a. Plans and executes national and regional soils and land use surveys.
- b. Gives advice on land use proposals and gives recommendations on the use of land as agricultural or non-agricultural sub-units.
- c. Gives advice on soil fertility management and cropping practices.
- d. Collects and analyses data for land evaluation.

The Director of the RPPD reports to the Director, Planning and Policy Review who in turn reports to the Permanent Secretary in the Ministry of Agriculture and Mining. Two Regional Rural Planning Units, the Central Soil Survey/Land Classification Unit and a Computer Department make up the organizational units which together comprise the RPPD [Ministry of Agriculture, 1993].



The two Regional Planning Units are headed by Regional Planners and are involved in physical resource inventory surveys and studies of specific agricultural land utilization, soil surveys, recommendations on crop suitability, land evaluation research and a farmer advisory service are the prerogative of the Soil Survey and Land Classification Unit. A Resource Data Processor Analyst and an Assistant Data analyst operates the Computer Department under the supervision of a Regional Physical Planner [Ford, n.d.]. The Computer Department processes all digital data and outputs maps, tables and text relevant to specific locations.

The general public pays a fee for such services as feasibility studies, soil testing and crop and fertilizer recommendation. Services provided to other government entities include the preparation of preliminary and final subdivision plans for land settlement schemes and other land divestment programs [Ford, 1994]. The fees charged are designed to recover costs and not to make a profit [Ford, n.d.].

The RPPD introduced the first comprehensive Geographic Information System in Jamaica. The system, named the Jamaica Geographic Information System (JAMGIS), came into being as a result of collaboration among staff from Michigan and Ohio State Universities, and the United States Department of Agriculture [Ford, n.d.]. Features such as infrastructure, hydrology, location, topography, soils, soil erosion hazard, land cover and use; agro-climatic aspects, physiography, population density, and farm size and distribution are covered [Ministry of Agriculture, 1993]. JAMGIS consisted of three components:

- a. ARC/INFO operating on Prime 2350 micro processor and storing the following layers of data at a scale of 1:50,000:
  - i. Soils.
  - ii. Land use and land cover.
  - iii. Agro-climatic.
  - iv. Coastline and parish boundaries.

- v. Lambert Grid.
- vi. Major latitude and longitude lines projected into Lambert coordinates.
- b. Earth Resource Data Analysis System (ERDAS) operating on an IBM PC-XT platform and used to import and analyze Landsat satellite imagery primarily for change detection as it relates to forest cover and water shed areas.
- c. Jamaica Physical Land Evaluation System (JAMPLES) operating on an IBM PC-XT platform, and developed by the RPPD to provide in-depth analysis of land characteristics in order to determine the suitability of land for specific crop production.

The Prime hardware hosting the ARC/INFO component of the system has become inefficient and obsolete, and its incompatibility with hardware existing in other agencies prevents the sharing of data. The Prime machinery has been replaced with SUN 670-MP architecture which should facilitate the sharing of data with other agencies, especially those which are also moving towards the SUN platform [Ford, n.d.]. Acquired with funds from the United States Agency for International Development (USAID), the system features a graphic terminal, non-graphics terminals, and a digitizing table capable of supporting whole map sheets at a time. The topology of the system is not exactly what was requested and there were difficulties in rectifying the situation because of the rigid policies of this external funding agency [Ford, 1994]. The system as acquired is sufficiently powerful to allow client organizations the option of remote access in exchange for sharing the maintenance costs. This would save not only on maintenance and under-utilization of the system, but also on the costs incurred by the acquisition of a multiplicity of systems [Ford, 1994]. However, up to July, 1994 the new SUN equipment was still in boxes awaiting assembly, while the Prime system is completely down.

In the opinion of Ford (n.d.), some of the problems facing the RPPD and which directly affects the efficiency of its land information system are:

- a. Lack of managerial competence.

- b. Non-existence of an approved organizational structure.
- c. Inadequately trained personnel, under staffing and a high staff turnover rate due to low levels of remuneration.
- d. Planners and policy makers being unaware of the potential of JAMGIS.
- e. Under-utilization of the system.
- f. A bureaucracy that features a slow pace of administration and business transactions which leads to a lack of confidence in the system by support services and suppliers.

### **3.1.10 Town Planning Department**

The Town Planning Department (TPD) was established in 1950 to ensure the systematic and orderly development of Jamaica's physical environment, and to secure a balance between the competing demands for land [Jamaica Information Service, 1985]. The responsibility of the TPD covers the planning of human settlements and the execution of long-range and comprehensive physical planning at the national, regional and local levels. The following are some of the functions performed by the TPD in order to meet its objectives [Town Planning Department, n.d.]:

- a. Advising Central Government and local government authorities on the optimal use of land for any purpose.
- b. Providing Government Ministries and Departments; and other interested agencies on the number of subdivisions and the number of lots within each subdivision.
- c. Assisting in policy formation, or reformation, in areas which exert impact upon the physical fabric of communities.
- d. Assisting in the drafting of legislation concerned with the achievement physical planning development and real property objectives.
- e. Advising the Courts on matters relating to the *Restrictive Covenants Act* [1960].

- f. Preparing, reviewing and maintaining physical plans at the national, urban and rural levels.
- g. Educating the public on planing needs, aims, problems and long-range proposals.
- h. Periodically revising development and subdivision standards, guidelines and regulations.
- i. Preparing Development Orders in accordance with Section 5 of the *Town and Country Planning Act* [1958].

All applications for the subdivision of land, whether by Government or private entities, and especially in environmentally sensitive areas, must come to the TPD. The TPD further gives recommendations on the erection of buildings although final approval is given by Local Government authorities such as the Kingston and Saint Andrew Corporation, and the various Parish Councils. Zoning and re-zoning are also the responsibilities of the TPD. Before coming to a decision on subdivision plans, other Government functionaries such as the Natural Resources Conservation Authority, Ministry of Construction and Ministry of Health are consulted. Other agencies, such as the Jamaica Bauxite Institute, are consulted in order to regulate development in areas of special interest to them [Alveranga, 1994].

Six Divisions carry out the functions of the TPD: Planning, Development Control, Legal, Research/Surveys, Administration and Community Relations [Jamaica Information Service, 1985]. The Government Town Planner runs the Department and in turn reports to the Permanent Secretary in the Ministry of Environment and Housing. Before January 1995, the Government Town Planner reported to the Permanent secretary in the then Ministry of Public Service and Environment.

Land information is stored, retrieved and output through a combination of paper file folders, manual drawing and digital systems. The digital part is comprised of a stand alone personal computer running ArcCAD under DOS, a printer and a digitizing table. Base analog maps are obtained from the Survey Department, and land capability data is

obtained from the Rural Physical Planning Division in order to produce land capability maps [Alveranga, 1994]. These maps are currently being digitized. Common themes stored are the location of social amenities such as schools, hospitals etc., and general land use.

### **3.1.11 Office of Disaster Preparedness and Emergency Management**

The principal objectives of the Office of Disaster Preparedness and Emergency Management (ODP) is stated as the advancing of "disaster preparedness and emergency management measures in Jamaica by facilitating and coordinating the development and implementation of integrated disaster management systems" [The *Disaster Preparedness and Emergency Management Act*, 1993]. In other words, the ODP is charged with ensuring that the nation itself is prepared to meet any disaster. The organization attempts to accomplish this through information dissemination, training, research, and ensuring that proper standards and laws are adhered to [Saunders, 1994]. The functions of the ODP as outlined in section 5(1) of the aforementioned Act are quoted below:

- (a) *developing and implementing policies and programmes to achieve and maintain an appropriate state of national and sectoral preparedness for coping with all emergency situations which may affect Jamaica;*
- (b) *encouraging and supporting disaster preparedness and mitigation measures in all parishes in collaboration with the local government authorities, community based organizations and the private and voluntary agencies, respectively;*
- (c) *providing appropriate training programmes and consulting services related to all aspects of disaster preparedness, disaster mitigation, loss reduction, and disaster management;*
- (d) *planning and implementing programmes to enhance public awareness and understanding of disaster related issues, emergency management, hazard prevention and other similar matters;*
- (e) *identifying and analyzing hazards or emergency situations and conducting related operational research into their effects;*
- (f) *establishing, maintaining and managing mutual assistance and co-operation agreements;*

The ODP is managed by a Board of Management which appoints a Director-General who is in charge of its day-to-day management and operations. The Board in turn reports to the Minister of Local Government and Works (formerly the Minister of Local Government, Youth and Sports) who gives general policy directions. The ODP carries out its objectives through its various sections, and through inter-related public and private sector agencies. Examples of this are the affiliates in the Parish Councils who are known as Parish Disaster Coordinators, and whose job it is to be responsible for disaster management in their own parish [Saunders, 1994].

Land information is of prime importance to the ODP. Land use information helps in the definition of high risk areas and the production of risk maps. Geologic data such as rock cover aids in the definition of areas of vulnerability. The organization is involved in small scale mapping of flooded areas but depends on other organizations with more resources to produce maps with greater detail. Saunders [1994] explains this when he says that:

*We do not have a large force of persons to actually do the detailed research that we need, so though we do some research ourselves we do a lot of information sharing with agencies such as the Geology and Geography Departments of the University of the West Indies [which produce maps] ... and from time to time we assist in funding them to do this type of work as we are end users of this information. You find that we do a lot of networking; for instance with the Underground Water Authority which is working on a flood mapping project - we use their flood maps for our work.*

Shortly after the tragedy of Hurricane Gilbert in 1988, the ODP acquired disaster management software: Emergency Information System (EIS) supplied by a firm in the United States. This software comes with a base map already digitized at a scale of 1:50,000. Overlaying of data on the base map may be done by EIS but no modification of the base map is allowed. Reporting aspects of EIS include a list of all resources available in a particular area to aid in disaster management, and input by staff of the ODP. The software is distributed among eleven Government entities who are networked via UHF

radios, and modems to download information unique to their individual functions [Saunders, 1994]. EIS runs on personal computers under DOS.

The need for dedicated computer personnel was identified by the Senior Director, Mitigation Planning and Research. However, consideration is being the question of whether the local installation of a GIS would prove more suitable; or whether access to some other system as an external user would prove to be a more feasible exercise [Saunders, 1994].

### **3.1.12 Underground Water Authority**

The Underground Water Authority (UWA) is part of the Ministry of Public Utilities and Transport. Before January 1995 the Authority was part of the then Ministry of Water and Transport. The Authority has responsibility for monitoring and regulating the use of Jamaica's surface and ground water resources [Government of Jamaica, 1994a]. The UWA's mandate is outlined in the *Underground Water Control Act* [1959]. A bill which will provide the legal framework for the UWA to carry out its mission and entitled the "Water Resources Act (1994)" is now ready for enactment by Parliament [Underground Water Authority, 1994]. In order to carry out its mandate, the UWA is expected to [Government of Jamaica, 1994a]:

- a. Monitor the stream flow, sediment and "aspects of surface and ground water quality."
- b. Interpret water quality data and use the information to aid decisions regarding policy revision.
- c. Analyze and interpret stream flow and well data in order to determine reliable yields of streams and safe yields from aquifers for water supply development.
- d. Provide watershed and flood plain boundaries for land use planning.
- e. Conduct public education from a water resources management perspective.

f. Participate in the design of gully control systems in the upper watersheds.

Discharge measurements of surface water are collected from 133 river gauging stations islandwide. Sixty of these river gauging stations are equipped with automatic recorders. In order to determine changes in ground water levels, data are collected from 1,802 wells. Approximately 100 sites are monitored in order to maintain information on the variability in the quality of critical water bodies [Underground Water Authority, 1994].

The UWA is the manager of a pilot automatic flood warning system for the Rio Cobre in the parish of Saint Catherine. The Rio Cobre is a major water source for the parishes of Saint Catherine, Kingston and Saint Andrew. Four self reporting rain gauges located in the upper watershed, and two remote river gauges transmit rainfall and river level data via radio signals which are relayed through two repeater sites to base stations in the Corporate Area. The remote weather stations are solar powered. Incoming signals are received, decoded and digitally processed at sites located at the UWA's office at Hope Gardens, the National Meteorological Services at the Norman Manley International Airport, and at the headquarters of the Office of disaster Preparedness.

Special software (HydroMet) running on an IBM 386 PC compatible under a version of DOS is used to process the data and provide real-time rainfall and stream flow data which is then combined with rainfall forecasts from the National Meteorological Services to predict flooding [Lawrence, n.d.]. Other land information products are flood risk and flood zone maps, and reports. Information produced by the UWA are used by both the public and private sectors including the National Water Commission, National Irrigation Commission, and private individuals using wells [Williams, 1994].

### **3.1.13 Natural Resources Conservation Authority**

The Natural Resources Conservation Authority (NRCA) is a statutory body established on June 5, 1991 under the provisions of the *Natural Resources Conservation*



*Authority Act (9)* of 1991 and is responsible for the management, conservation and protection of Jamaica's natural resources [Natural Resources Conservation Authority, n.d.]. A ten-member board supported by an Executive Director and a team of professional, technical, clerical and auxiliary staff manages the business of the NRCA. Among the items comprising the mandate of the NRCA [Government of Jamaica, 1994a] are those prescribing:

- a. The development and maintenance of data bases, information systems and maps covering all of Jamaica's natural resources.
- b. The development of land use plans for all natural resources including forest lands.
- c. The development of a system of regulations and laws that rationalize the control of all natural resources including forests.
- d. The conservation and enhancement of forests and cultural values within areas defined by the Government of Jamaica as National Parks.

Apart from the *Natural Resources Conservation Act* [1991], the legal mandate of the NRCA is also to be found in the *Beach Control Act* [1956], the *Wildlife Protection Act* [1945] and the *Watersheds Protection Act* [1964]. The NRCA is expected to effectively manage the physical environment of Jamaica, promote public awareness of the Jamaica's ecological systems; manage national and marine parks, protected areas and public recreational facilities; and to advise the Government on matters of general policy related to the management, development, conservation and care of the environment [Natural Resources Conservation Authority, n.d.]. Anyone who wishes to construct or develop property, especially as it relates to beaches, wetlands and watersheds, needs to apply to the NRCA for a permit.

A Cartography Unit produces and maintains analog maps created from stereoscopic equipment and aerial photographs. Digital hardware and software are in the process of being acquired. Thematic data maintained include land use changes and new developmental structures identified from aerial photographs. Other land information

maintained include habitat changes, pollution impact and data on flora and fauna, although these coverages may not be as complete as desired. Land data relevant to fishing and public bathing beaches are also managed [Miller, 1994].

The Centre for Nuclear Sciences (CNS), which does X-ray and radioactive analysis, is involved in pollution investigation and has digital data on areas sensitive to high levels of lead and other such pollutants. CNS is currently undertaking a project to analyze the soil composition of Jamaica, with the data to be stored digitally. The Conservation Data Centre has made some attempts to categorize, in digital form, information on critical Jamaican flora and fauna. Both of these entities are located at the University of the West Indies. Miller [1994] has sited the NRCA's need for some of the composite data held by these organizations to fill the gaps in the local data bank. Another need identified is the acquisition of digital hardware and software to manipulate and manage the NRCA's land information.

### **3.1.14 Statistical Institute of Jamaica**

The Statistical Institute of Jamaica is a statutory body established under the provisions of the *Statistics Act* [1949], and "all the functions of the organization are governed by this Act" [Simon, 1994]. According to its mission statement, the Statistical Institute of Jamaica aims for the provision of timely, cost effective, comprehensive, reliable and accurate statistical information which meets recognized international standards [Statistical Institute of Jamaica, n.d.]. The functions of the Institute include:

- a. Taking of all censuses in Jamaica.
- b. The collection, compilation, analysis and publication of statistical information to international standards and in accordance with the *Statistics Act* [1949].
- c. Collaborating with local, regional and international agencies to ensure that there is an integrated body of social and economic statistics for Jamaica.

- d. Representing the government of Jamaica at the local, regional and international levels in matters relating to the development of statistics.

The Institute is therefore mainly a data collecting and disseminating organization. Obviously, because of the nature of the organization, data is collected and disseminated nationwide though confidential personal information is not released. The basic statistical unit is the Enumeration District, which comprises approximately 150 to 180 households, in urban centers, but is a little less for rural areas because of population dispersion. Larger statistical units are the community and the constituency (adopted from the Electoral Office). Everything fits within the parish entity [Simon, 1994].

Maps are produced for the purposes of census and survey operations using the statistical units for the purpose of data collection. Survey Department base maps are used, on which census boundaries are then mapped. Maps are manipulated manually and digitally. Recently the Institute acquired ARC/INFO which is used to manipulate spatial data on an IBM 486 running under DOS. Usually maps are digitized at a scale of 1:50,000, but a scale of 1:12,500 is used for rural towns while scales of 1:10,000, 1:5,000, 1:2,500 are used for the Kingston Metropolitan Area. Some socio-economic mapping is being done based on census data, and some long term objectives such as re-districting are being pursued [Simon, 1994].

### **3.1.15 Urban Development Corporation**

The Urban Development Corporation (UDC) is a statutory entity established under the provisions of the *Urban Development Corporation Act* [1968] to ensure that urban development take place when and where it is most needed. Concerned with physical development, it complements the Town Planning Department but acts as the local planning authority only within its designated areas [Urban Development Corporation,

1983]. The UDC's functions are defined within the *Urban Development Corporation Act* [1968] and covers the:

- a. Acquisition, management and disposal of land both within and without its designated areas.
- b. Laying out, construction and maintenance of roads; construction and maintenance of buildings; and, performance of engineering operations relevant to its designated areas.
- c. Engaging in of such activities designed to promote the development of designated areas.

Before January 1995 the Board of Directors was appointed by the Minister of Finance and Planning who directed the operations of the UDC. Today the UDC reports to the Office of the Prime Minister. The administrative staff is headed by a General Manager and the UDC is expected to be self-supporting. The Corporation engages in land acquisition, development planning, primary infrastructure implementation, tourism and housing. Land acquisition projects are financed by the Government while projects for infrastructure and secondary development are financed by loans from commercial and international banking institutions [Urban Development Corporation, 1983].

Apart from land information in the form of ownership and land use the UDC maintains spatial data in the form of analog and digital maps. The digital spatial data is managed using AutoCAD running under UNIX on a SUN SPARC workstation acting as a Server, with two personal computers networked and used as terminals. Maps are ideally digitized at a scale of 1:12,500 but larger scales are used depending on availability. The institution is also in possession of the GRASS geographic information system obtained through the University of the West Indies and in the testing stage as the UDC's staff is not yet competent in its use [Grier, 1994].

### **3.1.16 Jamaica Bauxite Institute**

The Jamaica Bauxite Institute (JBI) was established by the Government of Jamaica in 1975 and registered as a limited liability company in 1976. Formerly operating under the then Ministry of Mining and Energy (before January 1995), the Institute now operates under the Ministry of Agriculture and Mining. The Institute functions as a regulatory, planning, research and development agency [Jamaica Bauxite Institute, 1992] providing "a wide range of studies, experiments, tests and other services for mineral and soil-related industries" [Jamaica Bauxite Institute, n.d.] but with the ultimate aim of securing Jamaica's bauxite reserves for future use [Gordon, 1994]. The following are included in the JBI's objectives:

- a. Monitoring, collating, reporting on information relating to the bauxite, alumina, aluminum and related industries.
- b. Researching into, and advising on the development of all phases of the industry.
- c. Exploring, evaluating and monitoring the bauxite resources in Jamaica, including geological and geochemical research; land and mine planning; and, mapping and cartographic services.
- d. Studying the conditions of any business concern, property, rights, etc. in the bauxite and alumina industries.
- e. Advising on social, economic, industrial, commercial and residential development in bauxite areas with emphasis on the impact the industry's activity will have on the environment.

The Government of Jamaica has a series of agreements with bauxite companies operating in the country, and these dictate the current objectives of the JBI. Through the Institute, the Government is obligated to make suitable deposits of ore available to the companies, thus enabling the companies to achieve their productive capacities over the tenure of the agreements. Also, the companies are able to meet their obligations under the

*Bauxite (Production Levy) Act* [1978], the *Income Tax Act* [1955] and the *Mining Act* [1947] ensuring that Jamaica earns revenue as levy, income tax and royalty. The Government has acquired varying levels of interests in the local operations of these companies and has pursued the re-acquisition of all the bauxite lands not immediately affected by mining and process operations [Jamaica Bauxite Institute, 1992].

An Executive Director heads a Board of Directors which manages the business of the JBI. Heads of Divisions report to the Executive Director [Jamaica Bauxite Institute, 1992]. The divisions of the JBI are:

- a. Bauxite Reserves, Land Use Planning and Environmental Management.
- b. Strategic Planning, Economics and Projects.
- c. Research and Development.
- d. Administration.
- e. Human Resource Development.
- f. Data Processing.
- g. Publications/Information Documentation Centre.

A Cartography Unit uses the mining lease signed between the Government of Jamaica and a particular mining company as the basic unit of work. Maps produced covers the occurrence, quantity and proximity of the ore to physical features, among other things. This means that the geology, hydrology, topology etc. of the island is covered and the maps are used to plan for future use of the ore. Map scales are normally 1:12,500 based on the Survey Department's base maps. Maps were originally created using the light table technique, but now AutoCAD is used to store maps in digital form. Also, because AutoCAD does not provide for the analytical procedures present in a GIS, the JBI has acquired PC ARC/INFO [Gordon, 1994]. The computer hardware possessed by the JBI include PCs, digitizing tables, and plotters.

### 3.1.17 Administrative Reform Programme

The Administrative Reform Programme (ARP) is a department of the Office of the Prime Minister. It is "the body designated by Central Government to carry out changes in procedures, methods and structures within the public sector with a view to modernizing them to achieve efficiency and customer service improvement" [Manley, 1994] among other things. The Executive Director of the ARP reports to the Cabinet Secretary and to the Inter-Ministerial Committee on Administrative Reform (IMCAR) which is chaired by the Prime Minister and which meets on a monthly basis.

With specific reference to information technology, the ARP is concerned with the adherence to standards. A directive from the Ministry of Finance requires all Central Government bodies acquiring computer hardware or software to communicate with the ARP and to gain approval for the purchase based on standards, but as Manley [1994] points out the ARP is not concerned with:

*highly detailed implementation of specific standards, but [with] rather trying to practically ensure that when money is spent on information technology that it is spent in a way that allows compatibility where required, so that you don't end up with totally diverse data structures that cannot talk to each other.*

Manley [1994] further points out that:

*This is always tempered by the reality that there are certain special purpose areas of which GIS is one, where for performance reasons what you would consider a standard operating environment might not be the ideal choice.*

Therefore the ARP's interest in systems like Geographic Information Systems "only occurs because there will be instances when GIS systems [sic] need to communicate with other Government systems ... using common hardware, or common networks, or using an existing network to share information" [Manley, 1994]. The assumption then is that any Government entity purchasing a GIS knows what it wants and will get what it wants; the

ARP will therefore only make comments about how the system will fit in with other systems with which it will have to communicate.

The standards used includes those like UNIX TCP/IP, an open systems approach which allows computer equipment manufactured by different vendors to communicate with each other. This was not the case when the ARP started, but the organization tries to apply generally accepted open systems standards [Manley, 1994].

### **3.1.18 Land Development and Utilization Commission**

The Land Development and Utilization Commission (LDUC) functions under the provisions of the *Land Development and Utilization Commission Act* of 1966, and is basically concerned with ensuring that lands with areas over 100 acres (40.47 Hectares) are utilized in a productive manner whether by private owners or Government tenants. The job of the Commission is to encourage the owners, or tenants, to develop the properties with crops, livestock or both. Each unit is monitored on an annual basis; if the unit remains idle after continuous inspection, steps are taken to acquire it under the provisions of the *Land Acquisition Act* [1947] through the Commissioner of Lands. The land is then dealt with under current land policy [Richardson, 1994].

The business of the Commission is directed by a five-member board headed by a Director. The Director reports to the Director of Technical Services at the Ministry of Environment and Housing, who in turn reports to the Permanent Secretary. Before January 1995, the Director reported to the Director of Technical Services in the then Ministry of Agriculture. Staff includes a legal officer, land use officers, land use assistants, a statistician and a surveyor [Richardson, 1994].

Land information maintenance is entirely manual. Maps on all areas and properties in Jamaica are maintained by the LDUC. These show parcel polygons and thematic data such as land use, ownership, area and the mining status of bauxite related lands.



Additionally, paper folder files are kept for each property. Standard forms storing such data as location, owner's name, rainfall pattern, metes and bounds description, and directions to reach the property are used. Land utilization reports are used by the Land Administration Division, Land Valuation Department and private lawyers [Richardson, 1994].

