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Towards Developing Information Systems for Enhancing Land Management in Developing Countries

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Abstract

The Earth surface or land is the basic element of the environment and it is exposed to significant inputs of all essential nutrients used by humankind and the other living creatures. Thus, the livelihoods of the world population depend on land to source food and water in addition to other natural resources exploitation. Access to land through security of tenure would therefore be vital to life sustenance and the community who inherits such land has the right to benefit from its untapped natural resources and it is not permissible for this right (the right of livelihood) to be expropriated by any person or authority. The land authorities of most developing countries deny this right and this paved the way for inequitable distribution of land thus creating widespread resentment and frustration, which lead to fighting and warring amongst people as well as against authorities. This is not the only sign of land mismanagement since other signs are evident such as shrinking of pasture areas and depletion of forest resources and evolution of squatter settlements. To contain such problems land management issues are discussed and studied and the result is a proposed land management paradigm. A fair description of the two effective and essential tools used for facilitating and enhancing land management, namely spatial planning and geo-spatial data systems is given.

Key Words: *Land Management, Developing Countries. Geo-Spatial Data, spatial planning*

1. Introduction

Land is the Major Constituent of the Environment. Its pivotal in sustaining livelihoods since it provides residence, stability and the main ingredients of the life process; food and water. The rural population is mainly linked to land and natural resources exploitation since industrial and service activities are lacking in rural areas where 70% of the African population is tied to the use of land and other national resources and farming has become for them a prerequisite to life maintenance.

The injustices leading to conflicts over land are among main indicators of land mismanagement in developing countries. Land ownership, land tenure and "security of land tenure" in some African countries have created a great confusion and are a source of conflict. It is now becoming a potential source of national and social disintegration as can be seen in Somalia.

Fighting over land, pasture and water continues to intensify in recent years, in some countries because national governments have been unable to solve those historical imbalances that affected both the pastoralists and the agro-pastoralist communities**.** Many of the countries, which had been under the sphere of influence of the colonization, suffer from such difficulties.

Deterioration of forests and natural pastures is another indicator. It is well known that forests play a vital role in the protection and eco-balance of the environment through the conservation of soils, water resources, and wildlife. This is in addition to its role in protecting the atmosphere from pollution and in producing food and medicines and providing shelter to many local communities. The natural pastures also acts as the main source for animal nutrition.

Despite all these benefits, forests have been subjected to a significant dilapidation in Africa, which has resulted in large-scale deforestation in the past decades. This can be directly attributed to intensive farming and the lack of due concern taken by the authorities in addition to increasing demand of fuel wood and other products. As example of

deforestation, the1995 Sudanese national forest inventory indicates that the areas occupied by forests decreased to 17% of the area of Sudan compared with 34% in 1956 following independence.

The squatter settlements is a third indicator. If environment protection through the total control of land development is our goal, then we must fail because of the shear magnitude of the problem**.** Due to complete absence of effort by the state in the developing world in the sphere of urban planning, housing and in providing basic services, the burgeoning population of the developing towns have developed squatter practices and begun aggressive encroaching on the town's vacant lands, escalated by the conflicting policies of consecutive authorities. This results in the speedy construction of sub-standards shelters for the needy population such as the displaced and migrants in constricted irregular and unsuitable areas justified by the demand for shelter. The narrow spaces left for ventilation and public use have been crowded with people irrespective of drainage, safe disposal of human excretions, whether solid or liquid.

2. The Need for Establishing Unified Land Management Concepts

There is a need throughout the developing world to establish unified concepts on the main issues related to land use and development based on land sustainability:

2.1 Land Rights/Tenure

The Community has the right of land through partnership as indicated in all divine religions or other people's cultures. Accordingly, the local community, which inherits the land, has the right to benefit from its untapped natural resources and it is not permissible for this right to be deprived by any government or authority.

The right of the individual is also secured when based on the principle of precedence of developing a dead land but this right must not conflict with the community rights or the land has been already planned for a specific purpose – that is because planning is an implicit indication of a standing right. Similarly, land right is an acknowledged when an investor develops a land for a specific purpose.

Land rights have increasingly come to be perceived as an integral part of human rights and are considered essential for livelihood.

There are several concepts and definitions in use that indicate clear 'land tenure' and rights. These specify the rights and obligations with respect to acquisition, use, expropriation and dispose off land. These include:

'Freehold', tenure is a traditionally western concept of individual property ownership. It implies the absolute right to own, control, manage, use and dispose off a land property. Such land rights, while being held in perpetuity, may however be expropriated through state intervention when land is targeted for a definite public interest.

'Leasehold', in which Land belonging to one entity - either the State or an individual - is, by contractual agreement, leased to another entity for a fixed period. Thus, 'Leasehold' lands are acquired through agreed rental values and for a specified period. If the lease period is for 99-year then it is considered as secure as freehold land tenure.

'Statutory allocations', a particular form of state land, is allocated by virtue of some statutory provision for the use of some legally constituted body. State land can also be put to private use through contractual arrangements. Access to land through the 'Statutory allocations' systems, in Sudan for example varies between men and women and even between married and unmarried men

'Customary land tenure' is acknowledged where land rights are ostensibly controlled and allocated according to traditional practice. Customary right is insecure and fragile, and is considered and perceived unfortunately as such. This is now leading to further inequalities and inequities.

Experiences show how colonial powers had initiated and nurtured the notion of customary tenure with serious distortions. Their definition regarding customary authorities and 'community' was conflicting with that of the tribe, according to the study conducted by the Economic Commission for Africa. Colonization in its control over the land in the Sudan adopted a customary system made suitable for its particular needs and this made new artificial leaders in the society. And since, the national governments inherited the colonizers' land tenure system and did not make sufficient reform, there are still many conflicts continuing. Customary system may give a complete guarantee since it is an efficient system like formal land systems of registration and can be developed in future to stop conflicts and disputes. The mentioned study concluded that inappropriate use of a unified freehold tenure concept will not achieve food security, while the local customary system is capable in adapting to population changes such as the development of land markets and socio-political influences. The study calls for implementing a dual freehold /customary tenure system, because it serves different purposes under different situations.

2.2- Land Expropriation

There are many reasons for compulsory acquisition of land, whether it is legally held or an illegally grabbed land. The expropriation comes to protect the public interest; for example, to restructure the urban-structure and to protect the environment or to ease public mobility or any other public purpose. However, the international human rights declarations as well as the other numerous resolutions issued by UN competent committees ignore the right of the citizen or his family to own private land property based on his right to share the inherited land. The provision in all the declarations calls for appropriate housing, which means adequate shelter with adequate municipal services. This provision can only be met by developed countries, which have adequate funds, and their nations have a reasonable standard of living. Of course, it is not in the capacity of a developing state with a limited domestic income to finance housing programmes, for its citizens. The responsibility of the state as indicated earlier may at first be confined to provision of land of a secured tenure. It is therefore, wise and meaningful for the international organisation to push the states for provision of land plots for their citizens.

2.3- Sustainability

The Rio Earth Summit defined sustainability as: "Humanity's ability "to insure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" Thus, environmental security may be stressed as the ability of human to meet their basic needs from a sustainable environment and that the exhaustion of natural recourses would be very dangerous if the environment is unable to produce population needs or absorbs the pollution. It is to be noted that the per capita consumption from the fossil in developing cities is 1/5 of that of the European and 1/10 of the American consumption.

Below are some of the conflicting forces confronting 'land sustainability that requires wise tackling as far as developing countries are concerned.

Fast Urbanization: The deterioration of the environments of the major cities in developing countries is bound by the phenomenon of urban population explosion, especially in the capital cities of the developing countries. Nairobi may be taken as an example of uncontrolled rapid urbanization that created serious degradation of the already deteriorated physical environment. It is best described by UNCHS (Habitat) which stated that 55% of Nairobi residents live in informal settlements and this covers only 5.5% of the city residential land. In other words, more than half of Nairobi's population is crammed into extremely congested slums.

Desertion of arable land and collapse of rural life: Internal displacement results in arable land desertion, particularly the fertile virgin land in the tropical areas. In the majority of cases, the land is left fallow and the irrigation facilities are destroyed through long misuse and lack of labour to work the land. Migration of manpower and the desertion of land are sufficient to destroy life in the country and rural agricultural economy on which most of the developing states rely on to keep the wheel turning in the community.

Sustaining Forests Resources: Current exemplary practices reflect the negative attitude of developing communities in managing forests resources. Forests are major natural resources and should be treated as economic, social and environmental goods. They ought to be utilized on sustainable basis considering market demand, pricing mechanisms, ecosystem requirements and that carbon supply cannot be met, while the demand for fuel wood and timber for construction is accelerating, unless through massive tree plantations.. This has not yet been adopted in some developing countries because they lack the proper legal framework under which misuses are punished while genuine investors are guaranteed adequate security for their investments.