### **3.1.19 Local Government Authorities**

The local government authorities (LGA) include the Kingston and Saint Andrew Corporation and the twelve Parish Councils. LGAs are managed by the Ministry of Local Government and Works (formerly the Ministry of Local Government, Youth and Sport), and play a major part in land management and land information management in Jamaica. LGAs are empowered to buy and sell land, and the lands that are owned are used as cemeteries, infirmaries, markets, parochial roadways and monument locations [Myers, 1994]. The LGAs are charged with, among other things:

- a. Providing adequate and efficient road communication throughout the parishes.
- b. Providing adequate market facilities throughout the parishes in order to accommodate itinerant vendors.
- c. Improving and maintaining civic amenities throughout the island.
- d. Complying with the provisions of the local government laws.

The Mayors of all capital cities and towns are also the chairpersons of the LGAs. The Mayors report to the Minister of Local Government and Works, and in turn have the Secretary/Managers who report to them. The governing laws include the *Kingston and Saint Andrew Corporation Act* [1931] and the *Parish Councils Act* [1901] [Myers, 1994].

All land information are currently stored in paper folders and books. The LGAs were supposed to have computers installed under the Local Government Reform

Programme, but to date that has not been done, perhaps as a result of the lack of funds [Myers, 1994].

### **3.1.20 Island Record Office**

The Island Record Office (IRO) is part of the Registrar General's Office which in turn is part of the Ministry of Health. The IRO is responsible for the recording and safekeeping of such documents as Deeds (Common Law Titles), Bills of Sale, Deed Polls, Powers of Attorney, Supreme Court and Resident Magistrate Courts Wills, and partnership documents of certain types. There are records of documents going back to the 1600s. The Office is headed by the Deputy Keeper of the Records who is also the Registrar General for the General Register Office where births, deaths and marriages are registered. The Chief Justice has the title of Keeper of the Records [Brown, 1994]. The author of this thesis has not been able to ascertain why this organization is part of the Ministry of Health and not some other more logical institution (e.g. the Ministry of Environment and Housing).

The information system is entirely manual and copies of documents are bound and kept in "Lifers," according to document type. The treatment of each type of document is governed by a separate law (e.g., the *Bills of Sale Act* [1867] and the *Conveyancing Act* [1889]), but the Island Record Office is administered under the *Record Office Act* [1879] [Brown, 1994].

### **3.1.21 National Water Commission**

The National Water Commission came into being in 1980 as an amalgamation of the then Kingston and Saint Andrew Water Commission and the National Water Authority. In 1985 it took over the water supply functions of the Parish Councils

operating under the National Water Authority, and so became the sole body responsible for the production and distribution of water islandwide [Burgess, 1994]. The relevant law is the *National Water Commission Act* [1980]. According to the mission statement of the National Water Commission its aim is to:

- a. Efficiently provide and distribute potable water.
- b. Safely collect, treat and dispose of waste-water at the lowest possible cost, consistent with long-term viability.
- c. Provide a reliable supply of water, at affordable costs, to all consumers and to maintain good conditions of employment.

Lands for waterworks or sewerage purposes are vested in the Commissioner of Lands. Lands managed comprise both those registered under the *Registration of Titles Act* [1889] and those transferred by Deeds. A manual listing of the description of relevant lands is maintained. City maps showing water pipe lines are maintained by a fully equipped drawing office. All drawings are presently done manually [Burgess, 1994].

It is recognized that a GIS would prove to be of great utility in the management of plans relating to land parcels and water pipe lines. ARC/INFO, specially designed applications and SUN workstations were purchased but not yet commissioned into service [Burgess, 1994].

### **3.1.22 Jamaica Public Service Company Limited**

The Jamaica Public Service Company Limited (JPSCo) is currently the monopoly with the responsibility for supplying electrical power to Jamaica. JPSCo is a public company that is 99% owned by the Government of Jamaica [Durrant, 1994].

Land Management is a secondary aim to the company as far as its information system program is concerned. The primary aim of its information system is the maintenance of records relevant to its electrical infrastructure which is the means by which

electrical power is distributed. The targets are the power lines which comprise their primary distribution system. Land management is done in relation to parcels used to locate electrical equipment; and data items such as location, land use, and land tenure such as easements from private individuals and ownership are stored [Durrant, 1994].

Survey Department base maps are used as a basis for the manipulation of spatial data using an AM/FM system supplied by a Canadian firm, Graphic Systems Incorporated. The software runs on IBM RISC 6000 workstations under IBM AIX which is a UNIX based operating system environment with OSF Motif graphic user interface. Other hardware include color plotters and digitizing tables [Durrant, 1994]. JPSCo has placed an order for ARC/INFO software [Clarke, 1994].

As far as data sharing with other entities are concerned there appears to be support, especially in recognition of the contribution that can be made in supplying statistical data on the availability of electricity to support planned infrastructural expansion. However, the question of the privacy of confidential data in a shared-data environment is a concern to JPSCo, motivated by fears of possible sabotage of electrical installations [Durrant, 1994].

### **3.1.23 National Housing Trust**

The National Housing Trust (NHT) is the final LIM organization that will be described. The NHT was established by the Government of Jamaica in 1976 to improve the "Housing Stock and Morale of Jamaicans" [National Housing Trust, n.d.], placing emphasis on low income earners. According to public relations material, the three main functions of the NHT are to:

- a. Finance housing projects.
- b. Make loans available to contributors to build, purchase, maintain or improve their own homes.

c. Encourage and stimulate improved methods of housing construction.

The Board of Directors which administers the NHT is comprised of members chosen from the Government in power at the time, NHT workers, the Private Sector Organization of Jamaica (PIOJ), and from among the trade unions.

NHT project and operational funds are raised from what are described in law as "special contributions" from employers and employees; loans which it may raise with the approval of the Minister of Finance; "its earnings, funds provided by Parliament, and other lawfully derived funds." [National Housing Trust, n.d. (a)] The "special contributions" paid to the NHT by employers and employees, along with earned bonuses, are returned to the contributors at times prescribed in NHT regulations. The NHT is expected to meet its expenses from its own income even though funds may be voted to it by Parliament. The Trust is exempt from income tax, property tax and transfer tax.

It is required of persons who have been selected to be recipients of "Build-on-own Land" or "Home Improvement" loans to provide proof of ownership of their holdings. They may provide a registered Certificate of Title under the *Registration of Titles Act* [1889], a "Common Law Title" (registered deed) which is actually a deed of the transfer of rights in land, or a Certificate of Compliance issued under the *Facilities for Titles Act* [1955] [National Housing Trust, n.d. (b)]. Persons who receive housing benefits on NHT's housing projects have Certificates of Title prepared for them by the Trust, in due course.

The NHT possesses an IBM 9221 mainframe running VSE ESA 121, and several LANs running Novelle 3.1. The mainframe is the central computer in a network whereby NHT branches are linked via telephone lines and modems. The branches have IBM PCs, and workstations installed [Ranger, 1994].

## **3.2 Private Companies with Potential to Support Jamaica's LIM Objectives**

Two private sector organizations that can figure positively in Jamaica's land information management are Telecommunications of Jamaica (TOJ) and Mona Informatix Limited (MI). The functions and capabilities of these companies are described in the following sub-sections.

### **3.2.1 Telecommunications of Jamaica**

Telecommunications of Jamaica (TOJ) has a monopoly for providing both local and international telecommunication services in Jamaica, including [Chambers, 1994]:

- a. Local and international telephone services.
- b. Local and international telegraph and cable services.
- c. Local and international cellular telecommunications services.
- d. Local and international packet switching services.
- e. Computer data links.

TOJ provides local and international telecommunications services to the island. TOJ's communications network is totally digital and is physically linked by optical fiber cables and microwave transmission sites encompassing the whole island. There is also an under-water optical fiber link to the United States of America via Florida. Most of the overseas transmissions go via satellites [Chambers, 1994].

TOJ has a Wide Area Network, physically linked by optical fiber cables, with which it intends to cover the whole island. Local relevant data communications services provided by TOJ include [Chambers, 1994]:

- a. Dial-up lines that facilitate transmission over the public network at rates of 9.6 Kbps, 19.2 Kbps and 28.8 Kbps.

- b. Leased digital lines that can accommodate LAN-LAN connectivity and that supports transmission rates up to 1.544 Mbps (T1).
- c. Packet-switched services (IEEE X.25).

TOJ uses land in much the same way as the other utility companies: as location sites for equipment and stations. All land records are manual at present. Cable records however are managed using MicroStation CAD system running on a DEC VAX platform, networked to Calcomp PCs [Richmond, 1994]. TOJ's telecommunications services will prove to be invaluable if GOJ is to set up a data network linking its LIM agencies, as is one of its objectives described in Chapter 4.

### **3.2.2 Mona Informatix Limited**

Mona Informatix Limited (MI) is a private company established by the University of the West Indies in 1992. Currently Mona Informatix provides conversion services for entities involved with CAD, AM/FM, and GIS. A wide range of raster formats is supported, and conversion of hard-copy drawings for the government organizations, industrial, mechanical and electrical engineering business entities, and utility companies is done [Mona Informatix Limited, n.d.].

The company has a large installed computer base and some very sophisticated technology. This technology is worth over seven million United States Dollars (US\$7,000,000.00) [Mona Informatix Limited, n.d.] and includes such equipment as:

- a. A Convex 3440 supercomputer.
- b. Networked SUN SPARC 10s.
- c. Networked PC 486 DXs.
- d. Alphanumeric terminals.
- e. Digitizing tables.
- f. Calcomp Gray Scale Scanners.

- g. An ink jet plotter.
- h. A high resolution plotter.
- i. Laser printers.
- j. Bar-code readers.

Major software products used include:

- a. ESRI ArcCAD.
- b. Image Systems Rasterware.
- c. AutoCAD 11 and 12.
- d. Grass 4.0.
- e. IGS CADCore Tracer for UNIX.
- f. IGS CADCore Tracer Recognizer for PCs.
- g. Arbour Images.
- h. Oracle RDBMS.
- i. Calcomp SCANPLUS.
- j. Advent Imager for Scanplus 70836.
- k. Spicer.

The Convex supercomputer is actually owned by the University of the West Indies and MI leases time on it. The Convex has 1 GigaByte (GB) of random access memory, and 28 GB of secondary disk storage which is expandable. The operating system is Berkeley UNIX and any system that runs File Transfer Protocol (FTP) can be connected with it. Non-UNIX machines, like a personal computer, may interface with the Convex as a dumb terminal, or have an IP address assigned which will allow the Convex to treat these machines as UNIX boxes [HoSue, 1994].

The first successful Fiber Distributed Data Interface (FDDI) LAN in Jamaica has been installed at the University of the West Indies by MI. This fiber optic network system has a band width of 100 Mega-Bits per second, and the Convex is connected to it. Each of the University's departments' Ethernet LAN, which are comprised of Macintoshes, IBM



compatible PCs and UNIX RISC boxes, are connected to this Token Ring topology by spurs and routers [HoSue, 1994].

Finalization of an Internet link through New York is ongoing and Mona Informatix is looking into selling Internet services. Some major implications of this include the international marketing of local products, and the setting up of a health network through which participating health facilities may do referrals and diagnosis [HoSue, 1994]. Other implications include the obtaining of spatial products that may have impact on the local land information management operations. The potential of MI lies in the use of the company's expertise and equipment, especially the supercomputer which possesses enormous processing and storage capabilities.

### **3.3 Recent GOJ Changes and their Impact on Jamaica's LIM**

GOJ has on many occasions made changes to ministries, agencies and departments. There have been various motives for the changes including administrative reorganization for efficiency of functions, among other things. This section examines the changes that were made by GOJ in January 1995 and which affected Jamaica's LIM organizations described in the previous sub-sections. The aim of this examination is to reveal the extent to which the changes have impacted upon the efficiency of Jamaica's LIM environment.

Tables 3.1 and 3.2 show the meaning of the acronyms used to identify the agencies and ministries, respectively, as they were before January 1995. Figure 3.1 shows the general function of each organization. Figure 3.2 shows the relationships between ministries and agencies as they were before January 1995. Tables 3.3 and 3.4 show the meaning of the acronyms used to identify the agencies and ministries, respectively, as they are today. Figure 3.3 shows the relationships between ministries and agencies as they have been since January 1995.

**TABLE 3.1**  
**ACRONYMS RELATING TO LIM AGENCIES BEFORE JANUARY 1995**

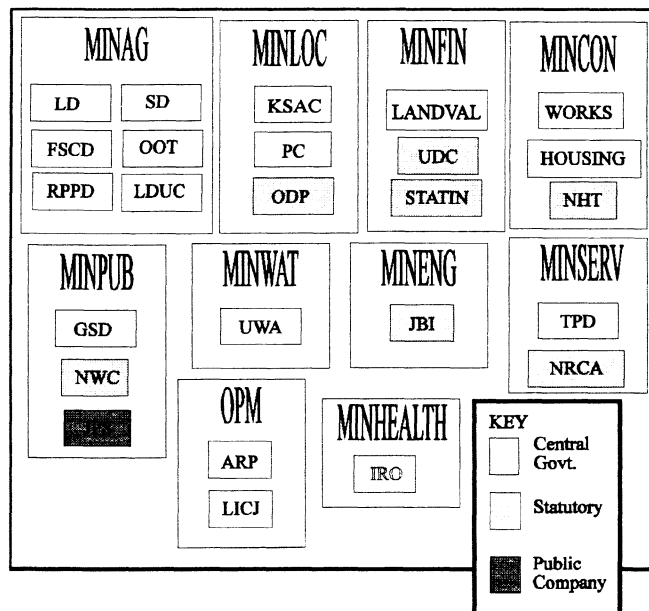
<b>ACRONYMS</b>	<b>ORGANIZATION</b>
ARP	Administrative Reform Program
FSCD	Forestry and Soil Conservation Department
GSD	Geological Survey Department
HOUSING	Ministry of Construction (Housing)
IRO	Island Record Office
JBI	Jamaica Bauxite Institute
JPS	Jamaica Public Service Company Limited
KSAC	Kingston and Saint Andrew Corporation
LANDVAL	Land Valuation Department
LD	Land Administration Division
LDUC	Land Development and Utilization Commission
LICJ	Land Information Council of Jamaica
NHT	National Housing Trust
NRCA	Natural Resources Conservation Authority
NWC	National Water Commission
ODP	Office of Disaster Preparedness
OOT	Office of Titles
PC	Parish Council(s)
RPPD	Rural Physical Planning Division
SD	Survey Department
STATIN	Statistical Institute of Jamaica
TPD	Town Planning Department
UDC	Urban Development Corporation
UWA	Underground Water Authority
WORKS	Public Works Department

**TABLE 3.2**  
**ACRONYMS RELATING TO MINISTRIES BEFORE JANUARY 1995**

<b>ACRONYMS</b>	<b>MINISTRY</b>
MINAG	Ministry of Agriculture
MINCON	Ministry of Construction
MINFIN	Ministry of Finance and Planning
MINHEALTH	Ministry of Health
MINLOC	Ministry of Local Government, Youth and Sports
MINPUB	Ministry of Public Utilities, Mining and Energy
MINSERV	Ministry of Public Service and Environment
MINWAT	Ministry of Water and Transport
OPM	Office of the Prime Minister

	HOUSING	CONSERVATION	LAND USE	LAND TENURE	LAND ADMIN.	TAXATION	DEMOGRAPHICS	MINERAL MGMT.	INFRASTRUCTURE	DISASTER MGMT.	TOPOGRAPHY	HYDROLOGY	SURVEYING	MAPPING
LD			•	•						•			•	•
SD											•	•	•	•
OOT				•	•									
FSCD			•							•				•
RPPD			•								•		•	•
LDUC			•	•									•	•
LANDVAL			•	•		•	•						•	•
UDC	•		•	•					•	•			•	•
WORKS			•						•	•			•	•
HOUSING	•		•										•	•
ARP													•	•
GSD		•	•					•		•			•	•
ODP		•	•				•		•	•			•	•
KSAC/PC	•		•	•			•		•	•			•	•
JBI		•	•	•				•		•			•	•
TPD			•				•		•	•			•	•
UWA		•	•						•	•		•		•
IRO				•	•									
STATIN			•				•							•
NRCA		•	•				•	•		•				•
NWC		•	•				•			•		•		•
NHT	•		•	•					•					•
JPS			•				•		•	•				•
TOJ			•				•		•	•				•
MI														•

**Figure 3.1**  
*General functions of LIM organizations*



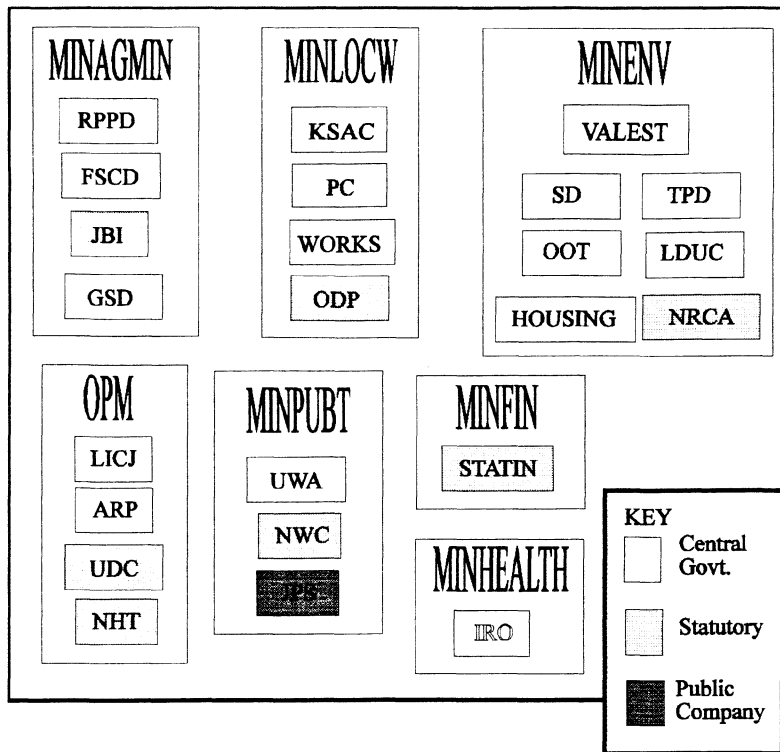
**Figure 3.2**  
*Relationships between ministries and agencies before January 1995*

**TABLE 3.3  
ACRONYMS RELATING TO LIM AGENCIES SINCE JANUARY 1995**

<b>ACRONYMS</b>	<b>ORGANIZATION</b>
ARP	Administrative Reform Program
FSCD	Forestry and Soil Conservation Department
GSD	Geological Survey Department
HOUSING	Housing Division
IRO	Island Record Office
JBI	Jamaica Bauxite Institute
JPS	Jamaica Public Service Company Limited
KSAC	Kingston and Saint Andrew Corporation
LDUC	Land Development and Utilization Commission
LICJ	Land Information Council of Jamaica
NHT	National Housing Trust
NRCA	Natural Resources Conservation Authority
NWC	National Water Commission
ODP	Office of Disaster Preparedness
OOT	Office of Titles
PC	Parish Council(s)
RPPD	Rural Physical Planning Division
SD	Survey Department
STATIN	Statistical Institute of Jamaica
TPD	Town Planning Department
UDC	Urban Development Corporation
UWA	Underground Water Authority
VALEST	Land Valuation and Estate Department
WORKS	Public Works Department

**TABLE 3.4  
ACRONYMS RELATING TO MINISTRIES SINCE JANUARY 1995**

<b>ACRONYMS</b>	<b>MINISTRY</b>
MINAGMIN	Ministry of Agriculture and Mining
MINENV	Ministry of Environment and Housing
MINFIN	Ministry of Finance and Planning
MINHEALTH	Ministry of Health
MINLOCW	Ministry of Local Government and Works
MINPUBT	Ministry of Public Utilities and Transport
OPM	Office of the Prime Minister



**Figure 3.3**  
*Relationships between ministries and agencies since January 1995*

An examination of the changes made by GOJ to ministries, departments and agencies (i.e. those about which we are concerned) reveals that a number of things have happened. They include the fact that:

- a. Some ministries have had new responsibilities defined for them and consequently have had name changes and new departments and agencies affiliated with them.
- b. Some ministries with new defined responsibilities have not had name changes but have had new departments and agencies affiliated with them.
- c. Some ministries have been eliminated while at least one new ministry has been created.
- d. Most departments or agencies, while shifted from one ministry to another, have not had their physical location, main objectives, functions, organizational

structures or names changed. The departments and agencies continue to function as before.

- e. Two departments, namely the former Lands Department and the former Land Valuation Department, have been administratively merged thereby creating a new department called the Land Valuation and Estates Department. This change has had only minimal effect on the main objectives, functions and internal organizational structures of the two former departments and each organization continue to function as before.

One can glean from the actions of GOJ, as mentioned above, that some attempt is being made to have the departments and agencies logically grouped for administrative purposes. This is good. Yet even in this regard one example stands out as defying that logic: the IRO which manages the island's deed (Common Law Title) registry among other things. The new Ministry of Environment and Housing has land registration defined as one of its responsibilities yet the IRO remains accountable to the Ministry of Health. Consideration should have been given to have the land related functions of the Island Record Office placed under the Ministry of Environment and Housing.

Also, it is clear from the changes described above that the departments and agencies continue to function as before. It could not be ascertained by the author of this thesis whether any changes to departmental functions and structures were planned for implementation in the near future. Therefore, Jamaica's LIM situation basically remains the same as it was before January 1995 when most of the changes were made. This means that the problems attendant with the departments' and agencies' structure and functions remain. The problems faced by GOJ's LIM organizations include:

- a. A bureaucracy that features a slow pace of administration and business transactions, which leads to a lack of confidence in the system by support services and suppliers.

- b. Low staff morale caused by protracted wage freezes dictated by external funding agencies, such as the International Monetary Fund (IMF), and by Governmental budgetary constraints.
- c. Personnel procurement problems leading to agencies being generally short staffed or under-staffed.
- d. Generally low educational levels of staff.
- e. A critical shortage of geographic information management specialists and skilled operational staff.
- f. High turnover rates and consequent loss of procedural knowledge.
- g. Inability to attract or keep qualified personnel because of low remuneration, inadequate organizational structures, and systems that mostly link upward mobility to years of service.
- h. Difficulty in compiling basic inventories of land assets as a result of a lack of knowledge about, and inaccessibility of, existing data stores.
- i. Sub-optimal land-use decision-making as a result of inadequate geographic data.
- j. Inadequate mechanisms that do not facilitate inter-agency sharing of information which leads to costly duplication of data collection and storage efforts.

Problems have causes, and *themselves* cause more problems. If these causes are understood the chances of finding solutions are good. The problems affecting Jamaica's human and technical resources, and organizing procedures (Jamaica's land information systems) are rooted in the country's historical, social, political and economic development, which also define the population's attitude towards work and technology.

It has already been established that GOJ is the major player in Jamaica's LIM. It has also been outlined in Chapter 1 how the poverty of the majority of the population has, along with current inadequate organizational structures, produced a public sector work force of generally less than desirable educational levels and competence. The structure and procedures of current Government bureaucracy has its roots in colonial history, and

the attending regulations (eg., staff orders) define the way the work force thinks and operates. It is this combination of inefficient work force and outdated bureaucracy that produces inefficient Government systems and negatively affects GOJ's LIM.

To solve the apparent inefficiencies, GOJ has over the years trained staff, implemented projects, created and reshuffled statutory agencies and public companies, and reshuffled the responsibilities of ministries (as described above). What it has not done is change the basic structure of the public service bureaucracy. The result has generally been that:

- a. Staff become unmotivated and lax, or migrate to more lucrative employment in the private sector (or abroad) after being trained because they generally return to structures that are inadequate to make full use of obtained skills. Trained staff sometimes find that Government bureaucracy is unable (or unwilling) to financially reward academic success and instead award upward mobility based on years of service.
- b. Although projects produce specific improvements in procedures (because of equipment acquisition, temporary unit creation, increased cash flow etc.) and staff morale (because of higher salaries, training opportunities etc.) they are by nature temporary and upon their completion things usually return to what they were.
- c. Although statutory agencies and public companies generally pay better salaries than Central Government organizations and are more efficiently organized, their efficiency is often negatively affected because they depend on inefficient Central Government entities for information and cooperation in many instances.

From this analysis it seems apparent that Central Government bureaucratic structures are the generators of administrative problems affecting Jamaica's LIM organizations. The efficiency of Central Government entities would improve if the limited finances of the country were spent to systematically re-engineer the dated bureaucratic structures and processes instead of reshuffling ministries, agencies and departments, or



adding layers of statutory institutions that depend on inefficient Central Government systems. Therefore, since the basic bureaucratic structure of the public sector was not affected by the recent changes of January 1995, the changes have had minimal impact upon Jamaica's LIM situation.

### **3.4 Jamaica's Problems Related to the Provision of Land Information**

Jamaica's LIM organizations are expected to provide accurate, complete, up-to-date and timely land information upon request. Land information clients of any Government agency normally include the public at large, the private sector, and other Government bodies. It has been pointed out that some Government entities have problems collating land information for use by these clients because of the inefficiencies of current manual systems. Many of them do not seek to reorganize manual processes or implement automated solutions because "they do not see the provision of information as a key function of Government institutions" [Rammelaere, 1994]. Others are genuinely stymied by the bureaucracy, financial constraints, or a lack of knowledge of the potential of automated solutions. This lack of understanding of technology potential is underscored by Manley [1994] who states, in relation to the under use of MI's CONVEX supercomputer:

*You have a potential there that could solve a lot of problems in one fell swoop with an intelligent approach to wide area networking, use of resources and acquisition of software ... It cannot make sense to be sitting down on hardware like that with a certain amount of expertise on hand at that site and the potential to tap into vastly more expertise through that university and its relationship to other universities. It must make sense to find a way to exploit that, because it is going to cost less.*

Tonkin et al. [1992] also supports the logical use of a supercomputer by stating that the "high cost of supercomputers means several organizations in different locations must share

access to a single supercomputer." Similar problems exist with more modest computer technology.

Computer technology has increasingly been applied within LIM for many years now in order to increase the efficiency of the output and management of land information. This is evidenced in Jamaica by the presence of a number of digital land related databases that have been established. However, data comparison and cross-correlation is severely hindered by the several non-standardized land records reference systems and map scales which are operated across agencies (Table 3.5). The databases include:

- a. The topographical database constructed by the Survey Department.
- b. The digital textual database of the Land Valuation Division with the graphical component being constructed by the Survey Department.
- c. The digital soils database of the Rural Physical Planning Division.
- d. The environmental database being constructed by the Centre of Nuclear Studies.
- e. The socio-economic databases being developed by the Planning Institute of Jamaica and the Statistical Institute of Jamaica.
- f. The Utility Data Management Systems being developed by the Jamaica Public Service company and the National Water Commission.

**TABLE 3.5**  
**COMMON LAND-RELATED IDENTIFIERS WITHIN THE PUBLIC SECTOR**  
**(After Government of Jamaica/ UNDP, 1989)**

<b><u>IDENTIFIER</u></b>	<b><u>GENERATOR</u></b>
Street Address	Urban Municipal Authorities
Volume/Folio	Office of Titles
Valuation Number	Land Valuation Department
Farm Number	Data Bank and Evaluation Division
Lot/DP/Property	Office of Titles
SD Examination Number	Survey Department
Parish/Property/Lot	Survey Department/ Lands Department
National Grid Centroid	Survey Department
Liber Series Number	Island Record Office
District Number/P.O.	Community/Post Office
1 Km Grid Square	Jamaica Defence Force
1/4 Hectare Grid Cell	Rural Physical Planning Division

These digital databases are accessed through a variety of computer hardware in varying degrees of connectivity (Figure 3.4), operating systems (Figure 3.5), software capable of processing spatial and text data (Figure 3.5), and database Management Systems (Figure 3.5). Hardware and software technology has however been constantly changing while organizations have committed themselves and their data to one or another technological solution at various intervals along this time line. The result is a number of automated solutions that differ in *standards* of data models, data structure, data quality, spatial reference keys, hardware platforms and software solutions. This lack of standards inhibits the efficient sharing of digital data among organizations that are required to share information as part of their normal functioning [Government of Jamaica, 1994b].

	PC OR CLONE	SUN WORKSTATION	IBM WORKSTATION	IBM MAINFRAME	DEC VAX	CONVEX 3440	PRINTER	PLOTTER	DIGITIZER	ETHERNET LAN	TOKEN RING LAN	MICROWAVE LAN	FDDI LAN	WAN
LD	•	•					•	•	•	•				
SD	•	•					•	•	•	•				
OOT	•	•					•	•	•	•				
FSCD														
RPPD	•	•					•	•	•	•				
LDUC														
LANDVAL					•									
UDC	•	•					•	•	•	•				
WORKS	•						•							
HOUSING														
ARP	•													
GSD	•						•	•	•					
ODP	•						•					•		
KSAC/PC														
JBI	•						•	•	•					
TPD	•						•	•						
UWA	•						•					•		
IRO														
STATIN	•						•	•	•					
NRCA														
NWC		•								•				
NHT	•		•	•			•				•			
JPS			•				•	•	•		•			
TOJ	•				•		•	•	•					•
MI	•	•				•	•	•	•		•		•	

**Figure 3.4**  
*General hardware configuration of the LIM organizations*

	PAPER FILES	ANALOG MAPS	PROPRIETARY LIS/GIS	ARC/INFO	ARC/CAD	AutoCAD	MicroStation	GRASS	ERDAS	DOS	UNIX	IBM AIX	VSE	VMS	NOVELL	DbaseX	Informix	Oracle	Other
LD	•	•		•						•	•					•	•		•
SD	•	•		•			•			•	•						•		
OOT	•	•		•						•	•						•		
FSCD	•	•																	
RPPD	•	•	•	•					•	•	•								•
LDUC	•	•																	
LANDVAL	•	•	•											•					•
UDC	•	•				•		•		•	•								•
WORKS	•	•				•				•									•
HOUSING	•	•																	
ARP																			
GSD	•	•				•				•									•
ODP	•	•	•							•									•
KSAC/PC	•	•																	
JBI	•	•		•		•				•									•
TPD	•	•			•					•									•
UWA	•	•	•							•									•
IRO	•	•																	
STATIN	•	•		•						•									•
NRCA	•	•																	
NWC	•	•		•						•	•								
NHT	•	•											•		•				
JPS	•	•	•	•							•	•							•
TOJ	•	•					•					•							•
MI					•	•		•			•							•	•

*Figure 3.5  
Manual and software configuration of the LIM organizations*

### 3.5 Summary

The Government is the main source of land information with an estimated 60 organizations that have responsibility for some aspect of land. All areas are apparently dealt with including land use, land tenure, natural resource conservation, demographics, infrastructure, taxation, topography, utilities, soils and minerals. Over 80 percent of Government's administrative decisions impact upon the land in some way.

Government land information systems are either totally manual, digital or a combination of both. The manual systems are inefficient at best, being severely affected by cumbersome paper folders, archaic filing systems, and Government bureaucracy. Digital systems vary in hardware and software standards. There exists a number of databases in varying stages of development, all using different keys to reference land records. The result of this inefficiency and heterogeneity, as it currently exists, is the difficulty experienced by Jamaican LIM organizations in sharing land information and providing their clients with information that is timely, up-to-date, accurate and complete.

In January 1995, GOJ made some changes which affected most, if not all, LIM organizations in terms of their relationships with various ministries. These changes had little impact on the efficiency of Jamaica's LIM.

Two private sector organizations that can figure positively in Jamaica's land information management are Telecommunications of Jamaica (TOJ) and Mona Informatix Limited (MI). TOJ provides local and international telecommunications services to the island and is the potential source for telecommunications services in the event of the establishment of a national data network to support LIM. MI possesses a Convex 3440 supercomputer that can be utilized in the processing of land information in Jamaica. MI currently provides conversion services for entities involved with CAD, AM/FM, and GIS.

## CHAPTER 4

### **CURRENT LAND INFORMATION MANAGEMENT: LIM Projects, Objectives and Policies**

#### **Introduction**

This chapter continues to describe the current LIM situation in Jamaica, but with the focus on GOJ's efforts at implementing projects, programs and land related policies in order to achieve its LIM objectives. The aim of the chapter is to identify the direction in which Jamaica wants to go in terms of LIM and to specify the requirements necessary in order to attain the country's LIM objectives. This is essential since the objective of this thesis is to design a model to re-engineer LIM in Jamaica according to a stated set of GOJ's objectives described in Section 4.3. The factors that may constrain the achievement of the identified LIM objectives are also examined.

#### **4.1 Land Titling Projects**

Centuries of struggle by the Jamaican poor under plantation and colonial systems that deprived them of land or relegated them to small marginal hillside holdings, have resulted in a very strong socio-cultural meaning being attached to the freehold ownership of land. Since the 1860s land settlement programs have been implemented as a response to "a variety of social pressures focused on the supply of land for housing and for agricultural production" [Government of Jamaica/United Nations Development Programme, 1989].

These land settlement programs have been the responsibility of the Land Administration Division (formerly the Lands Department) which in conjunction with the Survey Department and the Office of Titles issue Certificates of Title for the small farmers

involved. Typically, small farmers who are beneficiaries under land settlement schemes are given 25 years to pay the purchase price of their allotments which have an average size of 5 acres (2 hectares) [Ministry of Agriculture, 1991]. The Government shares in some of the legal costs incurred in producing the Certificate of Title, and in the provision of basic services such as roads, water and electricity. Until 1978 approximately 56,000 allotments were made but only about 20,000 settlers had received Certificates of Title [Robbins, 1990]. This inefficiency was attributed to a lack of resources available to the three responsible departments; and to inadequate procedures. To date an estimated 32,500 settlers have yet to receive their title [Clarke et al., 1991].

In order to rectify this situation, the Government of Jamaica, in accordance with external funding agencies, has embarked upon a number of land titling projects. In December 1988 a Land Titling and Land Information Project was instituted, jointly funded by the Government of Jamaica and the United Nations Development Programme (GOJ/UNDP). The Land Administration Division, Survey Department and Office of Titles were the target departments of this project. Three complementary actions were defined as a solution to the land titling problems [Government of Jamaica/United Nations Development Programme, 1989] and include:

- a. Carrying out field surveys and adjudication exercises to resolve ownership issues and define the area and extent of land parcels.
- b. Improving the processing and recording of vital land information, streamlining office procedures and upgrading staff skills in relation to modern office systems and automation.
- c. Introducing a computerized land information system complete with computer based property mapping.

The GOJ/UNDP project succeeded in, among other things:

- a. Commencing staff training in all three departments, especially focusing on limited computer exposure.

- b. Installing two personal computers and accounting application software in the Land Administration Division.
- c. Installing a personal computer in the Office of Titles along with application software to track submitted documents and index titled properties.
- d. Setting up two project units in the Survey Department, namely the Land Information System Unit and the CADMAP unit.
- e. Installing two personal computers, PC ARC/INFO and digitizing facilities in the Land Information System Unit.
- f. Making recommendations for further project-intensive activities to affect the three departments.

Continuing where the GOJ/UNDP project ended, a Government of Jamaica/Inter-American Development Bank (GOJ/IADB) Land Titling Project designed to run for four years was commenced in September 1989 [Government of Jamaica/United Nations Development Programme, 1989]. The effort to clear the backlog of land settlement titles has been broken into two phases [Robbins, 1990]:

- a. Phase I, where 12,000 parcels for which there is already adequate infrastructure to meet subdivision requirements (such as roads, domestic water and electricity) will be dealt with.
- b. Phase II, targeting 24,000 parcels that lack the necessary infrastructure for official subdivision.

It is estimated that Phase I will cost J\$402,000,000 (US\$58,000,000) over 10 years. The estimation includes the costs for the initial establishing of infrastructure and its maintenance over 10 years, "technical assistance, and building up the capacity of extension services aimed at farmer-beneficiaries" [Robbins, 1990]. Phase I of the project was extended to September 1994 and Phase II is still in the negotiation stage. The GOJ/IADB project has to date succeeded in, among other things:



- a Issuing in excess of 10,000 titles to small farmers under the Land Settlement Scheme.
- b Hiring additional staff, and training staff in the Land Administration Division, Survey Department and the Office of Titles.
- c Commencing the construction of a new office building to house the Office of Titles.
- d Refurbishing the buildings housing the Land Administration Division and the Survey Department.
- e Acquiring computer hardware and software (outlined below), survey equipment and vehicles to assist in the workload.

The purchased hardware includes one SUN Sparc Centre 1000, two SUN Sparc Classic servers, 21 SUN Sparc Classic workstations, 2 SUN Sparcstation LXs, plotters, printers, digitizing tables, tape drives, CD-ROM drives, modems and UPSs. The computer hardware and software acquired are part of a designed single Ethernet network to link the Land Administration Division, Survey Department and Office of Titles (Figure 4.1) and supported over fiber optic and twisted pair cabling. Three hubs, one in each of the departments' buildings, are to be linked via six channel fiber optic cables [Clarke, 1994].

The relational database management system chosen is Informix. ARC/INFO, combined with the Informix products and Informix-4GL will provide the application base for the GIS component. Spreadsheet and word processing capabilities will be provided by LOTUS V and Word Perfect V respectively. WingZ Hyperscript programming language/toolbox procedures will provide the basis of a decision support system [Clarke, 1994].

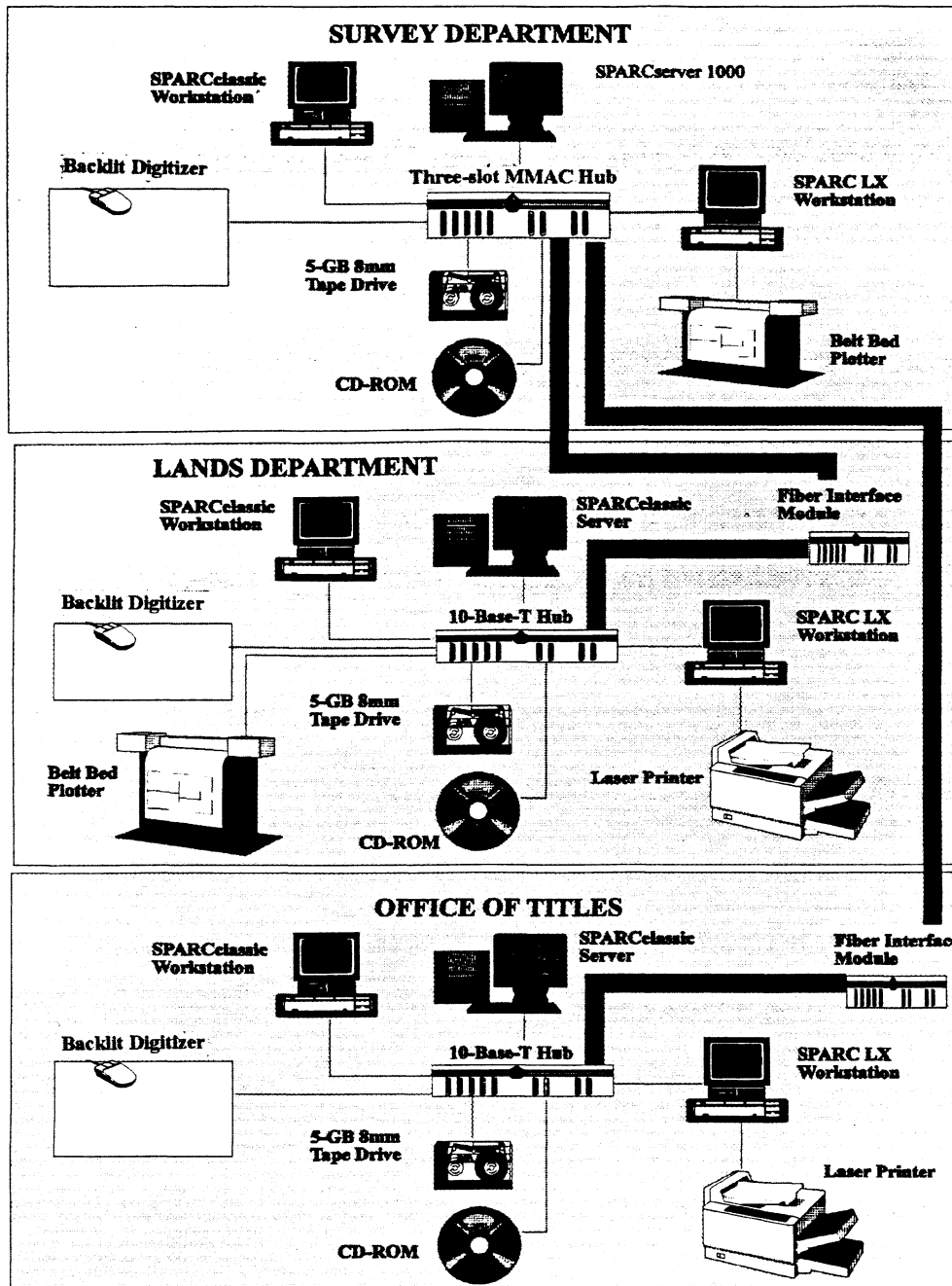
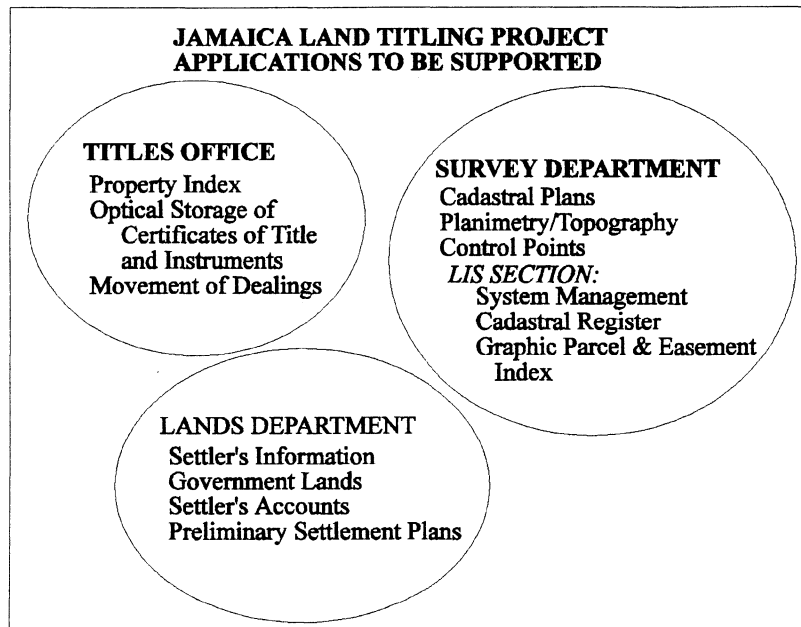


Figure 4.1

*Ethernet network linking Land Administration Division, Survey Department and the Office of Titles  
(After Clarke et al., 1994)*

A number of application software solutions are being designed and tested for the three departments (Figure 4.2). The following software solutions are being designed and tested for the Land Administration Division:

- a. A Land Settlers Information System to store and retrieve data on settlers assigned lots under the Land Settlement Scheme.
- b. A Government Land Management System to store and retrieve data on each parcel of land owned by the Government.
- c. A Land Settlers Accounting system to manage settler repayment accounts.



*Figure 4.2  
Applications to be supported by the Jamaica Land Titling Project  
(After Clarke et al., 1994)*

The following software solutions are being designed and tested for the Office of Titles:

- a. A Title Enquiry System to store and retrieve information on titled real property.
- b. A Dealings Tracking System to track all applications and instruments currently being processed by the Office of Titles.

The following software solutions are being designed and tested for the Survey Department:

- a. A General Property Database System to store and retrieve information on any parcel of land in the country, whether titled or not.
- b. A Digital Cadastral Database System to develop a graphical database of registered and unregistered parcels of land; and to support the title enquiry system.

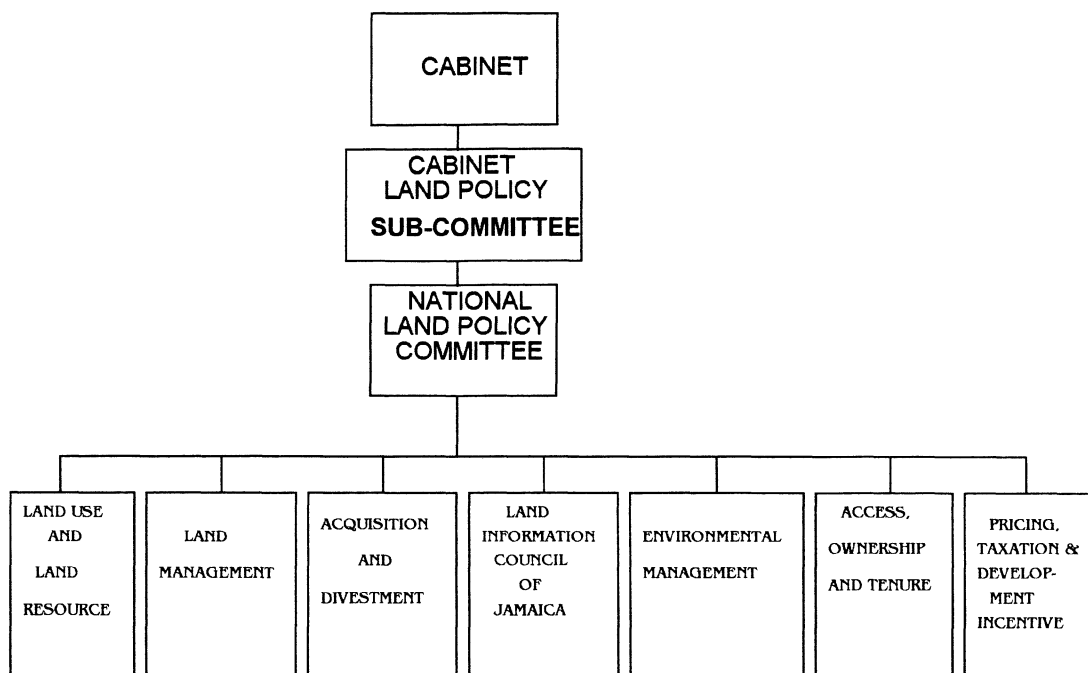
## **4.2 National Land Policy Committee**

In 1990 the then Ministry of Development, Planning and Production was mandated to co-ordinate the preparation of a comprehensive national land policy for Jamaica. Out of this mandate the National Land Policy Committee was formed. The objectives of the Committee were defined as the provision of an institutional forum for defining land information policies at the national level and the promotion of compatible policies and standards to be adopted by all levels of government and private sector agencies [Office of the Prime Minister, n.d.a]. The National Land Policy Committee is made up of six sub-committees and one council (Figure 4.3). The six sub-committees are as follows:

- a. Land Use and Land Resource
- b. Land Management
- c. Acquisition and Divestment
- d. Environmental Management
- e. Access, Ownership and Tenure
- f. Pricing, Taxation and Development Incentives

The only council is the Land Information Council of Jamaica (LICJ). It is divided into two groups: the Policy Committee and the Technical Advisory Committee [Office of the Prime Minister, n.d.a]. The LICJ's major objectives include:

- a. Establishing a network of existing and acquired land and land related information systems of 'tabular' and graphic data for multi-usage including planning, taxation, management quick and easy sharing and transfer of data etc.
- b. Obtaining from State agencies the commitment to the principle that their basic land information holdings form part of the State's corporate resources.
- c. Strengthening the land information technology knowledge-base within State agencies through technical tours, seminars, workshops, courses etc.
- d. Defining, developing and promoting the implementation of standards required for the efficient transfer of land information across institutions.
- e. Formulating data access and pricing policies based on sound business principles, fully recognizing the value of land information.



**Figure 4.3**  
**Structure of the National Land Policy Framework**

### 4.3 National Land Policy

For the purposes of this work only those policies relating to the management of land related data, and the legal and institutional framework will be focused on. The following paragraphs also reveal the policy objectives to which this thesis responds and that form the basis of the model design in Chapter 6. Optimal land use and management relies on effective access to accurate, up-to-date, timely, complete and comprehensive land information. Legal reform is required to effect land use, management, development, preservation, subdivision and control. It is also a necessary part of regulating institutional and administrative structures "required to effectively implement government policies and programmes dealing with land" [Government of Jamaica, 1994b].