The adoption of the global economic system: The challenges that face the developing countries because of the extension of international economic activities are immense. International financial movements, particularly the industrial activities are attracted by the lowest cost of production in the developing countries and the weakness of government environmental monitoring on industries. Government rules, regulations, and land use requirements, which protect the environment, are relaxed. This issue has a great impact on spatial organization and land use thus challenging the adoption of the sustainable development concept. The developing countries that have attracted the international investors and experienced fast development as it is happening in some East Asian cities are in need of urban restructuring. If implementation of such development models continues, a large part of the countryside surrounding such cities will deteriorate, land value decrease, the natural environment degrades and the social fabric of its rural communities will lose its cohesion.

3. Main Aspects of Land Management Reforms

3.1 Policy Reforms

The concept of policy reforms is not meant to lead to adopting radicalism, particularly when a restructuring programmer is implemented for the redistribution of lands and property rights. What is aimed for is the formulation of equitable land policies that encourages investment in land development to achieve food security, sustain the physical environment and promote social justice accepted by all stakeholders The revision process that must be undertaken by some developing countries should lead to new reform laws together with institutional restructuring of government institutions responsible for land management considering market forces, land prices and the effects of the colonization policies. Another aim is to guarantee the use of the land for the interest of the local community.
All reforms to be implemented should adopt justice in every step. Land reforms policies should achieve:

1. Developing agreed conceptions after conducting studies to find out the factors influencing land tenure such as market forces, globalization, macro economy, etc. Areas of research are;

a) Land rights, identification of the required type of land tenure system that ensure a reform in land management on the principle of efficient land utilization? the appropriate allocation of plots or holdings? Allocation of the appropriate areas for those with large capitals? Land expropriation, etc

b) Identifying the contradiction between application of the customary system and the execution of the legal provisions in settlement of disputes and how to remove the doubts that occurs as a result of the application of the two systems i.e mixing the customary principles that rule the local communities

2. Improving land transfer transactions.
3. Improving management frameworks including issuance of legislations, which governs land tenure, acquisition and expropriation systems. These systems should base on the following:

a) Accessibility of land to the needy.
b) Adoption of a system of transparency and accountability and the sharing of information amongst citizens.
c) Security of tenure. Lack of proper title of tenure acts as an absolute constraint to investment in land development.
d) Support traditional farmers who use smallholdings. Inequitable land distribution and insecure land tenure are the strongest factors affecting sustainable livelihood for the small-scale farmers as recommended by the African Economic Mission (ECA/SDD/05/09). The Mission blamed the colonial system, which led to unfair distribution of land and the consequential deterioration of land resources in southern Africa in addition to the existing food insecurity. This situation fuelled the conflict between states and tribal groups.

4. Adopting decentralized policies and setting federal system for land management to ensure public participation in decision-making and mobilize all stakeholders.

5. Strengthening institutional framework and achieving equitable and sustainable development.

6. Establishing equitable and effective adjudicating land systems to resolve previous and future conflicts over land ownership considering that the legal framework at present is in the favour of the state and the market and that representation of the ordinary citizen in the land chamber is extremely weak especially when the issues are related to land expropriation. In addition, land courts are biased toward the intellectuals and the western concepts of land tenure. Establishment of such systems requires institutional capacity building particularly to guarantee good treatment of those who have customary rights and land distribution..

7. Recognized by the customary system and guaranteeing the rights of the pastoral communities, including the nomads, to access natural resources without breaching the rights of the settled communities.

3.2 Institutional and Legislative Reforms

Settlement of Agrarian Disputes: Land disputes usually emanate from small stretches of land in troubled countries and the prostration of the tribes, which look like petty states on these stretches of land. It requires careful and elaborate negotiations to revise the rearrangement of land, specifying the arable and rangeland and stretches

needed for future posterity, allocating cattle droves for the nomads and the domestic needs of the pastoral communities. Complications appear because governments behave as if they possess the land and ignore people's right.

Inhibiting Illegal land occupation and speculation: Land traders and black market agents find an appropriate atmosphere to cheat poor people by selling them land they do not own, thus making a lot of money illegally. The illegal dealing of public land causes a loss of revenue for governments. In Kenyan law, squatters can claim title of land after a certain number of years and likewise in Sudan; but this provision has been ignored by some land officers. It has become very controversial because some people may find their land transferred, exchanged or illegally occupied, etc. It is therefore, very essential to fight illegal land speculation or grabbing and to grant land for those who are in terrible need for shelter.