Policies regarding the management of land related data have become a key issue in the formulation of Jamaica's land policy. The absence of usable and timely land data has, on more than one occasion, hampered the implementation of policies relating to land distribution, land registration, physical and environmental planning, development control, valuation and taxation. The following are the "major issues that have precipitated the government's need for a national policy framework for geographic data" [Government of Jamaica, 1994b]:

1. *Data comparison and cross-correlation is severely hindered by the several non-standardized land records reference systems and map scales which are operated across agencies.*
2. *Basic inventories of land assets are difficult to compile as a result of lack of knowledge on, and inaccessibility to, existing data stores.*
3. *Adequate mechanisms do not exist to facilitate inter-agency sharing of information therefore leading to costly duplication of data collection and storage efforts.*
4. *Sub-optimal land-use decision-making as a result of inadequate geographic data.*

5. *Critical shortage of geographic information management specialists and skilled operational staff.*

The current Government proposes to adopt policies [Government of Jamaica, 1994b] that will:

1. *Establish a comprehensive networked computerized geographic information system linking all government land related agencies by the year 2000.*
2. *Create national standards for geographic data collection, storage and exchange.*
3. *Develop the human resources required to manage and operate Geographical Data Management Systems (GDMS)<sup>1</sup>.*
4. *Establish a national digital geographic database comprising topographic, cadastral, land use, soil, environmental, natural resource, infrastructural and socio-economic components.*

The foregoing policy objectives are those that form the basis of the model design in Chapter 6. A number of elements that will support the implementation of the policies have already been, or are being, put in place. These include:

- a. The establishment of the LICJ.
- b. The installation of a Local Area Network (LAN) linking the Land Administration Division, Survey Department and Office of Titles.
- c. The topographical database constructed by the Survey Department.
- d. The digital textual database of the Land Valuation Division (formerly the Land Valuation Department) with the graphical component being constructed by the Survey Department.
- e. The digital soils database of the Rural Physical Planning Division.
- f. The environmental database being constructed by the Centre of Nuclear Studies.

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<sup>1</sup> A Geographic Data Management System has been defined as one that provides the expertise, procedures and technology to enable the efficient, effective and responsible application of geographic data to support decision-making by all actors in the land/geographic arena [Government of Jamaica, 1994].

- g. The socio-economic databases being developed by the Planning Institute of Jamaica and the Statistical Institute of Jamaica.
- h. The Utility Data Management Systems being developed by the Jamaica Public Service company and the National Water Commission.

The Government proposes to review more than one hundred pieces of land related legislation over the next five to ten years "with a view to putting in place laws which will more adequately deal with the physical resources of the country in a more comprehensive and coordinated manner" [Government of Jamaica, 1994b]. The areas targeted for attention include:

- a. Planning and development, land use standards and environmental issues.
- b. Land information systems including mapping and surveying.
- c. Pricing, taxation, divestment and incentives.
- d. Titling, adjudication and other areas of land management.

Over sixty government ministries, agencies and departments that deal with land related matters have been identified. In spite of the multitude of agencies dealing with land related matters, there has been over the years a recognized "inefficiency and ineffectiveness in the planning, management and administration of Jamaica's natural resources and their impact on the associated human settlements and socio-economic growth and development" [Government of Jamaica, 1994b]. To rectify this situation, the Government has identified three major areas for streamlining, namely:

- a. The national geographic information system network previously mentioned.
- b. The establishment of an Institute of Land Policy, Physical Planning and the Environment bringing together the Town Planning Department, Natural Resources Conservation Authority, and Rural Physical Planning Division.
- c. The establishment of an Institute of Land Management which will bring together the Land Valuation and Estates Department (the amalgamation of the former Land



Valuation Department and former Lands Department), Office of Titles, Survey Department, and Land Development and Utilization Commission.

#### **4.4 Operation PRIDE**

In the face of continued landlessness, shortage of available land for all types of development, and persistent squatting the current Government has proposed the launching of operation PRIDE (Programme for Resettlement and Integrated Development Enterprises) "to make land accessible to a wide cross section of persons using innovative techniques to ensure success" [Office of the Prime Minister, n.d.b]. The program is designed for implementation through the cooperation of a variety of organizations including government and quasi-government agencies, joint public/private ventures, the private sector, churches, professional groups, non-governmental agencies, and community based organizations. A Cabinet sub-committee, national commission, and parish committees are designed to ensure that the program is managed. A secretariat will be located at the Office of the Prime Minister.

Public and private sector owners of land will be asked to make land available to become part of a land bank. Lands will be designated by parish for potential uses including housing, agriculture, commerce, industry, recreation and religion. The program will seek to arrange different types of tenure including leasehold with option to purchase, rental and freehold. Other actions may include new land settlements, relocation of people presently living at unsuitable locations, and the regularization of squatter settlements "where this is determined to be the most feasible option" [Office of the Prime Minister, n.d.b]. It is to be noted that for Operation PRIDE to succeed timely, accurate, up-to-date, complete and comprehensive land information must be available.

## **4.5 Requirements for Achieving Jamaica's LIM Objectives**

Previous sections summarized Jamaica's LIM situation in terms of projects, programs objectives and policies that relate to land and land information. The direction in which the country's current political administration wants to go was given by the policy statements quoted. GOJ, by the policy statements previously mentioned, has shown that it has a national vision of establishing a networked LIM environment conducive to cooperation of relevant agencies at both the institutional and technical levels, within an adequate legal framework. The problems outlined in Chapter 3 will obviously have to be solved if the policy objectives are to be met. This section will focus on what is required to overcome the problems and attain the policy objectives previously stated.

### **4.5.1 Requirements Relevant to Jamaica's LIM Institutional Objectives**

The policy objectives mentioned above are components of a national vision for LIM and land management in Jamaica, the realization of which is being pursued by the current political administration. The first requirement in achieving these objectives is the communication of this vision to all levels of the relevant public service so that all the relevant entities share the same objectives. An attempt at fulfilling this requirement is being made through the Land Policy Committee. It is important that LIM organizations see the management and provision of information as a key function of Government departments.

Once the national vision for LIM and land management is understood and shared by all concerned, the next administrative requirement is the restructuring of the currently inefficient and outdated public service bureaucracy so that:

- a. Organizational structures reflect the capability to efficiently absorb and use modern information technology [Frank, 1992].

- b. Organizational functions and processes are examined, streamlined and improved in order to increase the efficiency of the departments and agencies in managing and producing land information.
- c. Top management becomes aware of the potentials of modern technology and how this new technology can be used to positively change the way business is done to the benefit of the organization and the country [Newton et al., 1992a].
- d. Organizational structures are modified in order to attract, keep and motivate qualified personnel.
- e. Central Government departments become efficient and not overlaid with statutory institutions that duplicate efforts and have to rely of Central Government entities to function.

A sound legal framework is another requirement for the achievement of Jamaica's LIM objectives. Jamaica has a good legal LIM framework with over 100 pieces of legislation that impact upon land in one way or another [Government of Jamaica, 1994b]. Areas targeted for investigation and possible legal reform are mentioned in a previous section. However, special thought should be given to legal or regulatory issues relevant to [Anderson, 1992]:

- a. The production of hard copy legal documents (eg., certificates of title, planning schemes etc.) from digital data.
- b. Liability of data providers regarding the quality of their products.
- c. Copyright of digital products.
- d. Public access to the network.
- e. Privacy of confidential information.
- f. Pricing and billing for user access to the network.
- g. Value added products derived by the private sector from output from network databases.

Another requirement is the establishment of a sound institutional framework to support administrative cooperation and data sharing among LIM organization pursuing similar goals and objectives. Actions proposed by the current political administration to bolster the current institutional framework were mentioned in Section 4.3.

#### **4.5.2 Requirements Relevant to Jamaica's LIM Networking Objectives**

*Organizational structures that traditionally prevented divisions or departments in the same organization from cooperating and sharing information now have technical reasons and capabilities to start sharing information for better data management and better decision making.*

[Camarata Jr., 1992]

As previously explained, there exists a number of LIM sites where data is processed digitally either in whole or in part. These digital systems were designed to basically serve the narrow objectives of the organizations to which they belong, though the information generated by these systems serve the national interests. Most Government organizations, whether they process land information or not, but especially if they do, have to share information with each other in order to carry out their functions. For example, 1:250,000 topographic base maps produced by the Survey Department are used by many other LIM organizations which overlay specific themes on them.

The benefits of sharing information is not lost on GOJ. Part of the policy objectives being pursued by the current political administration of Jamaica includes the setting up of a digital network to link all the LIM organizations by the year 2000 [Government of Jamaica, 1994b]. This is achievable only if concerted and concentrated effort (and resources) are expended. To achieve this, a number of actions are required, and are outlined below:

- a. A telecommunications network must be established (or used) to digitally connect organizations that are geographically dispersed. This telecommunications network

must be economical and provide satisfactory quality of service [Park, 1992]. The network must also be able to support the transfer of data in various forms and at high speed. Kirton [1992] writes:

*Future spatial information systems will require a high degree of connectivity in order to provide users with access to information widely in dispersed locations. The telecommunications network is the key to providing this connectivity. It will need to be able to handle a wide variety of information forms including text, vector graphics and raster images, at high speeds for rapid information transfer.*

Also, because of the heterogeneous nature of the computer hardware and software systems in existence in Jamaica, this network must be able to support heterogeneous interconnection.

- b. Decisions have to be made regarding the architecture of the network: client server, centralized or distributed network (or some combination).
- c. A spatial data infrastructure, which requires key national databases to conform to a common set of standards, must be established or adopted. These standards relate to data models, data quality, data features, data transfer, data custodianship and data distribution [Clarke, 1992].
- d. Standards have to be adopted regarding hardware, software and telecommunications services. Hardware standards will cover such areas as central processing units and peripheral devices. Software standards cover such areas as GIS software, database management systems, operating systems and graphical user interfaces. Telecommunications services standards cover such areas as communications networking software, and networking technologies such as local area networks (LAN), metropolitan area networks (MAN) wide area networks (WAN) among others [Pretty, 1992; Zwart and Coleman, 1992].

- e. Organizations having their manual systems being converted to digital systems will have to have their data reorganized to receive the new technology [Rammelaere, 1994].
- f. GOJ must consider the enterprise as a long term investment (for implementation and long term maintenance) and secure continued Government support (even through a change of Government by way of the electoral process) because of the high capital costs involved.
- g. Consideration must be given to the following issues [Anderson, 1992]:
  - i. Security of the host data.
  - ii. Privacy.
  - iii. Costs and benefits.
  - iv. Pricing and billing.
  - v. Copyright.
  - vi. Definition of users roles ( eg., data supplier, data user etc.).
  - vii. Value added products.
  - viii. Private sector cooperation in setting up the telecommunications infrastructure.
  - ix. Upgradability and expandability of systems.
  - x. Location of expertise and network support.

#### **4.6 Constraints Impacting on the Achievement of Jamaica's LIM Objectives**

With any objective, there exists the ideal on one hand, and what is feasible within any set of present constraints on the other hand. Jamaica is classified as a Third World

country and in the pursuit of any objective, economic constraints are nearly always present. Other constraints include GOJ's **inability** to:

- a. Successfully implement the institutional and legal reforms that are the subject of current policies.
- b. Restructure the Government bureaucracy in the face of unpopular support, and in light of the national vision mentioned above.
- c. Secure long-term political and managerial support of the enterprise.
- d. Secure the cooperation of the relevant private sector entity in setting up the telecommunications infrastructure.
- e. Attract, keep and motivate qualified personnel.

#### **4.7 Conclusions**

The importance of land information, and therefore its management, to the solution of Jamaica's land problems has been realized at least at the policy level. The current Government is aware of the problems especially since basic inventories of land assets are difficult to compile as a result of a lack of knowledge on, and inaccessibility to, existing data stores. Initiatives such as land titling projects, land policies that have been and are being formulated, and programs such as Operation PRIDE are being implemented in an effort to address the situation.

The current political administration of Jamaica has a vision to achieve efficiency in relation to the country's LIM. This vision is expressed in the form of policy objectives that relate to the management of land information, and the reform of the institutional and legal frameworks that support LIM. A number of problems lay between the present position of Jamaica's LIM and where the country wishes to be. These problems seem to stem mainly from an archaic public service bureaucracy which stifles itself with dated organizational

structures, procedures and regulations that inhibit interdepartmental coordination and the recruitment and retention of qualified personnel. The problems are not insurmountable, but may be constrained by the availability of financing, continued political support and the political will to reform the public sector to receive and efficiently use necessary new technology.



## CHAPTER 5

### **RE-ENGINEERING CONSIDERATIONS FOR LAND INFORMATION MANAGEMENT IN JAMAICA**

*The thinking used to be that automation alone was the answer ..., that idea was obviously off the mark. Why? Because automating organizational structures and processes that were inefficient in the first place is akin to getting power windows installed in a car that needs an engine overhaul. Clearly, the time is ripe for re-engineering.*

[Morris and Brandon, 1993]

#### **Introduction**

Chapter 3 described the Jamaican organizations involved with land information management (LIM) and the problems being experienced by these organizations with regard to their organizational structures, human resources, and technical resources. The problems that these organizations experience combine to prevent them from producing timely, accurate, up-to-date, complete and comprehensive land information to satisfy client demands. Chapter 4 described the actions taken by the Government of Jamaica (GOJ) to rectify this situation (i.e. programs, projects and policy objectives). The direction in which GOJ wants to go with regard to LIM was determined implicitly from the projects and programs implemented, and explicitly from the policy objectives stated. This chapter introduces the concept of re-engineering and outlines how re-engineering may be applied to effect the changes to the status quo in order for Jamaica to achieve its LIM objectives. The options that must be considered are outlined.

If we treat the public sector as the business of a nation, then to improve public sector performance is to improve that nation's chances of achieving its social, environmental, economical and political objectives. Improvement requires change, which must be treated as an ally and not as an enemy. Re-engineering entails the "analysing and

altering of the basic work processes of the business" [Morris and Brandon, 1993] and therefore is a process for effecting change. One may not only re-engineer business processes, but also technology and human resources [Morris and Brandon, 1993]. The following sections therefore focus on the re-engineering options that are applicable to the business processes, human resources, and technology resources of Jamaica's LIM which supports the nation's social, environmental, economic and political goals. First, however, the disciplines of general business re-engineering will be discussed.

## **5.1 Re-engineering**

Re-engineering is geared towards the achievement of improved business processes so that product and service costs are lowered and the quality of products and services improved. New goals must be set and a new foundation laid before re-engineering can be done. All of what is known to work can be incorporated, and all that is known not to work can be avoided [Morris and Brandon, 1993]. In effect, therefore, re-engineering involves a "fundamental rethinking and radical redesign of business processes" [Hammer and Champy, 1993] that results in a better way of doing work. Re-engineering is a relatively new concept and while some proponents suggest incremental re-engineering [Morris and Brandon, 1993], others advocate nothing less than revolutionary change [Hammer and Champy, 1993]. What is clear with regards to business re-engineering is that the application of change as a tool for improvement of performance is the basic and underlying theme.

LIM in Jamaica is the focus of re-engineering in this thesis, and the management and provision of land information is the service that requires improvement. In Jamaica, the public sector (the nation's business) is the major provider of land information (Chapters 3 and 4). According to Hammer and Champy [1993], "customers, competition

and change" are the three forces, separately and in combination, that today present contemporary businesses with challenges to successfully meet their objectives in the marketplace.

Jamaica's land information customers, from the point of view of the public sector provider of land information, are both internal and external. Internal customers are other public sector entities that require land information in order to perform their prescribed functions with regard to the nation's economic, social and environmental objectives. External customers include all non-public sector entities that require land information in order to pursue their own objectives (e.g., the acquisition or divestment of rights in land). The fact that Government of Jamaica is the major provider of land information means that competition for the provision of that service is almost non-existent. External customers have no other recourse but to deal with whatever mechanisms the Government puts in place. Even in this apparent monopoly, however, change has had effect since the internal customer (the Government itself) is more often than not negatively affected by the lack of timely, up-to-date and accurate land information to do its business (Chapter 4). Change may take the form of increased customer demand for land information, and the speed of production and format of the information requested. The fact that the current Jamaican mechanisms that provide land information are no longer adequately meeting demand is proof that change has had effect on the LIM organizations.

Changes in the way land information is managed in Jamaica are therefore required and these changes can be accomplished by re-engineering. However, there are a number of characteristics that generally describe most public sector organizations [Bower, 1977; Newman and Wallender, 1978; Perry and Porter, 1982] and which pose difficulties in applying re-engineering principles. They include:

- a. Being expected to pursue goals assigned to them by elected bodies without due regard to the amount of resources at their disposal.

- b. Being required to undertake programs without sufficient time and resources to ensure that they succeed in completing the tasks.
- c. Being faced with the difficulties associated with implementing the policies of newly elected political bodies by utilizing resistant bureaucratic systems that were created and sustained by previous administrations.

It must therefore be pointed out here that for re-engineering to succeed in relation to the public sector, the above characteristics must be recognized and dealt with in a way that will allow for the changes in focus that re-engineering will bring. It will require bold and radical actions by GOJ. It is unreasonable for them to keep the status quo and expect that things will improve.

The disciplines of re-engineering apply to re-engineering projects, and are done in phases: analysis, design, testing and comparison of design alternatives, selection, and implementation. Seven capabilities are necessary parts of re-engineering in order to ensure success [Morris and Brandon, 1993]. They include the ability to:

- a. Associate all of the management parameters of the business entity with each other through knowledge of company plans, mission statements, organizational charts, information systems, job descriptions etc.
- b. Coordinate the management of change for all affected business functions such that business entity seeking improvement responds to changes initiated by competition, regulation, technology and the need for internal improvements.
- c. Assess, plan, and implement change on a continuing basis since the benefits and advantages derived from re-engineering are only for a short time.
- d. Analyze the full impact of proposed changes through the understanding of inter-organizational relationships.
- e. Create new models through re-engineering designs and testing, and to use these models on a continuing basis.

- f. Conduct re-engineering in accordance with a comprehensive, systematic methodology which begins with a detailed mapping of the current business processes (modeling the business).

The following are some of the tasks suggested by Morris and Brandon [1993] which may be incorporated into a re-engineering methodology:

- a. Model the current business, analyze it, and use the model and analysis to design new processes and organizational structures.
- b. Consider the differing needs of individual departments and delineate their roles in the re-engineering process.
- c. Position the business to react to changing conditions and challenges in the marketplace.
- d. Create a built-in capacity for change by making change a perceived "friend" of management and workers.
- e. Cultivate an environment that expects and rewards quality assurance and quality initiative.
- f. Implement the new business operations and organizational structures while minimizing any sense of uncertainty in the workplace.
- g. Alter technological systems to support the new structures.

Chapter 3 examined Jamaica's current LIM situation (model) in detail, and Chapter 4 detailed the actions taken by GOJ to address the problems it faces with regard to LIM. The actions, especially in terms of explicit LIM policy statements, point to the way that GOJ wants to go and set the stage for the re-engineering options to be suggested in this chapter. The proceeding sections will therefore focus on the design options available to re-engineer the current LIM model with regard to general business functions and processes, human resources, and technology resources, but with regard to the set of objectives stated by GOJ.

## **5.2 Re-engineering Options for the General LIM Business Functions and Processes**

In assessing the re-engineering options available with regard to Jamaica's LIM business functions and processes, consideration will be given to departmental functions and business processes, organizational structures, and mechanisms that will facilitate dynamic organizational changes in tandem with changing conditions and challenges in the marketplace. The aim of the following discussions is to investigate the options available to Jamaican LIM organizations to implement changes in the way they operate individually and as coordinated groups, to achieve optimal efficiency in supporting the national LIM objectives. It is to be understood at this point that the options suggested herein are of a general nature and organizations will only be mentioned by name as examples.

### **5.2.1 Options Relating to Departmental Functions and Business Processes**

As far as departmental functions are concerned, research has verified that generally the environmental, legal, economic and social aspects of land information are covered by Jamaican LIM departments (Chapter 3) which have responsibilities that are within one or more of these areas. One option then is to keep the departmental functions as they are. Other options include:

- a. The reorganization or restructuring of business processes that support defined functions within departments.
- b. The transfer of one or more functions from one department to another.
- c. The combination of functions.

In Chapter 3 the changes made by GOJ in January 1995, which had little if any effect in the way that the departments functioned, were described. This action in effect kept the departments as they were, which means that the problems associated with the

departments' ability to manage land information also remained. Keeping the status quo is then not a positive action if the current Jamaican LIM objectives are to be met. The author of this thesis is not aware of any actions being taken by GOJ to address the functions of Jamaican organizations which manage land information.

An example of a possible transfer of functions to increase the LIM organizations' ability to manage and ultimately produce timely, up-to-date, complete and comprehensive land information, is moving the deeds registry functions from the Island Records Office (IRO) to the Office of Titles (OOT). This would have the effect of grouping the legal cadastral records (titles and deeds) for the entire island under one logical administration, increasing the possibility for organizing a more complete picture of the nation's cadastral situation. Also, the administration of lands registered by deeds would become the responsibility of the Ministry of Environment and Housing instead of the Ministry of Health.

GOJ, in March 1995 administratively merged the former Lands Department and the former Land Valuation Department to form a new department called the Land Valuation and Estates Department (Chapter 3). The move was motivated by GOJ's desire to implement a mechanism that would more effectively manage State lands [Blair, 1995]. The two former departments were physically located in different geographical areas and remain that way, functioning as they did before March 1995. No improvements were made to each entity's functions or structures, and therefore the problems that they faced before in supplying land information continue. The move is a good one in one respect: the logical function of land valuation could be concentrated in the Land Valuation Division (formerly the Land Valuation Department). The Land Administration Division (formerly the Lands Department) currently has a land valuation section (Chapter 3) which figured in GOJ's motive for creating the new department. The undervaluing of State land involved in recent land transactions was one of the reasons cited for the amalgamation [Blair, 1995].

With all the changes made in January and March of 1995, the land functions of IRO still remain under the Ministry of Health effectively excluding a significant portion of land transactions from the new Ministry of Environment and Housing which has responsibility for land transactions in Jamaica at this time. This is one area that deserves some consideration from GOJ.

Departmental functions must not merely be kept or transferred but **improved** to meet the overall business objectives, in this case effective and efficient LIM. This may entail the reorganization and restructuring (re-engineering) of business processes that support defined departmental functions [Hammer and Champy, 1993]. A business process is set of activities within an organization that are linked and together transform inputs (ideally adding value) into outputs (goods or services) [Johansson et al., 1993]. The reorganization and restructuring of business processes may include [Hammer and Champy, 1993]:

- a. The combination of several jobs into one so as to eliminate errors and misunderstandings caused by hand-offs.
- b. The performance of the component steps of a process in parallel, if possible, so as to reduce the processing time caused by linearity.
- c. The creation of multiple versions of a process so that in identifiable instances, unnecessary steps may be avoided.

This restructuring of business processes is essential if the re-engineering of business functions are to be accomplished. Traditional operational departments in the Jamaican public sector usually operate with each worker doing a set of specialized functions. These functions are usually part of a business process and the other parts of the process are usually scattered throughout the organization.

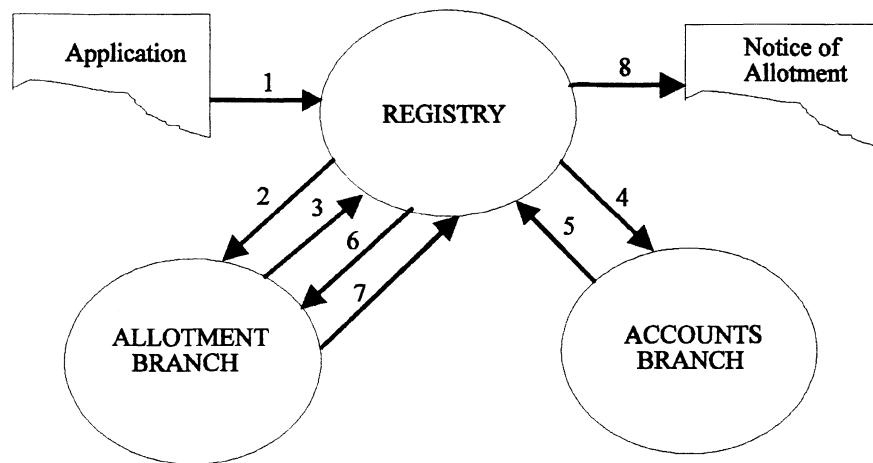
Let us examine the processing of a settler's application to purchase land under the Land Settlement Scheme (Figure 5.1) administered by the Land Administration Division (LAD). The input is an approved application and the output is a Notice of Allotment



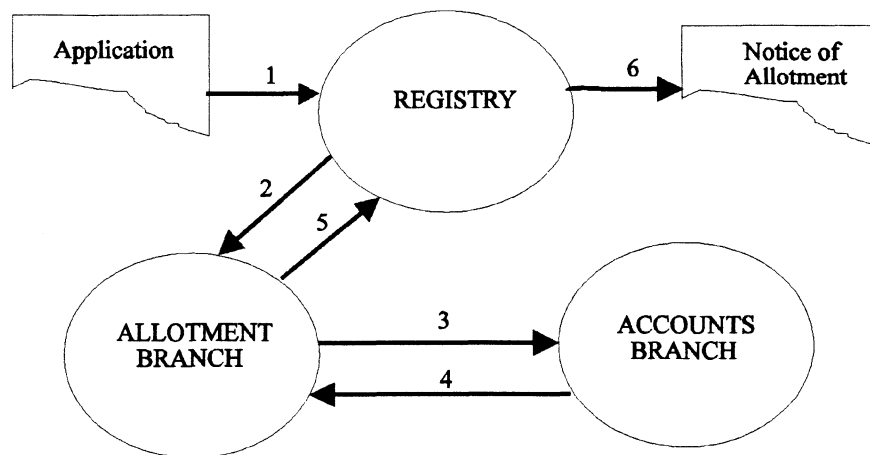
verifying GOJ's sanction of the application. The application arrives at LAD (usually by mail) and goes along with other correspondences to the Registry. The Registrar then sorts the mail (including the application) and places them into the respective registry tray. Each registry clerk takes his or her set of correspondences, sorts them, searches for the relevant paper folder (file), writes some instructions (where the file is to go), and places the file in the relevant tray. Office attendants clear the trays (normally twice a day) and take the files to their respective sections. The application is finally in the Allotment Branch after anywhere from three days to three weeks or more have passed, depending on the workload and other factors. The application is passed from one clerk to another within the Allotment Branch as sales figures are prepared and checked, and checked figures are approved by the head of the Branch. The application is again sent through the Registry to the Accounts Branch where an account is opened for the applicant. Again, the file circulates within a section as payment is verified, figures again checked, account opened and signatures added. The file with the application passes again through the Registry back again to the Allotment Branch where record books are noted and the Notice of Allotment prepared and signed. The file goes again to the Registry where the Notice of Allotment is added to other outgoing mail. Office attendants take the mail to the post office and finally the Notice of Allotment is on its way to the applicant. It may be anywhere from a month to years before the Notice of Allotment leaves the office.