Issuing local legislations: Revising the provisions of the prevailing legislations and issuing appropriate legislations and weaken the concept of the state sovereignty of land i.e the idea that land is owned by the state and that the individuals and the community have no land rights unless through government control.. Thus, the main aim of the legislation reform is to protect individual and group rights, and to adhere to the principle of the rule of law to solve conflicts that arise.

The deficiency of the central legislation issuance is not only related to lack of accommodation to local requirements as well as the distance between the central government and states, however, basically because legislations on land issues should be a local right with the approval and acceptance of the local community who inherit the land.

There is no reason why land legislation be issued locally as well as nationally. National legislations in such a case must be flexible and aimed at tackling the national issues whereby the state legislations should treat all executive matters and resolves local disputes but consideration given to variations in the nature of the requirements for each region. Some regions have problems related to allocated agricultural land with pastoral rights and passage and other have problems related to allocated residential land. Other have needs to bring investment in physical development, etc.

Institutional Strengthening: There is a need for institutional strengthening through professional development with all its technical and human-resource requirements and through capacity-building activities and whereby financial resources such as property taxation are put to good effect.

Financing land management from property taxation: Real estate taxation in financing land management in the developed countries come from the society through property taxation paid by investors because of the investment facilities and licenses provided by land institutions. Contrary, land authorities in developing countries prefers playing administrative and political roles rather than providing services in addition to their weak institutional powers, unfavorable legislations, bureaucracy and centralization. These authorities must adopt policies that allow private and co-operatives sectors to provide the services and generate revenues for institutional building. A good example is shown by Brazil where revenues indicated to equal 11.5% in 1984 from real estate taxation in the Rio de Janeiro and equal to 13.8% in 1992 in Sao Paulo and the greatest is in Belem, which amounts to 35% in 1998, as reported by Jose Julio Lima.

4. Proposed Land Management Model

4.1 Developing a Land Management Framework

4.1.1 The Management Paradigm

To mitigate the deteriorating position of land development in developing countries it is essential to establish an appropriate land management system that suits each country, which is able, effective and equipped with knowledge and popular authorisation? This requires an advanced administrative understanding much developed to satisfy the ever increasing land demands and which inspire the enthusiasm of the residents to develop their own devices to accommodate the environmental and socio-economic changes associated the with quick paced urban expansion that represents a major challenge in the developing world.

There are many frameworks or models for land management, all of which focus on satisfying three criteria: meeting the demand for land development through efficient administration, community acceptance and development sustainability. Satisfying these criteria would only be through the application of sound spatial planning and use of correct information. Good governance strengthened by decentralisation and community empowerment reflects community acceptance. According to this concept, land management is viewed as a multi-actor and a multi-criteria process. These three criteria or approaches are complementary to one another and they constitute the essence of land management, or in other

words, they form the three axes of a three-dimensional perspective:

a) The land development/administration (or the need for land) approach.
b) Community empowerment (the enabling approach), and
c) Development sustainability approach.

The aforementioned means that whenever considering a topic related to land management, it is necessary to touch its various angles where consideration is based on the three dimensions, which beleaguer its various aspects. It means land demand, sustainability and community enablement inputs shall be present in the mind of a multi-disciplinary authority with written statements from specialized institutions representing the three axes in order that the process of taking a land development decision becomes institutionalised and engraved in the minds of the technical and political decision makers.

When considering development need as a major input, it is meaningful to consider land administration where land transactions are dealt with besides the material and the workforce resources, and in addition to information technology and spatial planning which are the main tools land management authorities utilize.

The proposed model of land management is exhibited in Figure 1, while the functions and activities assigned for each of the designated elements of the model is indicated below:

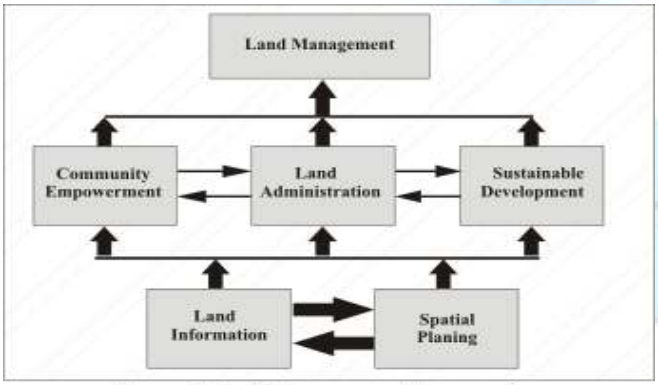

Figure 1: Land Management Framework

4.1.2 Land administration

It is a process where by land tenure transactions and land development and control are performed. Its paradigm is displayed in Figure 2 and its scope of work covers the following areas:

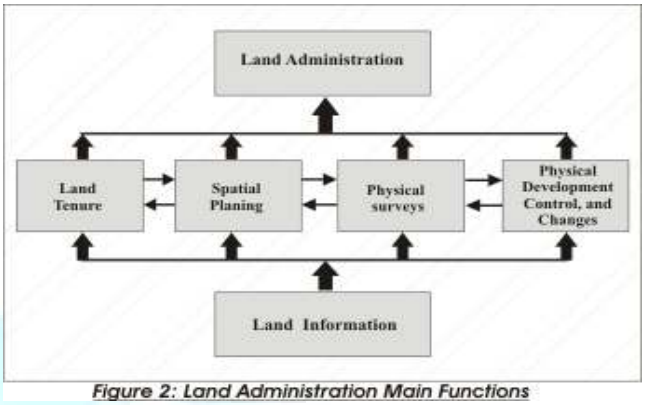

Figure 2: Land Administration Main Functions

Spatial planning, Land tenure (allocation of lands, physical surveys to delineate parcel boundaries, transfer of property through sale or lease, and the management and adjudication of disputes regarding rights, etc), land valuation and taxation (assessment of the value of land and properties, management and adjudication of land-valuation and taxation disputes.). Land properties, land use (classification and control of land use, physical development controls) and development function (industrial, commercial, markets, office, residential, economic development enterprises, tourism etc.), transport, infrastructure and public utilities systems, cultural and social facilities, urban renewal projects and changes necessitated by physical restructuring operations or environmental enhancement programmes, etc. A restructuring example of good land management is seen in Greater Khartoum which conducted surgical operations and physical changes included the following: –

Treatment of squatter and unauthorized settlements for integration into the urban fabric

Through relocation, planning or incorporation. Greater Khartoum has been able to regularised more than 150 settlements including agglomerations of IDPs. Some of these were demolished because they were built in areas unsuitable for residential use, while some were re-planned and others incorporated.

Treatment of the main suburban villages was completed and incorporated in the physical block of the Greater Khartoum after being subjected to the planning process, which improved their environmental conditions and linked them with the main transportation lines and other infrastructure networks.

Urban centres and old residential neighbourhoods underwent urban renewal and renovation to improve their environment, to facilitate the provision of services and public utilities, and to ease traffic flows. The process

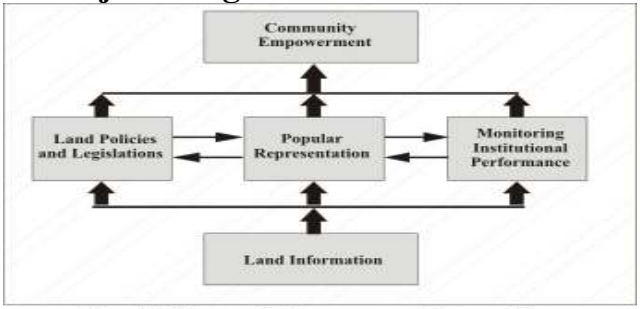

Figure 3: Community Empowerment Perspective

covered 16 old residential neighbourhoods in addition to reallocation of numerous urban functions in the city centres for compatibility.

Khartoum experience confirms that a number of advantages can be gained from regularization of squatter and informal settlements. These include security of tenure, provision of services, environmental enhancement, investment in home based economic activities, and freedom from violent crimes, poverty reduction through tradable assets and house market and transparency of land delivery system.

4.1.3 Community empowerment

It is a concept of legally enabling and empowering community groups, non-governmental organisations and other local-level actors to cooperate in land management. Therefore, it is essential that the land management process adopts, through the community empowering approach consultancy decisions in which the involvement of all stakeholders is assured, knowing that the consultancy decision would not be attained except through the application of a real decentralization system and a consolidated base of the civil community which values the application of the rule of law and institutionalise a democratic system where all citizens are equal in rights and obligations. The expected community rolls and functions are given in Figure 3. Apart from enforcing, the democratic process and assuring real representation of people the community shall monitor the performance of the land institutions and make sure that the policies and legislations set by the community are implemented. Thus the main tasks of the community organisations, particularly the national and local parliaments, are the laying of policies, criteria, etc and legislation that govern land use, allocation, tenure, expropriation, acquisition, etc. These legislations should of course reflect the local cultural and judicial settings of each country.