In the above, the bureaucracy dictates all the checks and routing and indicate an example of where business process re-engineering could be applied. Research carried out by the author of this thesis indicated that there are similar situations existing in other public sector organizations dealing with land information. The fact that a business process is ensuing is lost on most of the employees because the focus is on sectional functions and not on business processes. If the management concentrated on business processes instead of on operational functions, efficiency could be introduced into the process.

One example would be for applications to pass directly from the Allotment Branch to the Account Branch and vice versa, thereby eliminating the time lost in passing the file through the Registry (Figure 5.2). Appropriate mechanisms could be created to inform the Registry of the file's whereabouts should that information be needed. Furthermore a process team could be created, consisting of individuals with all the necessary skills to process Notices of Allotments and ensuring that Notices of Allotments are processed without the many time consuming checks introduced by the bureaucracy.



**Figure 5.1**  
*Work flow that produces Notices of Allotment*



**Figure 5.2**  
*Suggested modification to work flow that produces Notices of Allotment*

The incorporation of computer technology can affect the efficiency of many of these functions, but that technology is best used to develop more efficient processes to meet the business' objectives [Hammer and Champy, 1993]. To support this point, Morris and Brandon [1993] state:

*For some time, perhaps since computers have been used in business, technology professionals have known that the best way to use computers was to enable new improved business processes, rather than automate old ones.*

The thought that the introduction of information technology implicitly translates to improved performance is a trap that must be avoided by the Jamaican LIM community. What is needed are basic changes in the way business processes that support LIM is done. The following quotation from Hammer and Champy [1993] makes this point:

*Some people think that automation alone is the answer to business problems. True, computers can speed work up, and in the past forty years businesses have spent billions of dollars to automate tasks that people once did by hand. Automating does get some jobs done faster. But fundamentally the same jobs are being done, and that means no fundamental improvements in performance.*

Some intra-departmental business processes are part of inter-departmental business processes. The former, for its own completion, may depend on the completion of certain extra-departmental processes. An example of this is the production by LAD of a long-term lease, which in part depends on a cadastral survey of the lot being leased. The lot may be part of a sub-division being divested by GOJ as part of its land reform program. The production of a long term lease, in this simplified scenario, is the inter-departmental business process. The surveying of the lots by the Survey Department and the production of the legal document by LAD are both relevant intra-departmental business processes. Sometimes GOJ, endeavoring to quickly implement land reform programs, permits applications to be processed for these lots before the cadastral survey is completed. Although the applications receive attention at LAD, the production of the legal document

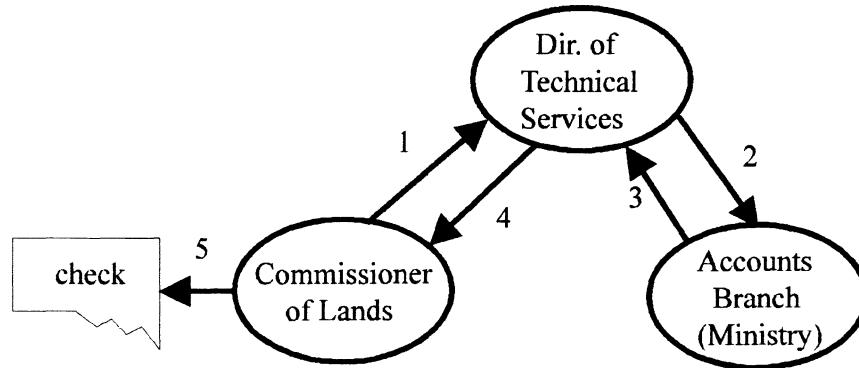
(and its delivery to the applicant) is hindered because a cadastral plan of the lot is not available. The applicants then complain because of the delays.

One way to re-engineer this process is to incorporate the identification and survey of areas targeted for divestment well in advance of giving the public access via applications. In this case, an accepted preliminary (or preferably a final sub-division plan) of the targeted area can be referenced in the description of the lots by LAD, for each application it processes. The turn-around time for the production of a long-term lease, from the time the application is received by GOJ, will under normal circumstances be much less.

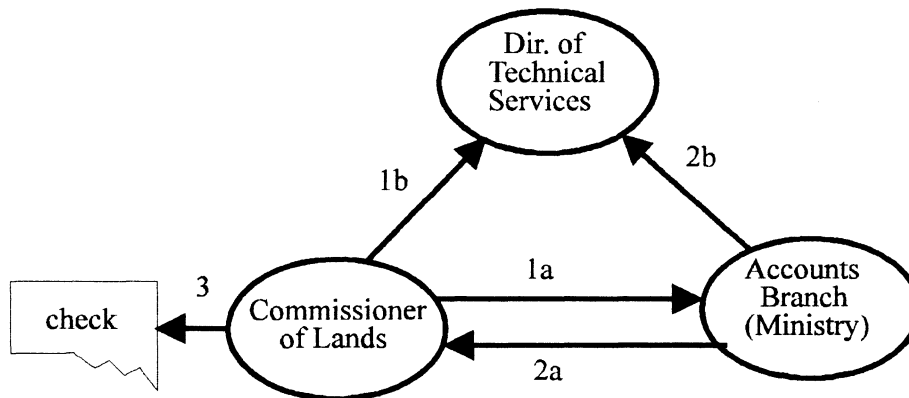
Another example of an inter-departmental business process which can be re-engineered is the production of a check payable to a vendor of land being sold to GOJ through the Commissioner of Lands (at LAD). The negotiation for purchase of the land is normally between the Commissioner and the vendor, but the preparation of the check is done at the Ministry in charge of State and Crown lands. The Commissioner must first obtain the written approval of the Minister responsible for State and Crown lands before the purchase can proceed. The Commissioner makes the request for the check through the Director of Technical Services in the Ministry, who in turn sends the request to the Accounts Branch in that Ministry. The check is then sent to the Director who forwards it to the Commissioner (Figure 5.3). Delays are normally experienced through hand-offs between registries and sections within both the Ministry and LAD, and this should also be investigated with a view to re-engineering those intra-departmental processes. There are usually penalties in terms of fines or litigation for late payment of the purchase price. To make this process more efficient, the following can be done (Figure 5.4):

- a. Eliminate the Director's role as facilitator of the check's request from the process.
- b. The Commissioner makes the request directly to the Accounts Branch at the Ministry. The request is accompanied by a copy of the Minister's approval.
- c. The Accounts Branch sends the check directly to the Commissioner.

- d. Copies of both the request and supply of the check are sent to the Director for his records. These steps may be done in parallel, when the request and supply are made respectively.



**Figure 5.3**  
*Work flow that produces a check for a vendor*



**Figure 5.4**  
*Re-engineered work flow that produces a check for a vendor*

## **5.2.2 Options Relating to Organizational Structures**

Analysis of the current organizational structures of Jamaica's LIM organizations (Chapter 3) has revealed that generally these structures need to be reorganized to absorb and use modern information technology, if GOJ's objective of setting up a data network linking all LIM organizations by the year 2000 is to be realized. They are also found to be incapable of attracting, keeping and motivating qualified information technology personnel (and qualified personnel in general) because of poor remuneration and a system that generally facilitates upward mobility through long service.

Most of these organizations have already installed high end computer technology, or have the intention to do so in order to better manage their land based information. Since the public sector may not be able to compete with large corporations in the private sector as far as salaries are concerned, the advanced computer equipment may be under-utilized and misused in the hands of unskilled workers (Chapter 3). The basic aim of re-engineering the organizational structures of Jamaican LIM agencies is to have them produce accurate, up-to-date, timely, complete and comprehensive land information (based on improved management of the information) so that the nation's LIM objectives may be achieved. The benefits to be gained by having land information possessing those attributes are worth the money spent to give the information technology personnel competitive salaries and scope for upward mobility.

Of course consideration is to be given to the fact the public sector has to deal with the other needs served by Government that also demand expenditure. In any event, the consequence of keeping the status quo is continual migration of skilled personnel to more lucrative employment in the private sector and abroad. The organizational structures therefore must be modified to reflect an awareness of this reality, with the degree of modification tempered according to the complexity of local land information system and the level of expertise needed. Consideration is not only to be given to computer

personnel, but all personnel. Computer personnel are specially mentioned here because of the impact of the introduction (or intended introduction) of computer equipment on the organizational structures themselves. Other issues relevant to staffing at large will be dealt with in Section 5.3 (relating to re-engineering human resources).

To keep the structures as they are is not a viable option. Hammer and Champy [1993] confirms the inadequacies latent in the "classical" organizational structures such as those embraced by GOJ (Chapter 3) which are characterized by specialized departments and fragmented processes. These include:

- a. Unresponsiveness.
- b. Inflexibility.
- c. The absence of customer focus.
- d. An obsession with activity rather than results.
- e. Bureaucratic paralysis.
- f. A lack of innovation.
- g. High overhead.

Drake [1974] suggests a number of characteristics of organizational structures that if re-structured may aid in creating an atmosphere conducive to the performance of efficient work. Some of these characteristics are evident where:

- a. An operation is repeated more than once in the work flow of a business process indicating that jobs involved may not warrant separation and may be combined into one job.
- b. There are unusual reporting relationships such as an individual reporting to more than one supervisor, creating the possibility of role conflict.
- c. Individuals know virtually everything about an organization and are heavily relied on by the organization (Although they are very important to the organization, their monopoly generally takes a level of responsibility, meaningfulness, and autonomy

from the other employees while leaving the organization vulnerable to their departure).

- d. Special checking or inspection jobs are not necessary.

Hammer and Champy [1993] suggests a number of scenarios that might occur within a re-engineered business. These include:

- a. Changing the work unit from functional departments to process teams, which are groups of diversely qualified people working together to perform an entire process.
- b. Changing the structure of the organization from hierarchical to flat, enabling process teams to resolve problems that were previously solved by managers in groups.

The effect of (a) is that the tasks that are done by individuals are not changed, only the manner in which they are done. The delays in business processes caused by hand-offs from employees in one department to other employees in another department are avoided [Hammer and Champy, 1993]. Also individuals can move from one process team to another, taking their individual skills and learning to enhance another team working on a project [Johansson et al., 1993].

The effect of (b) is that the lines of communication does not always have to be vertical; people will communicate with whomever they need to in order to get the work done [Hammer and Champy, 1993]. This is most beneficial in terms of speed of execution and performance since in most traditional organizations layers of managers neither make decisions nor lead, but function as a conduit for information. An example of this is the application approval process relevant to the purchase of Government owned land.

The Commissioner of Lands is required by the provisions of the *Crown Property (Vesting) Act* [1960] to secure the approval of the Minister in charge of Crown lands before divesting and Government owned land. The current bureaucracy requires that the request for approval pass through the Director of Technical Services in the relevant



Ministry before receiving the Minister's attention. The Director of Technical Services basically acts as a conduit for information between the Minister and the Commissioner of Lands, and a request for approval may be delayed in the process because the Director is focusing on some other job deemed to be of more importance.

Within the context of (b), one way to deal with this situation is to have the process become the focus (or part of the focus) of a process team which will ensure that the process goes through only the relevant and necessary stages. What is required on the part of the operating individuals, however, is greater self-discipline towards work and responsibility for maintaining communications within the departmental structure [Drucker, 1988].

### **5.2.3 Options Relating to Mechanisms to Facilitate Changes**

Technology is constantly changing, affecting the way information is captured, stored, organized, output and disseminated. These changes invariably affect the manner in which business is done, and many other areas including communication, travel and entertainment among other things. Population growth, social needs, international and local economic and environmental issues also present increasingly rapid change factors to which governments must respond if they are to remain effective. The management of change is therefore a crucial part of dynamic re-engineering [Morris and Brandon, 1993]. This section is concerned with the management of changes that must take place within Jamaica's LIM environment of organizing procedures, human resources and technical resources in order that the country's LIM objectives may be met.

As previously mentioned, the benefits of re-engineering are only for a (relatively) short time (Section 5.1). Mechanisms therefore have to be established in order to manage change in Jamaica's LIM arena. The mechanisms may take the form of an individual, an institutional group, or an organization that is dedicated to the monitoring and coordinating

of the island's LIM situation and that will initiate the steps necessary to effect the desired changes in accordance with stated national LIM objectives. Whether it is an individual, a group or an organization, the entity will have to:

- a. Be aware of the national LIM policies and objectives, and what is happening within the national LIM arena.
- b. Be aware of the needs (business processes, human resources and technical resources) of the various LIM organizations and methods that will enable the fulfillment of those needs in order to assist them in being able to fully participate as part of a national land information system (LIS).
- c. Be aware of GOJ's land information customer needs (i.e., the nature of the demand for land information) and how best to organize the national LIM resources to satisfy those needs.
- d. Be aware of the existence, use, costs, benefits and capabilities of information technologies as they relate to LIM generally, and how those technologies may be applied specifically to the fulfillment of GOJ's LIM policy objectives.
- e. Be aware of the necessary standards that are applicable to data organization, data exchange, and computer hardware and software so that effective data sharing can take place among Jamaica's LIM organizations.
- e. Be able to have access to key Government organizations and individuals in order to obtain economic and other resources, and influence cooperative political actions so that projects geared towards effecting the necessary and desirable changes to Jamaica's LIM environment may be implemented and supported.

The responsibilities of this entity would relate to the re-engineering capabilities described previously in Section 5.1. Additionally, the guidelines influencing the actions of this monitoring and coordinating entity would come from the national vision for LIM described in Chapter 4. The entity would have to have the power to coordinate agreements among departments regarding the sharing of information and the

implementation of re-engineering projects in accordance with national policy objectives and accepted standards for data, data organization, computer hardware and software.

The objectives of the Land Information Council of Jamaica (LICJ) were outlined in Chapter 4 and cover the administrative (policy) and technical aspects of Jamaica's LIM. Also mentioned in Chapter 4 was GOJ's institutional policy proposal to create an Institute of Land Policy and an Institute of Land Management. The proposed membership of the two institutes named above, are also represented on the LICJ, which is comprised of representatives of all the major land related organizations in Jamaica. These institutions, together with the LICJ, therefore represent one option for monitoring and coordinating change in the island's LIM situation. However the problem with the LICJ and the proposed Institutes that may not make them suitable to perform the functions of monitoring and coordinating change in Jamaica's LIM is that the time expended by the membership in attending meetings is voluntary as members already have responsibilities defined for them within their own organizations. The members can bring knowledge of the status of their organizations to the table and can guarantee cooperation in the pursuit of any LIM policy, but cannot guarantee the continual focus that will be necessary to ensure that national LIM plans are coordinated and monitored.

Another option is the appointment of an individual to assume the responsibilities of national LIM monitoring and coordination mentioned above. Such a move was taken by GOJ in February 1995 when an individual was appointed as National Geographic Information System (GIS) Coordinator. During field research information about this individual's functions was not yet available. However the reference in the job title to GIS gives an indication of the focus of the job. A GIS is not always necessary to manage all forms of land information. A database management system (DBMS) or an efficient manual system may serve that purpose in some instances (e.g., the management of text data). A number of concerns in the use of an individual to monitor and coordinate the national LIM machinery are related to whether that individual can:

- a. Remain objective and free from negative political interference.
- b. Adequately monitor and coordinate the LIM situation for the whole island.
- c. Secure the cooperation of the various LIM organizations.

These are only some of the questions that must be answered if the choice of an individual to perform the coordinating and monitoring functions mentioned above is to be a viable one.

The last option mentioned in this section is that of the creation of an organization to perform the national LIM monitoring and coordinating functions. If the concepts of re-engineering are applied to this organization, then the rigid hierarchical structures of traditional functional organizations will be avoided and the organization will be comprised of process teams [Morris and Brandon, 1993; Johansson et al., 1993] which themselves will be comprised of individuals of varying but relevant skills sufficient to ensure the fulfillment of GOJ's LIM objectives. The same concerns mentioned above in relation to the appointment of an individual are also relevant here. The choice of an individual or an organization also implies additional expenditure of funds in terms of salaries, for instance, from the already limited economic resources of Jamaica. This fact must be weighed against the need for some entity that not only can be afforded but will be able to accomplish the tasks at hand.

### **5.3 Re-engineering Options for Human Resources**

Regardless of how much technology is incorporated into an organization, or how much reorganization of its basic structure takes place, the objectives of the organization will not be attained unless the employees perform efficiently and effectively. This is underscored by Morris and Brandon [1993] who stated that:

*The human side of enterprise is second to no other factor in importance. In a business that employs a workforce of any size, success must depend upon their performance. While it is rare to find an organization that does not employ a few people who contribute less than they take, none can tolerate more than a very small percentage of such and survive ... The re-engineered business process, if it is designed to be more efficient than the old, may be even more dependent on everyone in the company performing the work for which he or she is responsible.*

The human resource aspect of any re-engineering project must receive attention from the beginning as "no design can be implemented if the staff fight it" [Morris and Brandon, 1993]. While being made aware of the changes that are imminent, the staff must also be motivated in such a way that change is not fought and uncertainty in the workplace is avoided. Two important concepts are referred to in the last sentence: communication and motivation. Communication, in this context, is not only in relation to the changes that are to come but to the objectives that the changes are expected to achieve. This kind of communication gives the employee an awareness of the purpose of his or her work and puts his or her function into perspective. GOJ is then to ensure that its vision as far as LIM is concerned (refer to Chapter 4) is communicated to its employees at all levels since "a person must be committed to a goal in order to strive toward attaining it" [Pinder, 1984].

The commitment to a goal as mentioned above implies motivation, but how do you motivate workers? This is a crucial question to be answered especially considering the poor work environment and unmotivated employees existing in Jamaica's LIM organizations (Chapter 3). Motivation in the workplace is linked to job satisfaction that promotes positive job attitudes [Pinder, 1984]. Research has identified five worker motivating factors [Pinder, 1984] linked to job satisfaction that normally directly relate to worker performance:

- a. Responsibility.
- b. Challenging, varied or interesting work.

- c. Achievement.
- d. Recognition.
- e. Advancement.

For employees to be given responsibility, they must have the ability to perform the tasks assigned to them. Implied in this link of responsibility and ability is careful personnel selection and placement, and job design [Pinder, 1984]. Supporting this implication Lofquist and Dawis [1969] state:

*Highly competent people who are assigned to jobs for which their ability sets are not appropriate are generally no more effective in organizations than are people with less impressive ability sets who are assigned to jobs for which they have some of the basic requisite abilities.*

Challenging, varied, and interesting work was found to generally stimulate employees' interest in their jobs, and when the efforts expended produce significant contributions to the employer, a sense of achievement is experienced. If these efforts are recognized by the employer, the worker generally experiences more job satisfaction and is motivated to continue to perform. Failure to receive recognition often leads to job dissatisfaction. One form of recognition is advancement within the hierarchy of the organization, which together with the previously mentioned motivating factors tend to engender feelings of growth and personal development [Pinder, 1984]. Quality assurance and initiatives should also be rewarded [Morris and Brandon, 1993].

A number of other factors which seem to produce job dissatisfaction which tend to inhibit worker performance have also been identified by research [Pinder, 1984]. These include:

- a. Unhappiness with company policy and administration.
- b. Poor working conditions.
- c. Unhappy employee-supervisor relations.
- d. Unfriendly relationships with workers' peers.

The existence of any or all of the above factors tend to engender feelings in an employee of being unfairly treated [Pinder, 1984]. This negative feeling then tends to prevent an employee from expending his best efforts in the interest of the achievement of the organization's goals and objectives. From the author's observation, these factors are all present in one or more of Jamaica's LIM organizations. Factors (c) and (d) usually relate to conflicts of personalities and may be addressed through management and staff training in improving worker relations and the development of interpersonal skills. Factors (a) and (b) relate to the organization's work environment and must directly be addressed by the organization's top management.

It is a common Jamaican opinion that its public sector workers are lazy, unskilled and incompetent. As a Jamaican of more than 18 years of experience in the public sector (and dealing with the private sector) the author of this thesis has observed that these attributes also occur in private sector employees, but only in very few instances. What has been observed is better company policy, administration and working conditions in the private sector which is performance and profit motivated, and appears to know the value of its employees. Low remuneration and the general public sector policy of awarding upward mobility on the basis of years of service instead of on the basis of qualifications, skills and competence (Chapter 3) has prevented many qualified persons from joining or staying within the Government service, and has frustrated many of those who stayed. Also, as experienced by the author of this thesis, while the cost of living has spiraled continually upward over the last two decades, public sector workers at the lower levels have had to endure wage freezes or incremental increases of an average of 15% per annum of their relatively meager salaries, while Ministers have had increases of over 200% of their more substantial salaries. Additionally, the author has observed that generally that the physical working conditions of public sector offices pale significantly to the more comfortable physical surroundings of private sector offices. These factors, in addition to

the stifling and inefficient bureaucracy of the public sector (Chapter 3), serve to create a public sector worker who is less motivated than he or she ought to be.

The Jamaican public sector also seems to be modeled on the set of assumptions about human nature known as *Theory X* [McGregor, 1957, 1960]. Theory X generally upholds the paradigm that the average human adult is by nature lazy, indifferent to the organization's needs and goals, resistant to change and not very intelligent. As such is the case the workers must be tightly controlled and coerced into performance. According to Pinder [1984] the implementation of management practices and policies that are based on these assumptions generally produce the very attributes that they are meant to curb, and managers who hold Theory X beliefs respond by introducing more control and coercion. the result is a self-fulfilling prophesy [Pinder, 1984].

Conversely, *Theory Y* [McGregor, 1957, 1960] upholds the assumptions that average human adults are potentially able to develop, assume responsibility and support organizational goals, and that they only becomes passive as a result of the way they are treated in the organization. The assumptions also holds that managers have the responsibility to recognize workers' potentials and allow them to develop those potentials *themselves* by structuring organizational policies in such a way that they can achieve their own goals while pursuing the goals of the organization.

The assumptions of Theory Y are related to the theory of human needs expounded by Alderfer [1969, 1972]. These needs are identified as *existence, relatedness and growth needs*. Existence needs refer to an individual's physical security and relate to such outcomes as salaries which support workers' existences. Relatedness needs are those that are necessary to obtain prestige or the esteem of others. Growth needs refer to one's desire to successfully interact with one's environment: to investigate, explore and master it [Pinder, 1984]. These theories are worth considering in re-engineering the human resources of Jamaica's LIM organizations. Attempts at human resources re-engineering will also include:



- a. The definition of positions and skills.
- b. The re-deployment of staff.
- c. Training and re-training of management and staff.
- d. The upgrading of employees' posts commensurate with qualifications and skills.

The definition of positions and skills and re-deployment of human resources, as far as human resources re-engineering is concerned, relate to the activities of process teams comprised of diversely qualified and skilled personnel. The aim of these actions is to give employees access to a broader range of skills on a day to day basis, and to enlarge their thinking to that of a bigger picture: the objectives of the organization and their role in achieving those objectives [Hammer and Champy, 1993]. The idea of process teams is in contrast to the idea of workers permanently linked to operational departments thus limiting their view and appreciation of the overall work flow and objectives of the organization.

Training and re-training of management and staff will be geared towards not just **how** to perform a task, or set of tasks, but also towards **why** they are doing what they do. This in effect is more than training, it is education [Hammer and Champy, 1993]. A number of other suggestions were put forward by Hammer and Champy [1993] with regard to what might occur in a re-engineered business as far as human resources are concerned. They relate to the education of managers and employees and include:

- a. Changing the role of employees from controlled to empowered so that they can exercise judgment instead of just following rules.
- b. Changing the attitude of the organization's employee such that they realize that they work for their customers and not their bosses.
- c. Changing the attitude of managers such that they give advice and help in the solution of problems instead of designing and allocating work.
- d. Changing the role of executives from that of score-keepers to that of influencing the workers' values by words and actions.

Empowering the employees to exercise judgment instead of just following rules requires that they obtain the in-depth knowledge needed to make those decisions, and it releases the managers from having to make those decisions thus saving time. For employees to realize that the customer is the focus of the organization requires a revolution in the culture of the organization that unofficially upholds the paradigm that an employee works for his or her boss. Managers and executives will have to be in possession of strong inter-personal skills and be able to take pride in the accomplishment of others in order for them to be able to support a business re-engineered in the manner stated above [Hammer and Champy, 1993]. Managers will be considered effective if their "staff of subordinates accomplishes their respective work goals" [Pinder, 1984]. The upgrading of employees' posts must be applied to those employees that are qualified in order to motivate them to perform and support the re-engineering process [Morris and Brandon, 1993].

Where necessary, principles of total quality management (TQM) should be utilized, incorporating the relevant suggestions of employees in effecting changes [McLean, 1992]: they are closer to the operations level and normally have better ideas as to how tasks may be accomplished to the satisfaction of the business' clients. What is made clear in the foregoing is that successful re-engineering of any business rests in great part on the support of its employees. Hammer and Champy [1993] puts it thus:

*Reengineering demands that employees deeply believe that they work for their customers and not for their bosses ... In a reengineered environment, the successful accomplishment of work depends far more on the attitudes and effort of empowered workers than on the actions of the task oriented functional managers .*

## 5.4 Re-engineering Options for Technology Resources

In today's world, the use of information technology is nearly always considered in re-engineering projects [Morris and Brandon, 1993]. It is known that information technology can support many business processes [Morris and Brandon, 1993]. These include:

- a. Increasing the speed at which information is processed.
- b. Facilitating the speedy and efficient storage and retrieval of large data sets.
- c. Improving the communication of data from one entity to another.
- d. Controlling tasks directly and thereby eliminating human error.
- e. Supporting decision making.
- f. Doing actual work such as fabricating, manufacturing etc.

Information technology is also an enabler that creates opportunities for organizations to break old rules and create new ways to do work, or in other words re-engineer [Hammer and Champy, 1993]. When dealing with the re-engineering of technical resources, this section is specifically concerned with information technology resources within the Jamaican LIM organizations. The proceeding sections go into some details regarding the elements of relevant information technology. The reason for this lies in the fact that making the right choices in implementing information technology to support the re-engineering of land information management is crucial, especially since GOJ has made it an objective to digitally link all LIM organizations by the year 2000.

There are a number of issues relating to data, software and hardware **standards** that must be dealt if the sharing of digital data in Jamaica is to be accomplished in an acceptable manner. These standards are considered within the context of the concept of a national data infrastructure which requires key national databases to conform to common set of standards [Clarke, 1992]. Also of importance is database organization, bearing in

mind that the automation process must not only target local needs but that of a national data network.

#### **5.4.1 Issues Relating to Data Standards**

Data standards, in a distributed computing environment that includes the sharing of spatial data, cover a number of areas including data models, data feature definition, data quality and data transfer [Clarke, 1992]. Data models refer to the representation of real world phenomena and their relationships as data objects. A vector spatial data model, for example, may represent roads as lines, forests as polygons and wells as points [Clarke, 1992]. Data feature definition relates to the attributes used to define spatial objects. Attributes of x and y coordinates, depth, ownership and volume may be used to define a spatial object such as a well. Data quality refers to that of the products of a LIS/GIS: positional accuracy, attribute accuracy, completeness, semantic consistency, geometric accuracy etc. [Clarke, 1992; Newton et al., 1992]. Data transfer covers such areas as media, file and record structures, and metadata for data transfer [Clarke, 1992].

According to Clarke [1992], there are also a number of management data standards that must be taken into consideration, especially in the context of a nationwide data network: data custodianship and data distribution. Data custodianship refers to the responsibility for the acquisition, storage, maintenance, quality assurance, security, access and documentation of data. Data distribution relates to the responsibilities of data custodians associated with the dissemination of data, and the pricing policies and licensing conditions for external users.

Formulating or adopting, and enforcing these data standards is essential for the sharing of distributed digital land information in Jamaica. This is especially the case since the digital databases that exist all use different data models and different keys for referencing data records (Section 4.1.2).

## 5.4.2 Issues Relating to Software Standards

Software standards cover such areas as operating systems, database management systems (DBMS), distributed database management systems (DDBMS), GIS, graphical user interfaces (GUI) and application programs. Telecommunications software will be dealt with when options relevant to telecommunications services are examined. The software products currently in use in the Jamaican LIM environment were described in Section 4.1.2.

**(a) Operating systems.** Some of the operating systems in place (Section 4.1.2) can handle distributed and remote processing (e.g., UNIX, IBM AIX) and some cannot (e.g., DOS). The choice of an operating system must be made with regard to its ability to function as a *distributed operating system* [Elmasri and Navathe, 1994].

**(b) DBMS/DDBMS.** The concept of a national data network in the manner described in Section 4.3.2 implies distributed processing. The choice to be made with regard to DBMS/DDBMS is therefore a crucial one. When choosing a DBMS/DDBMS, a number of factors [Hyslop, 1994; Elmasri and Navathe, 1994] should be considered, including:

- i. The data model.
- ii. The ability to provide security and recovery features in a distributed environment.
- iii. The ability to access data from more than one site.
- iv. The ability to manage replication of data.
- v. The ability to maintain data consistency in a distributed environment.
- vi. The ability to maintain concurrency control in a distributed environment.
- vii. The presence of utilities such as editors, design tools and graphic tools.

**(c) GUI and application programs.** A GUI should be chosen on the basis of ease of use and common presentation in order to minimize the need for re-learning upon the transfer of personnel, and also to present a common interface for external clients of Government systems [Camarata Jr., 1992]. **Application programs** should also present a standard user interface where the same type of functionality is common across organizational boundaries.

**(d) GIS/CAD software packages.** A number of GIS/CAD software packages are currently in use in Jamaica (Section 4.1.2). For those LIM organizations that are automating their LIS and need to process spatial data, the options available include the purchasing of GIS/CAD packages. Again the sharing of information, and the manner in which the information is shared are to be the deciding factors influencing the choice of GIS/CAD packages purchased. Also the choice of a GIS as against a CAD type software will depend on the local need for the analytical features of a GIS

In general, software chosen by Jamaica for use in its national land data network should have a number of features [Forrest, 1992]. These include:

- a. Adherence to international standards.
- b. Portability.
- c. Expandability.
- d. Consistency of appearance and behavior across platforms.
- e. Ease of use.

### **5.4.3 Issues Relating to Hardware Standards**

Hardware standards dealt with in this section are not specifically related to international standards which enable equipment from one vendor to communicate with that from another vendor [Halsall, 1992] although these standards are implied. The issue

of hardware standards is dealt with in the context of **standard types of equipment** that may be accepted by the organization/entity responsible for standards in Jamaica for use by the various LIM organizations. This is so that problems associated with heterogeneity of equipment may be avoided.

The hardware components of current Jamaican LISs were described in Section 4.1.2. The options available to LIM organizations seeking to automate their LISs should include the purchase of equipment of the type already in use by other LIM organizations, and which are capable of handling large volumes of spatial data in addition to being linked to a national telecommunications data network. The purchase option should also include the purchase of equipment not currently owned by other LIM organizations, as long as the objective of interconnectivity is not compromised. Ideally hardware systems should [Forrest, 1992]:

- a. Adhere to international standards.
- b. Support interconnectivity.
- c. Facilitate the integration of components.
- d. Support the portability of software.
- e. Be expandable.

#### **5.4.4 Database Organization Options**

Database organization will be dealt with from two perspectives: options concerning the organization of individual databases and options relevant to the amalgamation of discrete databases. Land information databases in Jamaica have both cadastral bases and thematic bases. The databases of the Land Valuation Department (LANDVAL) and the OOT are fiscal and legal cadastres respectively. The polygons on a map maintained by the Geological Survey Division (GSD) represent geological themes.

In order for data in these databases to be shared, each database has to be organized in such a way that common record identifiers are used to reference information about the same geographical location [Newton et al., 1992]. Also, departments may be interested in common themes (e.g., geological themes) or common units (e.g., cadastral parcels). In those instances, the option of the amalgamation of databases could produce significant savings in storage, hardware and software costs and reduce unwanted redundancy and duplication of effort [Manley, 1994].

Additionally, since the desired national data network implies a distributed database of some kind, other options must be dealt with in terms of the characteristics of the distributed database environment. These include [Elmasri and Navathe, 1994]:

- a. The type of database fragmentation (vertical, horizontal or mixed).
- b. The level of data replication and allocation.
- c. The degree of homogeneity or heterogeneity.
- d. The type of database (distributed or federated).
- e. The degree of distribution transparency.

#### **5.4.5 Options Relevant to the Automation of Manual Systems**

This section focuses on those Jamaican LIM organizations that still maintain manual land information systems (LIS). Considering the policy objective of digitally linking all LIM organizations by the year 2000 (Section 4.2.1), it is necessary to prepare each organization to have the requisite processes automated so that the organization's information system can function as a node in the desired telecommunications network. Morris and Brandon [1993] outlines some steps towards the effective use of technology as part of the re-engineering process, and which are applicable to introducing information technology into an organization in Jamaica. They include:



- a. Assessing current information support services and office technology related to the process being studied.
- b. Finding the tasks and processes that have an especially critical requirement for information and information technology.
- c. Determining how to improve the business process by the use of information technology and also how to get the data required.
- d. Defining the information technology architecture, technology support and information systems that are needed.
- e. Implementing the required technologies using the re-engineering models as a basis.
- f. Using re-engineering models on a routine basis to control the flow of information in the corporation.

The discussion in this section is of a general nature and therefore steps (a) to (c) and (e) will not be covered for the individually researched organizations. It is assumed that they will be dealt with by specific projects targeting the individual organizations following the paths outlined in Section 5.2.1. Step (f) refers to future actions that will be dealt with in Chapter 6. This section will concern itself with step (d): the technology options that may be applicable the local processing of data and preparation by the organization to have its system become part of a national telecommunications data network.

The first action necessary in automating manual systems, after a re-engineering analysis process, is to have the current database organized to enable automation [Rammelaere, 1994]. In many instances, as previously mentioned in chapter 4, this is a daunting task because of the state of many of the current manual systems. It is however not an impossible one and is absolutely necessary with regard to GOJ's objective to set up a data network to digitally link all LIM organizations by the year 2000 [Government of Jamaica, 1994b]. General database organization was dealt with in section 5.4.4. Sections 5.4.1 to 5.4.3 dealt with the standards that must be considered in automating manual systems.

#### **5.4.6 Options Relevant to the Upgrading of Automated Systems**

The hardware components of current Jamaican LISs were described in Section 4.1.2. The analysis of the current Jamaican LIM situation revealed that many of these systems serve local departmental objectives. Additionally, many of these organizations possess low end, stand alone personal computers with limited secondary storage, random access memory, and processing power. Other considerations include the capabilities of existing operating systems, DBMSs, GUIs, and application programs.

These organizations' systems may therefore be incapable, in their present state of configuration, to effectively handle the heavy traffic that may result from connections to an islandwide data network. Their databases may also not be organized to support the sharing of data in a national telecommunications data network. It may then become necessary for these systems to be upgraded through one or more of the following actions:

- a. Organizing (or re-organizing) databases to support data sharing.
- b. Purchasing more powerful workstations to be used instead of personal computers.
- c. Purchasing peripheral devices such as plotters, scanners and printers.
- d. Migrating to multi-tasking operating systems.
- e. Procuring DBMS/DDBMS capable of facilitating queries both within their own systems and into the databases of other LIM organizations through a telecommunications data network.
- f. Securing upgraded application software capable of handling data from both local and external databases, and operating in a multi-tasking environment.

#### **5.4.7 Network Options**

Two or more computers physically and logically linked by way of some data communications facility is said to be networked [Halsall, 1992]. A matrix showing the

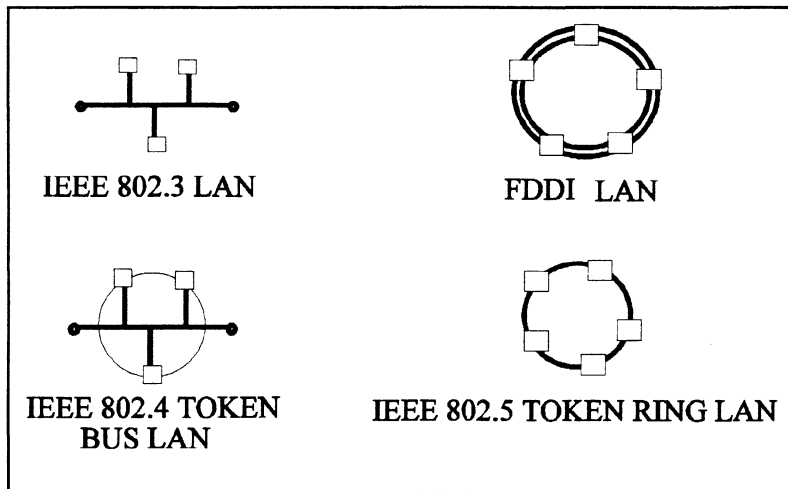
LIM organizations possessing some type of network was presented in Section 4.1.2. Data networks are usually described as local area networks (LAN), metropolitan area networks (MAN) or wide area networks (WAN), depending on factors which include geographic dispersion of network nodes and the type of communications facilities used. The purpose of any computer network is to "permit computers to communicate with one another, exchanging information that ultimately should benefit their users" [Pretty, 1992]. Networking facilitates the sharing of data, hardware, and software resources [Pretty, 1992]. Network interconnection, apart from **some** examples of LAN connectivity, are *typically* offered by telecommunications common carriers which are usually regulated public utilities [Ellis, 1986]. In Jamaica networking services are offered by Telecommunications of Jamaica (TOJ) which is a private corporation.

The discussion in this section will focus on the network and telecommunications options that can facilitate the achievement of the policy objective of digitally linking all Jamaican LIM organizations by the year 2000 (Section 4.2.1). Network types and the rationale behind choosing one of these types will be the focus of the network discussion.

#### **5.4.7.1      *Local Area Network (LAN) Options***

A LAN is characterized by a number of features [Chorafas, 1989]:

- a. Data communication is confined to a moderate-size geographic area such as a building, a group of closely located buildings, or a campus.
- b. Error rate is generally consistently low.
- c. The network is usually owned by a single organization.



**Figure 5.5**  
**Industry Standard LANs [after Pretty, 1992]**

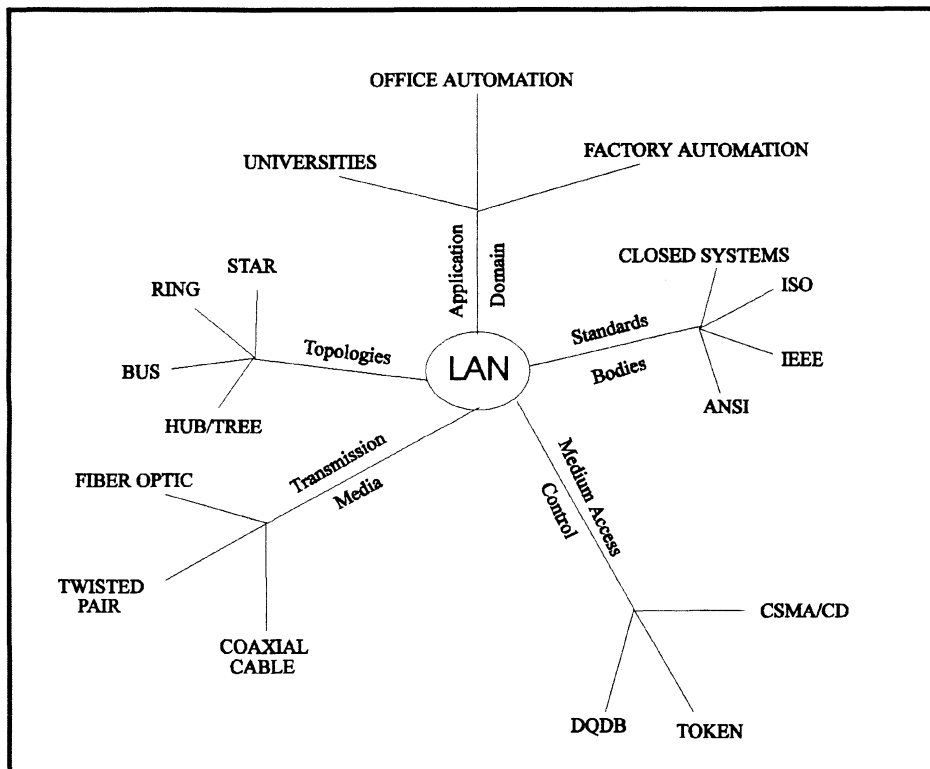
There are a number of industry accepted standards (Figure 5.5) associated with LANs. These standards were developed by standards organizations such as the Institute of Electrical and Electronic Engineers (IEEE) and the American National Standards Institute (ANSI) [Pretty, 1992] and include:

- a. IEEE 802.3: Carrier-Sense-Multiple-Access with Collision Detection (CSMA/CD) or "Ethernet."
- b. IEEE 802.4: token bus.
- c. IEEE 802.5: token ring.
- d. ANSI's Fiber Distributed Data Interface (FDDI).

IEEE 802.3 (Ethernet or CSMA/CD) standard utilizes a shared-bus topology (multiple access). Every machine monitors the bus (carrier sensing) and each can transmit data at any time, if no other machine is using the bus. Due to propagation delay, a machine may sense that the bus is free when it is actually busy. The machine may then try to transmit and a collision may occur. The system will notify the machines that a collision has occurred (collision detection), and the machines will have to wait a random period of time and then re-transmit. This protocol works well if less than 40 percent of the bus

capacity is used and interconnection distances are short. Collisions consumes bandwidth [Fetterolf, 1991].

IEEE 802.4 also uses a physical bus topology which operates as a logical ring. IEEE 802.5 uses a strictly ring topology. The medium access method for both of these standards is characterized by token (control packet) ring passing. Each station wishing to transmit data takes control of the token, marks it "busy" and appends data to it. After transmission has been completed to the destination station the token is returned to the sending station which marks it as "free" and puts it back into circulation. Although cable length is still limited by propagation delay, token passing has the advantage of bandwidth efficiency (because of the absence of collisions) giving higher throughput [Fetterolf, 1991].



**Figure 5.6**  
*LAN Selection Issues [after Halsall, 1992]*

FDDI is a fiber-optic based token ring standard that uses a counter-rotating ring topology. This is a very robust topology as the failure of one ring does not inhibit the transmission of data on the other. Also, if a cable is cut the two counter-rotating rings can re-configure themselves to implement a new ring. The multiple token-ring protocol of FDDI generates a new token after each frame allowing for the simultaneous transmission of multiple frames [Fetterolf, 1991].

There are a number of other selection issues, apart from standards organizations and topology (Figure 5.5), which are to be considered when selecting a LAN (Figure 5.6). These issues are application domain, transmission media, medium access control. Application domain refers to the business or environment within which the LAN functions, and which determines the kind of data being processed. Transmission media refer to the physical link (cable) that facilitates data communication. Medium access control refers to the methodology used by the network to ensure that nodes get access to the transmission media in order to transmit data to other nodes [Halsall, 1992].

The options open to the LIM organizations, as far as LANs are concerned, are determined by the kind of interconnectivity that is desired within and among LIM organizations, the volume of data to be transmitted from node to node, the kind of data to be transmitted from node to node, the desired speed of transmission, the degree of local autonomy desired, among other things [Halsall, 1992; Elmasri and Navathe, 1994]. Table 5.1 shows the various industry-standard LANs with such factors as transmission speed(s), transmission media, topology, and medium access control which must be considered in any choice of LAN technology to be implemented as support for Jamaica's LIM data network objectives.

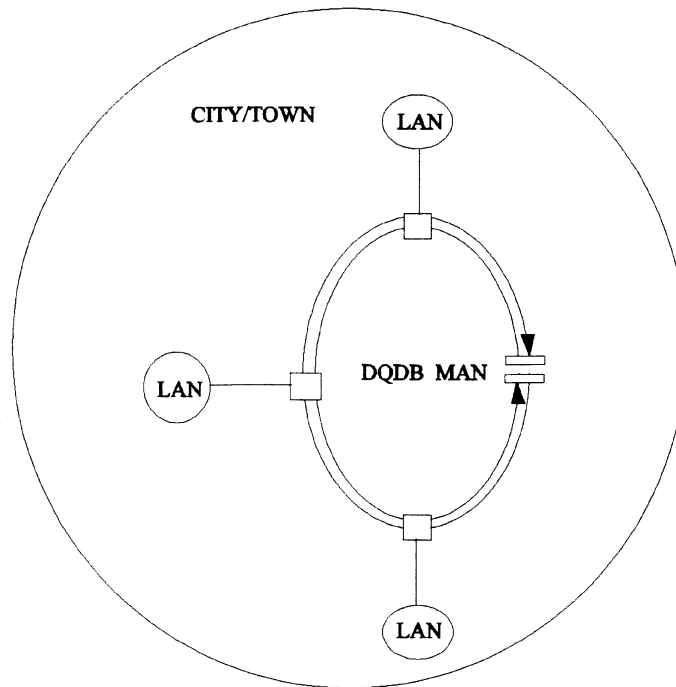
**TABLE 5.1**  
**CHARACTERISTICS OF INDUSTRY STANDARD LANS**  
**[Derived from Halsall, 1992; Pretty 1992; Mirchandani, 1993]**

Industry Standard LAN	Topology	Transmission Media	Medium Access Control	Transmission Speed(s)
IEEE 802.3	Bus	Coaxial Cable	CSMA/CD	10 Mbps
IEEE 802.4	Bus	Coaxial Cable	Token	1, 5 and 10 Mbps
IEEE 802.5	Ring	Twisted Pair Cable	Token	4 and 16 Mbps
ANSI FDDI	Dual-Counter-Rotating Ring	Fiber Optic Cable (and others)	Token	100 Mbps

#### **5.4.7.2 Metropolitan Area Network (MAN) Options**

The medium access protocol of a LAN limits the operation of the network to a relatively small geographic area [Pretty, 1992]. A number of LANs distributed over the geographic area of a city or town may however be connected via a higher speed intermediate network backbone. The result of this inter-networking over the geographic area of a town or city is a metropolitan area network MAN [Halsall, 1992]. Fiber-optic based standards such as FDDI (described in the previous section) and distributed-queue, dual-bus (DQDB) are networks that can be used. Figure 5.7 illustrates the topology of a DQDB MAN.

DQDB falls within the parameters of IEEE-802.6 MAN standards which utilizes the high speed transmission capabilities of fiber optics and a shared medium architecture. DQDB also supports circuit-switched voice traffic [Fetterolf, 1991]. The DQDB medium access method utilizes two transmission buses flowing in the opposite direction. A continuous stream of fixed sized slots flow along each bus and data is communicated between two stations by writing the data into free slots on each of the two buses [Halsall, 1992]. The aggregate capacity of a DQDB MAN ranges from 34 Mbps to 140 Mbps [Pretty, 1992].



**Figure 5.7**  
***DQDB MAN [after Halsall, 1992]***

### **5.4.7.3 Wide Area Network (WAN) Options**

Wide area networks (WAN) are basically of two types: centralized and distributed. Centralized WANs are characterized by the linking of geographically dispersed dumb terminals to a central computer (usually a mainframe) via leased lines [Fetterolf, 1991]. Distributed WANs are characterized by the networking of independent computers, with each computer having equal levels of control in the network [Fetterolf, 1991]. The geographic dispersion of network nodes may include an entire country, or even the globe [Pretty, 1992].



A WAN may utilize switched services or dedicated lines. Switched services provide flexible connectivity [Pretty, 1992] utilizing the resources of a public common carrier. The advantages of utilizing switched services [Ellis, 1986] include:

- a. Low fixed cost.
- b. Quick ordering and installation.
- c. Billing done on usage only.
- d. Accurate network accounting using the common carrier's records.

The disadvantages of utilizing switched services [Ellis, 1986] include:

- a. Possible variable quality of the common carrier's lines.
- b. Long setup (dial-up) time (approximately 25 seconds).
- c. Heavy usage charge during work hours.
- d. Full-minute billing.

Lines may also be leased from public common carriers to provide private WANs guaranteeing permanent (dedicated) connections among network nodes. These private line networks require high initial investments in purchasing or leasing the equipment, and the generation of enough data traffic in order to make the investment justifiable [Halsall, 1992]. The advantages of utilizing dedicated lines [Ellis, 1986] include:

- a. An assured connection.
- b. An immediate connection.
- c. A more reliable connection.

The disadvantages of utilizing dedicated lines [Ellis, 1986] include:

- a. A high investment cost.
- b. The requirement for long term commitment.
- c. The need for dense traffic to justify investment.

WANs may be circuit-switched or packet-switched. The following are some characteristics of a circuit-switched network [Halsall, 1992]:

- a. Connections must be established through the network before data can be transmitted.
- b. Connections are used exclusively by the two subscribers.
- c. A fixed data rate is provided and both subscribers must operate at this rate.
- d. Error control and flow control are performed by the user's equipment.

Traditionally WANs utilized public switched data networks (PSDN) because of the wide connectivity they provide [Pretty, 1992]. However, the relative low transmission rates of analog lines together with high charges for calls (based on distance and duration) can make some transactions very expensive [Halsall, 1992]. Recently, however, the trend has been towards computer-controlled switching exchanges, and digital transmission all the way to the user's equipment [Halsall, 1992; Pretty, 1992].

These all digital switched-circuits also support the transmission of voice, and so are known as integrated services digital networks (ISDN). ISDNs offers multiple transmission channels, each with 64 kbps digital transmission rates. Also, the International Telegraph and Telephone Consultative Committee (CCITT) is presently developing standards for Broad-band ISDN (B-ISDN) to take advantage of fiber optic transmission media. B-ISDN will have 155 and 622 Mbps digital data accesses [Kirton, 1992].

The following are some characteristics of a packet-switched network [Halsall, 1992]:

- a. No physical connection is set up.
- b. Connected subscribers may operate at different data rates.
- c. Data are organized into message units called packets.
- d. Error control and flow control are performed on each link by the packet-switching exchange.

The CCITT X.25 network is an example of a packet-switching network. CCITT X.25 is a packet-switching standard (protocol set) used to interface a data terminal equipment (e.g., a computer) to a data circuit terminating equipment (e.g., a modem)

associated with a packet-switched data network [Halsall, 1992]. X.25 is a popular standard accommodated by computer vendors, and therefore it is very easy to connect to an X.25 network [Pretty, 1992]. X.25 typically operates at transmission speeds of about 64 Kbps [Stallings, 1991].

The choice of WAN type to support Jamaica's land data network objectives to will depend on the speed and capacity requirements of data transfer between geographically dispersed LIM organizational entities. Of course the choice is also limited to the services made available by Telecommunications of Jamaica (TOJ) which is the company offering telecommunications services in the island.

#### **5.4.7.4      *Network Design Goals***

Networks exist to satisfy the needs of those who use them [Ellis, 1989]. The general requirements to be met for a telecommunications data network needed to satisfy Jamaica's LIM policy objectives were stated in Section 4.3.2. Other elements are also important considering the constraints outlined in Section 4.4. These elements [Ellis, 1989] include:

- a.      The costs for telecommunications lines, software and equipment.
- b.      The network's:
  - i.      Performance.
  - ii.     Security features.
  - iii.    Reliability (probability of failure).
  - iv.    Level of redundancy (alternatives and backup systems).
  - v.     Robustness (ability to deal with surges of user demands).
  - vi.    Flexibility (ability to accommodate new users, applications, technology etc.).
  - vii.   Compatibility with organizational political realities.

- viii. Cohesion (which affects protocol compatibility etc.).
- c. The reputation and experience of network components' vendors.
- d. The ease of implementation.

Also of important consideration is the implication of open systems interconnection since the existing LIM digital systems intended for interconnection are heterogeneous. Open systems interconnection refers to the concept of vendor-independent interconnected computers utilizing the same standard communication protocols stack. These standards are relevant to the interfacing of computer equipment to different types of networks (e.g., PSDN, ISDN), and the format and control of data exchange between systems [Halsall, 1992]. The two current open system standards (Figure 5.8) are the International Standards Organization reference model for Open Systems Interconnection (ISO/OSI) and the Transmission Control Protocol/Internet Protocol (TCP/IP).

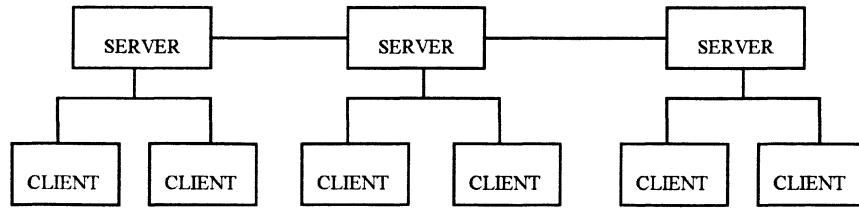
The ISO/OSI model is comprised of a seven layer protocol stack, with each layer responsible for some aspect of network-specific or application-supporting functions. ISO and IEEE produce standards for use by computer manufacturers while standards for connecting equipment to various types of networks are produced by CCITT [Halsall, 1992].

The standard supported by the Administrative Reform Programme (ARP), as stated in Section 3.1.16 [Manley, 1994], is TCP/IP. The protocol specifications associated with TCP/IP are in the public domain and require no payment of license fees. These protocol specifications, which include both application-support and network-oriented protocols, are very popular and have been widely used to create open systems [Halsall, 1992]. However the evolving ISO/OSI standard is considered the "key to global interconnectivity" [Hubley, 1991] and must be an option deserving serious consideration. The main problem with ISO/OSI is that there is a lack of products that comply with that standard [Alexander and Fox, 1992].

ISO PROTOCOL LAYERS		TCP/IP PROTOCOL SUITE	
File transfer, access and management, document/message interchange, job transfer and manipulation	Application Layer	*File transfer protocol (FTP) *Remote terminal protocol, (TELNET) *Simple mail transfer protocol, (SMTP)	
Transfer syntax negotiation. Data representation transformation	Session Layer	*Name server protocol, (NSP) *Simple network mgmt. protocol, (SNMP)	
Dialogue and synchronization control for application entities	Presentation Layer		
End-to-end message transfer	Transport Layer	TCP	UDP
Network routing, addressing, call set-up and clearing	Network Layer	IP	
Data link control (framing, data transparency, error control)	Link Layer	IEEE 802.X	
Mechanical and electrical network interface definitions	Physical Layer	X.25	

**Figure 5.8**  
**ISO/OSI Open System Model and TCP/IP Protocol Suite**  
**[After Halsall, 1992]**

Implied with the discussion of an open distributed data processing environment is the data access architecture: the manner in which the data is stored and accessed and processed. The architecture recently evolved is the client/server architecture. Clients are workstations (or personal computers) located on the desktop, providing front-end interfaces and applications. Servers are central computers providing back-end processing and the basic database management functions [Hubley, 1991; Lee and McLaughlin 1991]. In an open distributed environment, applications and services may be modularized and spread among two or more linked servers (Figure 5.9), with the potential for a very huge network. Servers may then pass information among themselves on request from each other in a manner that makes servers clients of each other [Hubley, 1991].



**Figure 5.9**  
***Client/Server Architecture in a Distributed Open Environment***  
***[After Hubley, 1991]***

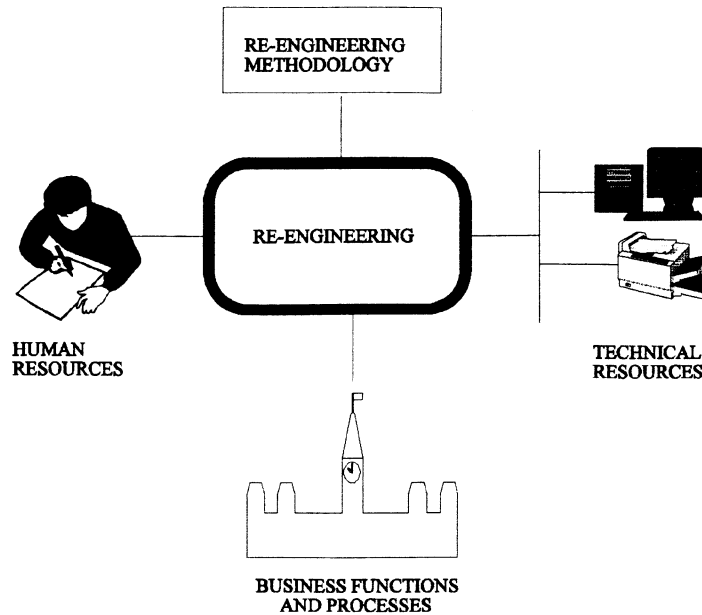
The foregoing represents some elements of consideration with regard to manner in which a national data network may be implemented to achieve Jamaica's objective of digitally linking all LIM organizations by the year 2000 so as to facilitate the sharing of data. Also outlined were some of the desired characteristics of that network that will enable quality performance.

## 5.5 Conclusions

The demand for land information in Jamaica and the problems faced by the custodians of land information in meeting that demand has brought to fore the fact that the manner in which land information is managed in the island is in need of change. Jamaica's requirements with regard to its LIM objectives are achievable through re-engineering (Figure 5.10). A re-engineering methodology for creating new models (at the local and national levels) to effect the necessary changes is needed. The aim is to produce an environment conducive to the efficient acquisition, storage, processing and dissemination of land information to support the business of the nation that relies on such information.

Re-engineering may be applied to Jamaica's LIM business functions as are impacted upon by departmental functions and business processes, organizational structures and mechanisms that facilitate change. It was shown that the benefits of re-engineering

are realized when a business seeks to find new ways of doing business in order to effectively meet its objectives in the market place through improved performance [Morris and Brandon, 1993; Hammer and Champy, 1993].



**Figure 5.10**  
**Re-engineering Scenario**

Human and technical resources are also to be the focus of any re-engineering effort. Human resources are to be dealt with as a high priority issue since the success or failure of any re-engineering project depends on their performance. The education and empowering of employees has been proven to increase productivity and reduce costs [Morris and Brandon, 1993; Hammer and Champy, 1993].

The technical resources to be dealt with include data, software and hardware which must all adhere to established standards. This is extremely important in light of the inevitable use of information technology as support systems for Jamaica's LIM. The existing heterogeneous systems, and the systems that may be introduced to organizations

that are not yet, or partially, been automated will have to communicate with one another in order to facilitate the digital sharing of data.

Data standards were discussed in the context of the establishment of a national data infrastructure and affect data models, feature definition, quality, transfer, custodianship, and distribution, especially since spatial data sharing is involved. Software standards affect DBMS/DDBMS, operating systems, GUIs, GIS/LIS, and application programs. Hardware standards relate to the established international standards that support open systems interconnection.

Re-engineering must also be applied to the organizations' databases which have to be re-organized to support data sharing over networks. These networks (LAN, MAN, WAN) provide the means for sharing data among geographically dispersed LIM organizations and must be selected to provide the most efficient services at the most economical cost. Performance is however key, and must not be sacrificed for lower cost [Elmasri and Navathe, 1994]. The network(s) chosen should conform to design goals which include an open distributed environment. It must be noted that the choice of telecommunications services is a factor of the services available through TOJ.



## CHAPTER 6

### DESIGN OF A MODEL FOR RE-ENGINEERING LAND INFORMATION MANAGEMENT IN JAMAICA

*Since the overriding concern is to provide for the best possible management of the land to meet the needs of the present while sustaining the ability to meet future needs, a key part of the solution is to ensure the best possible management of information about land.*

[US. Department of the Interior, 1990]

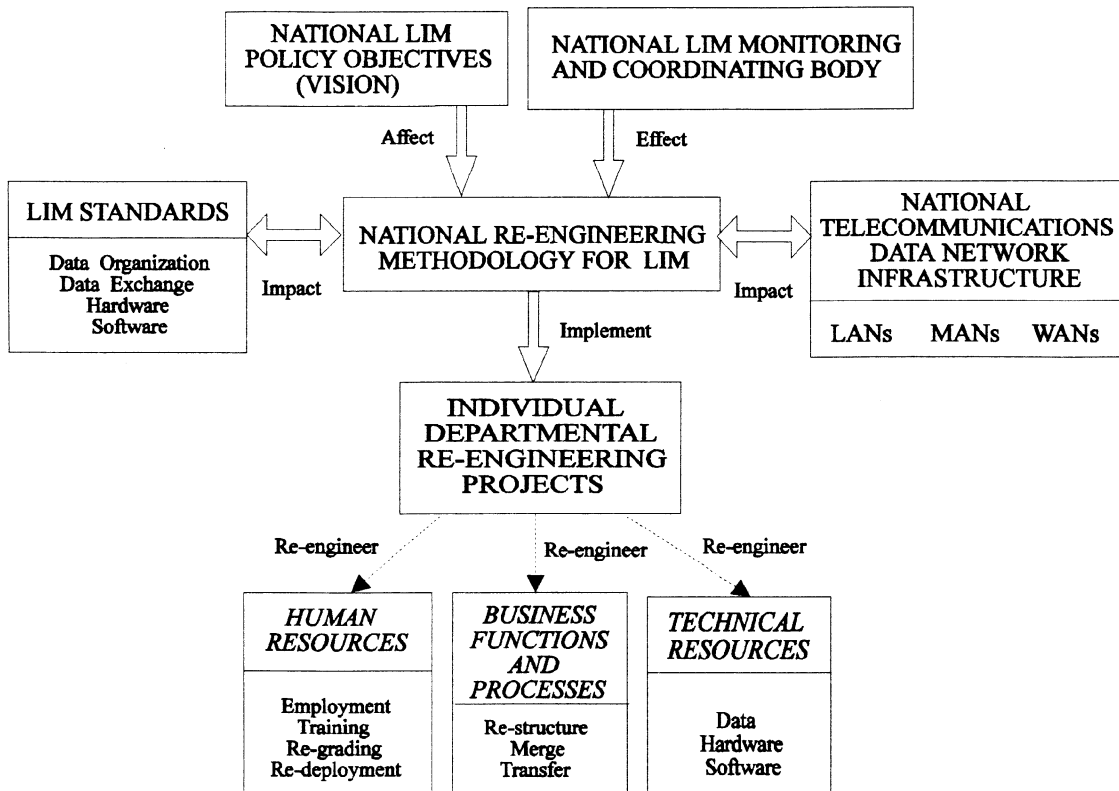
#### Introduction

The previous chapters of this thesis have progressively identified and analyzed Jamaica's current land information management (LIM) model, and outlined the considerations and options that are relevant to effect that model's re-engineering in order to overcome the problems being experienced in producing up-to-date, timely, accurate, complete and comprehensive land information. This chapter will focus on the design of a model to re-engineer LIM in Jamaica (hereinafter called "the model") so that the nation's **stated** LIM objectives (made in response to those problems described in Chapter 4) may be achieved. It is not the objective of this model to dictate to the Government of Jamaica (GOJ) what land related policies to pursue, or what the construction of its institutional and legal frameworks should be, only to provide a framework that will enable it arrive at the destination that its stated LIM objectives indicate it wants to go.

The following sections outline the components of the model, and describe how the model works. In the ensuing discussion of the model the areas of priorities, expected outputs from the model, testing of the model, and the alternatives that are applicable should the expected outputs not materialize will be outlined.

## 6.1 The Components of the Model

The model is comprised of six major components (Figure 6.1): the national LIM policy objectives (LIM vision), a national LIM monitoring and coordinating body, LIM standards, a national telecommunications data network infrastructure, a national methodology for effecting the re-engineering of LIM, and projects geared at effecting the re-engineering of individual LIM departments and agencies. The last component is broken down into three sub-components that together will effect the re-engineering of individual LIM departments and agencies.



**Figure 6.1**  
*The model for re-engineering LIM in Jamaica*

**(a) National LIM Policy Objectives (National Vision).** The national policy objectives as they relate to the management of land information represent the vision of GOJ as to the type of LIM environment it wishes to establish in the country. These objectives are the basis upon which the model is built. For ease of reference the objectives are listed below [Government of Jamaica, 1994b]:

- i. The establishment of a comprehensive networked and computerized geographic information system linking all government land related agencies by the year 2000.
- ii. The creation of national standards for geographic data collection, storage and exchange.
- iii. The development of the human resources required to manage and operate Geographical Data Management Systems (GDMS).
- iv. The establishment of a national digital geographic database comprising topographic, cadastral, land use, soil, environmental, natural resource, infrastructural and socio-economic components.

**(b) National LIM Monitoring and Coordinating Body.** The national LIM monitoring and coordinating body was discussed in Section 5.2.3 in terms of the attributes and characteristics it should possess. This entity will have the responsibility for developing the national LIM methodology and for effecting the re-engineering of Jamaica's LIM environment in accordance with the stated LIM policy objectives. Recommendations regarding the structure of this body is outlined in Chapter 7.

**(c) LIM Standards.** The component comprising the LIM standards is a necessary response to objectives (i), (ii) and (iv) stated above. The standards cover data organization, data exchange, computer hardware and software. They are absolutely necessary if data is to be shared among LIM organizations in a distributed heterogeneous

computerized environment. The heterogeneous nature of Jamaica's land information systems (LIS) was described in Chapter 3. The considerations relevant to this component were discussed in Sections 5.4.1 to 5.4.4. The chosen standards would be enforced by the national monitoring and coordinating body.

**(d) National Telecommunications Data Infrastructure.** This component is also in response to objectives (i), (ii) and (iv). This component will form the backbone that will facilitate the linking of the distributed (or federated) databases that will form the national digital "geographic" database referred to in objective (iv). The options and considerations relevant to this component were outlined in Section 5.4.7. The most likely candidate for the installation and maintenance of this component is Telecommunications of Jamaica.

**(e) National Methodology for Re-engineering LIM.** This component is concerned with how the re-engineering of Jamaica's LIM environment will take place. This component represents the national re-engineering strategy. The methodology will target individual LIM organizations with a common re-engineering approach, in order to bring each to a state of readiness to participate in the construction of a national LIM environment that will be able to secure the production of timely, up-to-date, accurate, complete and comprehensive land information for the satisfaction of customer demand. The methodology is impacted upon by the national telecommunications infrastructure and LIM standards which are taken into consideration when implementing the individual departmental re-engineering projects. Also, the methodology is effected by the national LIM monitoring and coordinating body in accordance with the stated LIM objectives. As such, this is the central component of the model. The steps in a proposed national re-engineering methodology for LIM in Jamaica would include:

- i. Identifying all the LIM organizations, both in the public and private sectors.

- ii. Identifying the business functions, human resources and technical resources of each LIM organization that needs to be addressed in order to make the organizations efficient in the production of land information and that will put them in a state of readiness to be connected to a national telecommunications data network infrastructure.
- iii. Designing re-engineering alternatives for addressing the business functions, human resources and technical resources needs of the LIM organizations within the context of the foregoing step (ii).
- iv. Researching each organization's technical resources in order to define the data organization, data exchange, hardware and software standards that are applicable to achieving the objectives of digitally linking these organizations' databases and effecting efficient data sharing among them.
- v. Defining the LIM standards applicable to data organization, data exchange, hardware and software.
- vi. Defining the characteristics of the national telecommunications data network infrastructure that will facilitate the linking of the distributed databases and the efficient sharing of data among LIM organizations.
- vii. Identifying the economic resources necessary for implementing the re-engineering changes as defined by the alternatives designed at (iii).
- viii. Selecting the best alternatives for each department according to the feasibility of the alternatives as dictated by availability of resources, the potentials of the alternatives, and the acceptance of the alternatives by GOJ.
- ix. Designing an implementation strategy.
- x. Implementing the designs within each LIM organization.
- xi. Reviewing the design implementations and assess the outcomes against expected outcomes.

- xii. Redesigning and re-engineering where applicable, going back to (ii) where necessary.

**(f) Individual Departmental Re-engineering Projects.** This component is geared towards the re-engineering of the business functions, human resources and technical resources of each Jamaican LIM organization in order that they become efficient in producing land information to satisfy their customers' demands. This component represents the actual implementation of re-engineering principles (or what will be done) according to the designs outlined in the national re-engineering methodology. It includes:

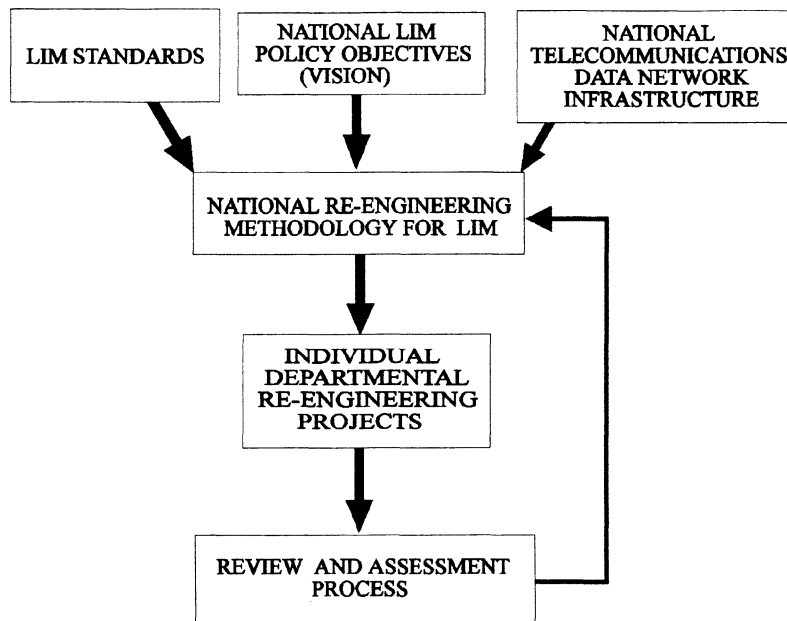
- i. The business functions and processes sub-component which is concerned with the application of re-engineering principles that affect the transferring, merging and restructuring of individual departmental functions, work flow and business processes so that efficiency is factored into the departments' operations and management of land information. The options and considerations relevant to this component were discussed in Section 5.2.
- ii. The human resources sub-component which is concerned with the application of re-engineering principles that cause the staff of Jamaica's LIM organizations to become skilled, motivated, dedicated and efficient in the performance of their allotted tasks which produce the land information needed by their organization's customers. The options and considerations relevant to this component were discussed in Section 5.3.
- iii. The technical resources sub-component which is concerned with the data, hardware and software located in individual LIM organizations and their conformity to the LIM standards adopted by GOJ. Also this component is concerned with the connection of computer resources to the national telecommunications data network infrastructure. The options and considerations relevant to this component were discussed in Section 5.4.

## 6.2 How the Model Works

This section offers a description of the way the model works by describing the interaction of the model's main components, the priorities that must be considered, and the expected outcomes of the model. The target of the model is the national LIM environment as defined by the functions and resources of Jamaica's LIM organizations. GOJ's LIM objectives provide the framework within which the model works.

### 6.2.1 The Interaction of the Model's Main Components

In this section the interaction of the model's main components will be outlined. The model's main components interact as follows (Figure 6.2):



*Figure 6.2*  
*The interaction of the model's main components*

- a. The national LIM objectives influences the creation and implementation of the national methodology for re-engineering LIM in Jamaica.
- b. The national methodology for re-engineering LIM in Jamaica is implemented according to defined LIM standards and with the aim of fitting each LIM organization within the framework of the national telecommunications data network infrastructure. The LIM organizations are affected by way of projects on a agency by agency basis, focusing on each organization's business functions, human resources, and technical resources.
- c. The progress of the individual projects is continually monitored by the national LIM monitoring and coordinating body which reviews and assesses the status of each project from time to time to ensure that their objectives are being met and standards are being adhered to.
- d. The outcome of the review and assessment process is used to make adjustments, where necessary, to the individual projects within the framework of the LIM objectives and according to the methodology being implemented.

## **6.2.2 Priority Considerations in the Implementation of the Model**

This section focuses on the priorities that must be considered in implementing the model. Assuming that the national LIM objectives component already exists and defines where the country wants to go in terms of LIM, the area of first priority is the establishment of the national LIM monitoring and coordinating body which will effect and monitor the changes to Jamaica's LIM environment. After deciding where to go, Jamaica must then define how it will get there. The monitoring and coordinating body will be responsible for developing the national methodology for re-engineering LIM in that regard.



The other priority considerations (in order) were implied in the methodology suggested in Sub-section 6.1 (e) which will be used as the basis for further discussion. The LIM organizations are first examined in order to identify their business functions, human resources and technical resources needs [Nichols, 1993] in order for that actions may be taken to address these areas and thereby enabling the organization to produce timely, up-to-date, accurate, complete and comprehensive land information. Even if the departments are not part of a telecommunications network, it is desirable that they function at optimal efficiency. This is consistent with the concept that what is not known cannot be re-engineered [Morris and Brandon, 1993] and defines the next area of priority.

Considering the intention to digitally link all Jamaican LIM organizations in a national data network, the next area of priority is the definition of data organization, data exchange, hardware and software standards that will enable the digital databases distributed throughout the country to exchange data. This is the next step towards realizing objectives (ii) mentioned in Section 6.1.

One advantage of a team versus an individual functioning as monitor and coordinator of the re-engineering of Jamaica's LIM environment is that a number of the tasks can be done in parallel by a process team consisting of individuals of varying skills, a feat that will be difficult for an individual to accomplish. For instance, the tasks of identifying, testing and defining LIM standards may be done by one team, while the definition of the characteristics of the national telecommunications data network infrastructure can be done by another. Of very important consideration is the economic resources that will, in addition to the other resources previously discussed, provide GOJ with the means of achieving its LIM objectives. However, the cost of implementing the re-engineering strategies will only fully be known when all the design parameters have been identified.

Continuing to use the methodology suggested in Sub-section 6.1 (e) to define the priority considerations, and assuming that the steps previously discussed have been

implemented, the other steps in the methodology may be accomplished in sequence. However, in implementing the design consideration should be given to which agencies and departments are to first receive attention. Criteria will have to be developed in order to make these decisions. For instance it may be decided that all agencies and departments that manage cadastral land information should receive attention before other LIM agencies and departments so that GOJ can better quantify its land holdings in the island. Observations made during research visits to Jamaica seem to indicate that cadastral land information is of immediate importance to GOJ. This is borne out by the fact that programs like Operation PRIDE (Section 4.4), developed by GOJ as an urgent measure to address the terrible squatting situation, depends on cadastral information (most of which relate to Government owned land). Cadastral information is also important in continuing and expanding land reform programs like the Land Settlement Scheme.

Also, support should be given where there are ongoing projects that affect how LIM agencies and departments manage land information. The support could be in the form of staff training, business function and process re-engineering design and implementation, and information technology implementation. Steps should also be taken to fill in the gaps left by completed projects in relation to the areas mentioned in the last sentence. Whether the focus is on completed or ongoing projects, it is important to ensure that the organizations involved are fully prepared to participate as part of Jamaica's re-engineered LIM model.

There are some milestones that are achievable over the time-span of the model's implementation. These milestones assume that the model's implementation will commence in late 1995 and include the:

- a. Establishment of the national LIM monitoring and coordinating body. This should be done within the first three months of the model's implementation (by early 1996).

- b. Design of the national re-engineering methodology for LIM. This should be completed approximately three months after the establishment of the national LIM monitoring and coordinating body (by mid 1996).
- c. Identification of all LIM organizations' re-engineering needs. This should commence within six months of the Body's establishment and be completed over a period of one and a six months (by late 1997).
- d. Design of re-engineering all alternatives for each LIM organization. This runs in parallel with (c) and should be completed over a period of two years (by early 1998).
- e. Definition of LIM standards. This should commence within nine months of the model's implementation and should be completed within one year of commencement (by late 1997).
- f. Design of the national telecommunications data network infrastructure. This should commence within nine months of the model's implementation and should be completed within one year and six months of commencement (by early 1998).
- g. Implementation of the national telecommunications data network infrastructure, and LIM standards. This should be completed by the third year of the model's implementation (by late 1998).
- h. Re-engineering of cadastral LIM organizations. This should be completed by the fifth year of the model's implementation (by late 2000).
- i. Re-engineering of Environmental LIM organizations. This should be completed by the tenth year of the model's implementation (by late 2005).
- j. Re-engineering of Infrastructural LIM organizations. This should be completed by the end of the model's implementation (by late 2010).

The times given in relation to the achievement of each milestone are estimates. They are subject to modification due to constraints and unforeseen problems, that in all

likelihood, will be experienced. The estimated times are achievable only with focused energy and discipline.

### **6.2.3 Expected Outputs from the Model**

This section deals with the outputs that are expected from the implementation of the model. These include:

- i. **LIM organizations that have become efficient** in managing and producing land information due to the implementation of projects that re-engineer their business functions and processes, human resources and technical resources. The organizations should experience organizational structures conducive to smoother work flows, efficient business processes, more motivated staff, and more efficient land information systems.
- ii. **Timely, accurate, up-to-date, complete and comprehensive land information** capable of supporting the land related policies of GOJ and satisfying the demand for that information from other customers in the public and private sectors. This information will come from the efficient functioning of Jamaica's LIM organizations.
- iii. **Legal reform**, which by the implication of managing land information in a shared computer environment, is necessary to deal with issues related to the computerization of legal documents (e.g, Certificate of titles), copyright, privacy of personal information, pricing and billing of land data, data custodianship, and value added products among other things.
- iv. **The achievement of GOJ's stated objectives** (Sub-section 6.1 (a)). Objectives (i) and (ii) will have been achieved by the creation of the model components related to LIM standards and the national telecommunications data network infrastructure. The "national digital geographic database" [Government of

Jamaica, 1994b] will have been facilitated by the combination of the two model components mentioned above in addition to the projects component referred to in output (i) which would have organized each organization's local database so that both local efficiency in the production of land information and national interconnection would have taken place. The objective of securing skilled human resources (objective (iii)) will also have been facilitated by the projects component referred to in output (i).

#### **6.2.4 Testing the Model**

This section deals with how the model can be tested (in terms of efficiency and effectiveness) in order that the expected outputs can be obtained. Criteria can be set to determine whether the model itself or components (or sub-components) of the model are efficient or effective. The efficiency of an entity is the measure of its ability to bring about a desired result in terms of the amount of energy input to produce the result, while an entity is said to be effective if the desired result is actually achieved [Hornby, 1974].

LIM standards will have to be tested using models of the LIM organizations' databases, and benchmark tests done to evaluate the ease of data transfer (and the quality of the data transferred) as facilitated by the combination of data models, database organizations, software and hardware. The testing of LIM standards will also have to be done over a model telecommunications network topology representative of the LIM organizations' hardware and software heterogeneity. These tests will enable the national LIM monitoring and coordinating body to evaluate the feasibility of LIM standards, and telecommunications network topologies, by measuring response times and system ease of use, among other things. Some questions to be answered in this regard include:

- a. Are the various computer systems able to communicate with each other?

- b. Are the response times for data requests to remote sites within acceptable time frames (especially with regard to large data sets such as image data)?
- c. Is the quality of data received from remote sites within defined acceptable parameters?
- d. Is the network able to efficiently and effectively handle heavy traffic?
- e. How easy to use is the network?

While many Jamaican LIM organizations were sometimes effective in that land information was actually produced in the form that was desired, they were generally inefficient because their land information systems (LIS) did not easily produce the information, when it could. Through re-engineering the human resources, technical resources, and business functions and processes of Jamaica's LIM organizations, it is expected that their efficiency and effectiveness in managing and producing land information will improve because:

- a. The work flow of their business processes will be such that the time and energy taken to convert inputs (e.g. requests for land information) to outputs (e.g. land information that is timely, accurate, complete, up-to-date and comprehensive) will be much less than is currently experienced.
- b. The technical resources of the organizations will be adequate to manage land information both in the locality and in a distributed computing environment.
- c. The human resources of these organizations will be skilled (possessing the ability to perform efficiently), motivated (possessing the desire to perform), and consequently apply effort to the tasks set for them (i.e., perform).

The efficiency and effectiveness of LIM organizations can be tested is by making comparisons with regard to the time and energy taken by these organizations (both before and after the model's implementation) to produce land information in the forms desired. This task would be the responsibility of the LIM monitoring and coordinating body. Strategies would include:

- a. *Customer satisfaction surveys.* Surveys are made of the levels of customer satisfaction both before and after re-engineering has been done. Customer satisfaction will cover the areas of general service, and the production of timely, accurate, up-to-date, complete and comprehensive land information. Customers will include the political directorate, other Government agencies, and the public at large.
- b. *Comparisons of business processes completion times.* The total times taken to complete various business processes are measured both before and after re-engineering has been done, and comparisons made in order to ascertain the level of improvement (if any).

Legal reform must be done in relation to the production of legal documents from digital data, copyright, value added products, data custodianship etc. This is also the responsibility of the LIM monitoring and coordinating body which must secure legal expertise in formulating and passing into law the necessary statutes and regulations. The measure of this output's effectiveness is relevant to the level of satisfaction encountered when the statutes and regulations are proposed. Customers and suppliers must be satisfied that their rights are protected. The level of satisfaction can be ascertained through opinion surveys of the customers and suppliers of land information.

What can be tested before implementation, is whether the composition of the model will be acceptable to GOJ, whose support is crucial if the model is to have a chance of being adopted. During the second research visit to Jamaica, the structure of the model was discussed with a number of key individuals in Jamaica's current LIM environment. While time did not permit great details to be discussed, the general opinion was summed up by Clarke [1995] who indicated that the model generally fits the country's LIM objectives because:

- a. The LIM standards component was defined.
- b. The telecommunications data network infrastructure component was defined.

- c. The model addresses the need to make LIM organizations more efficient and effective.
- d. The need for a national LIM monitoring and coordinating body was identified.

The obvious problems would be in effecting basic changes in a public sector bureaucracy that has often proved recalcitrant [Bower, 1977] in the face of efforts over the years to make it more efficient. Many senior officers have not yet grasped the concept that land information is probably one of the most important products of the organizations that have throughout this thesis been described as LIM organizations. However, from the discussions it appears that the model at least would have a good chance of at least receiving GOJ's attention. This current Government seems to have realized that without reliable land information it faces many difficulties in implementing its land related policies. Many key officers have expressed an interest in reviewing this work upon completion.

### **6.2.5 Alternatives to be Considered if Outputs are Not Realized**

In this section the alternatives that are to be considered if the expected outcomes from the model are not realized will be discussed. Each output will be discussed individually. In the ensuing discussion it is assumed that the model is complete and therefore those components that are also expected outcomes (e.g., the LIM standards and the national telecommunications data network infrastructure) are in place.

If the efficiency of the LIM organizations has not improved, then the factors that should have contributed to their efficiency should be investigated: organizational structures, work flow, business processes, staff skills, motivation and effort, and the components and performance of their land information systems. These factors are interdependent as efficient organizational structures usually promote smoother work flow, contain efficient business process, are able to attract, keep and motivate skilled employees



[Morris and Brandon, 1993] who make the best use of the organization's technical resources to output, in this case, land information with all the desirable attributes.

Modifications will have to be made to organizational structures, work flow and business processes if deficiencies are found. This is the job of the monitoring and coordinating body who, as mentioned in the Section 6.2.1, has the responsibility for continually monitoring the re-engineering projects directed at the LIM organizations. If problems are found in the staffing situation then the level of job satisfaction and worker competence is to be investigated to ensure that job design, and personnel selection and placement [Lofquist and Dawis, 1989] are optimal.

If the problem within the organizations relate to the use of technical resources, then investigation must proceed with a view to identifying which areas are not functioning as expected. Areas of investigation should include equipment performance, database organization, performance of database management systems (DBMS) and staff use of the technical resources. The second expected output (timely, accurate, up-to-date, complete and comprehensive land information) is dependent on all the factors discussed in this and previous paragraphs.

As far as the output of legal reform (as described in Section 6.2.3) is concerned, it is a matter that these areas must receive attention if GOJ is to avoid unforeseen litigation caused by dealing with land information in a computerized distributed shared environment. Litigation consumes time and money resources and may produce instances of bad faith between GOJ and its clients. If customers lose faith in GOJ's systems, they will tend not to use the facilities as is evident, in some instances, in the public's preference in registering land under the deed system at the Island Record Office instead of with the Registrar of Titles under the *Registration of Titles Act* [1889].

As previously mentioned the achievement of some of GOJ's LIM objectives are explicit in the creation of some of the model's components (e.g., the LIM standards and the national telecommunications data network infrastructure). To have the "national

digital geographic database" [Government of Jamaica, 1994b] set up requires concentrated and dedicated effort, and long-term financial and temporal investment by GOJ. Commitment by GOJ is needed to:

- a. Ensure that what is needed is identified along with the resources to support the database's establishment.
- b. Ensure that the services of Telecommunications of Jamaica (TOJ) (Chapter 3) are secured in setting up and delivering telecommunications services to support the database's establishment.
- c. Ensure that the support and cooperation of the management and staff of the LIM organizations are secured.
- d. Ensure that the vital skills need to ensure the database's establishment are employed within the re-engineering projects.

Finally, most of the success of the model's implementation will rest on the competence and performance of the coordinating and monitoring body. The body will have to be ready to perform the role of guide and enforcer in order to ensure that Jamaica's LIM objectives are met in accordance with the design of the model.

### **6.3 Strengths and Weaknesses of the Model**

The model has certain strengths and weaknesses which will be outlined in the following paragraphs. This exercise is necessary in order to be able to define the limitations and benefits of the model.

**(a) Strengths of the Model.** The model is considered to have strengths in that it:

- i. Provides for a methodology for the achievement of GOJ's explicitly stated LIM objectives, (e.g., LIM standards) as it was designed to do.

- ii. Provides for a methodology for the achievement of GOJ's implicit LIM objectives (e.g., timely, accurate, up-to-date, complete and comprehensive land information).
- iii. Encourages GOJ to consider the underlying causes of inefficiency and ineffectiveness in its LIM environment (e.g., the bureaucracy, organizational structures, human resources and business processes).
- iv. Shows not just what is necessary to achieve GOJ's LIM objectives, but also how these necessary elements interact and depend on each other (e.g., the impact of LIM standards and the national telecommunications data network infrastructure on how each agency's technical resources are re-engineered).
- v. Provides for the strengthening of LIM organizations generally, and not just in terms of managing land information.
- vi. Encourages GOJ to set up lines of communication that will ensure that its national vision for LIM in Jamaica is shared by all concerned in supporting it.
- vii. Encourages LIM organizations to function as part of a national vision for LIM in Jamaica, instead of functioning in the pursuit of narrow departmental objectives (therefore fostering cooperation among these organizations).
- viii. Provides for continual improvement in response to changes in the demand for land information the market place.
- ix. Provides a framework that is not dependent on specific LIM standards, computer and telecommunications technology, or re-engineering technique.

**(b) Weaknesses of the Model.** The weaknesses of the model are determined in that it:

- i. Depends on all components being in place, and functioning efficiently and effectively, in order to achieve optimal results.
- ii. Requires significant input in terms of financial support, human energy and time so that objectives, such as linking all LIM organizations by the year 2000 (which may not be realistic), can be achieved.

- iii. Depends on the support of the current (and possibly future) political administration for implementation and continued maintenance, in the face of Jamaica's other national needs and the tremendous costs that might be incurred in effecting the re-engineering changes to the status quo the model demands.
- iv. Depends on the support of the management and staff of the LIM organizations which are to be affected for implementation (which might not be forthcoming if the required changes are perceived to be negatively affecting their current positions).

## **6.4 Summary**

In summary the model is designed to re-engineer LIM in Jamaica so that the nation's stated LIM objectives, made in response to a set of LIM problems being experienced, may be achieved. It is not the objective of this model to dictate to the Government of Jamaica (GOJ) what land related policies to pursue, or what the constructions of its institutional and legal frameworks should be, only to provide a framework that will enable it arrive at the destination that its stated LIM objectives indicate it wants to go.

The model is comprised of six major components: the national LIM policy objectives (LIM vision), a national LIM monitoring and coordinating body, LIM standards, a national telecommunications data network infrastructure, a national methodology for effecting the re-engineering of LIM, and projects geared at effecting the re-engineering of individual LIM departments and agencies. The last component is broken down into three sub-components that together will effect the re-engineering of individual LIM departments and agencies.

The outputs that are expected from the implementation of the model include: (a) LIM organizations that have become efficient in producing land information, (b) timely,

accurate, up-to-date, complete and comprehensive land information, (c) legal reform, and (d) the achievement of GOJ's stated objectives. These expected outputs are based upon the assumption that GOJ is able to garner the economic and other resources to support the model. It is to be noted that as reliable land information will remain important regardless of which political party forms the Government, the relevance of the model should span political interests [Nichols, 1993].

The strengths of the model are mainly that all the parameters that are necessary to achieve the explicit and implicit LIM objectives of GOJ are provided for. The weaknesses of the model are mainly that its implementation depends on continued support from politicians, and the staff and management of the LIM organizations themselves, who may have their own personal agenda that conflicts with the objectives of the model's implementation.

## CHAPTER 7

### CONCLUSIONS AND RECOMMENDATIONS

*To achieve sustainable development, there must be a balance between economic and environmental goals and greater recognition must be given to social goals and the role of institutions in land management.*  
[Environment Canada, 1990]

Jamaica is the third largest island in the Caribbean basin, with an area of approximately 4411 square miles (2.7 million acres) supporting a population estimated at approximately 2.4 million. The population is expected to reach 3 million by the year 2000 and this, along with industrial and commercial expansion, has resulted in an intense competition for land, urban sprawl, urban blight, crime, scattered development, inefficient use of space, and the inadequate provision of housing and community facilities [Government of Jamaica, 1994b].

The need for the implementation of land related policies to solve these problem is evident. Timely, up-to-date, accurate, complete and comprehensive land information is needed to support these policies. To obtain this information, the Government of Jamaica (GOJ) depends on its departments and agencies that manage land information, but over the years GOJ has experienced great difficulty at times in obtaining the information it needs from these organizations. The Jamaican public has also had the same difficulty in obtaining land information to carry on their day to day business.

GOJ is aware of the problems and has implemented a number of projects and programs to address them. Also, looking into the future of its land information management (LIM), GOJ has formulated some LIM objectives, some of which it has targeted for achievement by the year 2000. To date objectives remain as statements, i.e. GOJ has declared the direction that it wants to go but not how it is going to get there.

This thesis is designed to give GOJ a framework within which to achieve its LIM objectives: the design of a model to re-engineer LIM in Jamaica. The model is based on the concept that GOJ's land information system (LIS), which is comprised of the human and technical resources, and the organizing procedures of all its LIM organizations, must be made efficient in order for GOJ to achieve its stated LIM objectives. Also, as a response to explicit GOJ LIM objective statements, the model is composed of components relating to:

- a. LIM standards for data organization, data exchange, computer hardware and software.
- b. A national telecommunications data infrastructure to support data sharing among LIM organizations.
- c. A re-engineering methodology to guide the implementation of the model through re-engineering projects targeting the LIM organizations.
- d. Individual re-engineering projects targeting the LIM organizations.
- e. A monitoring and coordinating body to ensure the implementation of the model.

Because the model does not provide specifics (e.g., which data organization or data exchange standard to adopt, or which telecommunication network topology to implement), Chapter 5 explored in some detail the options which, in relation to organizing procedures, business processes, human resources, and technical resources, must be addressed in the implementation of the model.

The concept of re-engineering was also outlined and its principles made applicable to Jamaica's LIM environment of business processes, human resources, and technical resources. The author is aware that the principles of re-engineering are less easily applied to Government organizations than to companies in the private sector which are able to more easily modify their goals and objectives, undertake new projects, or abandon old projects on the basis of the availability of resources [Pinder, 1984]. However, the public sector is the business of the nation, although the prevailing bureaucracy (which has been

shown in this work to be one of the main causes of inefficiency in the public sector) prevents it from being run like a business. For example, because of Government regulations it is much harder to fire a public officer who does not perform, a situation which is normally not tolerated in the private sector.

The bureaucracy may be difficult to change but Jamaica's experience with GOJ's actions in this regard has shown that changes can be made. GOJ has in the past cut staff, merged departments, added business processes in response to implemented projects and programs among other things. What it has not done, while making these changes, is change the focus of its agencies from function oriented departments to process oriented departments (a tenet of business re-engineering). If GOJ has the will it can be done, although perceiving the possibility requires a radical change in thought by the Government. It must see and operate the public sector as the business of the nation. It is within this radical change of focus that the application of re-engineering principles to Jamaica's LIM becomes possible, and the model can be implemented.

It is also recommended that:

- a. Re-engineering be done on an incremental basis with each improvement used to contribute to the logical progression toward the achievement of objectives [Nichols, 1993], especially with regard to the constraints discussed in Section 4.6.
- b. The monitoring and coordinating body to effect the re-engineering of Jamaica's LIM environment be established in the very near future. The target year 2000 is only five years away, and there are approximately sixty LIM organizations which have to be re-engineered. The Body should:
  - i. Be an agency consisting of at least 8 individuals of varying skills including business re-engineering, computer network implementation, GIS/CAD, LIM, telecommunications, database management, and data exchange standards, land law, and copyright law among other things.



- ii. Be empowered by the political directorate to secure the cooperation of the LIM organizations which will be affected by the re-engineering model.
  - iii. Have at least two key resource personnel from each LIM organization made available to it, in order that needed information about their respective organizations can be secured.
  - iv. Design and implement the national re-engineering methodology.
  - v. Secure the necessary resources to support the implementation of the national re-engineering methodology.
  - vi. Enforce the compliance by LIM organizations with accepted data, hardware, software, and network standards.
  - vii. Continually monitor the progress of LIM organizations within the framework of the model, and take the steps necessary to rectify all problems encountered.
  - viii. Give periodic reports on the status quo to the political directorate.
- c. The target year be extended from 2000 to 2010, as five years may not be a feasible time frame within which to achieve all the LIM objectives that GOJ has determined it wants to achieve. Section 6.2.2 outlines the estimated time-frames needed to accomplish all the tasks necessary to achieve the LIM objectives and the model's implementation.
  - d. Steps be taken immediately to communicate the national vision for LIM to all levels of management and staff of the LIM organizations.
  - e. Investigations and research into LIM standards and telecommunications strategies adopted by other countries be undertaken in order to determine which standards and technologies are feasible for Jamaica. The matter of standards is very important and not to be taken lightly. Also, there is no guarantee that adopted standards will be efficient , effective or accepted. It is up to the national

monitoring and coordinating body to ensure that appropriate standards are adopted.

- f. On-going projects affecting LIM organizations be implemented in such a way as to facilitate the implementation of the model in those organizations.
- g. The land functions of the Island Record Office be transferred to the Registrar of Titles so that the islands land registration information may be under one logical and physical administration and management.
- h. Special attention be given to the human resource element of the LIM organizations (whether the model is implemented or not) as this aspect of any organization is crucial to the achievement of any organizational objective.
- i. Suggestions be polled from the management and staff of LIM organizations in order to get an idea of the problems being experienced within these organizations and the areas that may need urgent attention. Also, the interest of the employees in the model and the part that they may play in its implementation may be obtained from such a poll.
- j. Some LIM organizations have only workstations installed while their data is physically held at other locations where the computing power is adequate. For example, the data from Geological Survey Department (GSD) and the Jamaica Bauxite Institute (JBI) may be physically held at Rural Physical Planning Division's (RPPD) site. RPPD is in relatively close physical proximity to GSD and JBI, and RPPD is in possession of computer hardware and software that are powerful enough to service the other's needs (Section 3.1.9).
- k. Use be made of the tremendous processing and storage potential of Mona Informatix Limited's supercomputer, and also of the company's GIS/CAD expertise. The company's facilities could be used as a centralized storage and processing site for LIM organizations in close geographic proximity, thereby saving on the purchase and maintenance of expensive computer equipment.

1. GOJ work with Telecommunications of Jamaica in setting up ISDN or B-ISDN services in the future to facilitate end to end digital broadband transmission of land-related image, voice and text data between LIM organizations.

The application of re-engineering to improve Jamaica's LIM environment is a concept that can work. The model designed in this thesis provides an adequate framework within which that re-engineering can be accomplished. However, the model depends on political support spanning political administrations, and will require the commitment of great financial, temporal, and human resources to see it come to fruition.

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