4.1.4 Sustainability

It has been previously emphasised that fast urban expansion produces serious impacts on the environment and that many decisions taken related to developmental projects had adverse impacts on land sustainability. Accordingly, it is imperative upon land management authorities to ensure through the sustainability approach that land development activities do not degrade the quality of the environment and that environmental inputs shall be pivotal in all developmental considerations. One of these inputs, which shall ensure the prevention of non-serious environmental deterioration, is the utilization of sound spatial Planning, since spatial planning is one of the tools used to protect and promote the environment through the optimum use of space. Tthe other range of sustainability functions includes proper management of people's rights, obligations, responsibilities and safety in relation to land allocation and use**,** monitoring of environmental resources, particularly forests and natural pastures. In addition, investigating and publicizing against incidents of abuse of rights and power regarding land use and wastes generating activities and encouraging coordinated approaches and harmonized provisions in management criteria and codes of practices.

The sustainability approach regarding monitoring and implementation of international treaties and conventions, is expected to:

- Ensure implementation of the laws protecting and enhancing the environment such as land tenure and international and national legal framework that determines the rights and benefits from the use of land.
- Check national commitments endorsed in the international conventions and treaties are incorporated in national policies and laws.
- Study the proposed draft legislations in the environmental field, which are under discussions by international gatherings during the preparatory phase and before endorsement by UN conventions or summits and to make sure that the proposals are appropriate for local implementation.

Integrating poverty plans into environmental programmers:

4.1.5 Spatial Planning as a Tool

Spatial planning is an important mechanism for environmental protection and enhancement, and

particularly for land management. It is a tool for local governors as well as for land administrators. It is used for appropriate and safe land use and for establishing people's rights. Furthermore, it is the art of managing the fundamental goods of the environment and should therefore be divided justly. Briefly, sound spatial planning can be used to achieve the followings:

- Conserving the elements of the built environment through implementation of sets of rules which conforms to society's culture, customs, norms and traditions and reflect its values, and preserve the social fabric.
- Allocating land for different urban functions (such as – housing, public transport, industries, recreation areas etc.) and developmental projects through delineation of the land zones, spatial distribution patterns such as housing clusters and demarcation of land plots. It maintains the rights of the public, the individual, the community and the state through production of land use maps and layouts for all elements of the physical block.
- Controlling physical development and managing future physical changes through spatial organization such as upgrading of squatter and illegal human settlements.
- Providing for healthy cities evolution through balancing of population density, controlling of land misuse that causes the quality of soils and the biodiversity to deteriorate and diluting industrial pollution concentrations.
- Upholding the rights of the individuals and the society through introduction of measures to prevent activities that adversely affect the value of land property, such as placing industrial complexes, slaughterhouses and similar activities away from people's property. It is to be noted that in 1913, a law was introduced in the US defining residential areas and stipulating its characteristics. This was the first time that US adopted zoning regulation The law prevented the renewal of licenses for commercial and industrial businesses or any activity that might affect the rights of citizens of the less privileged outskirts of the town and the neighboring areas who had limited incomes as reported by Dr Al Hathloul.

4.1.6 Information System as a Tool

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Previously, the importance of data system for land management is explained because information is an essential part of planning or management processes. Therefore, an information system must be adopted in developing countries, and use of the correct information should be ready in suitable times for decision markers at all levels of land management. This ensures best usage of the land and supports the quantitative and qualitative monitoring of the environment through regularly conducted spatial survey, which identifies the environmental stress level - especially the pollution that occurs from the accompanying impacts of different developmental activities of land usage or for reasons of physical changes. This will also assist in availing environmental statistics and regularly give the status of sustainable development. And since information technology is rapidly advancing and various information are in use for various purposes a separate article in this regard is given below.

5. Establishing Geo-Spatial Data Systems

Importance of data systems

It is very essential to benefit from the geo-spatial data as bases for monitoring the environmental stress and above-mentioned physical changes, which happen as a result of the abusive practices and lack of corrective measures. Thus, establishment of a national geo-spatial data network to avail information at the central, regional and local levels is necessary. Some of developing countries need such networks; however, it is already available in the Western countries.

Firstly*:* Use of remote sensing technology, geographical information system and computer technology, enables land management to benefit from the spatial data technology such as assessing natural resources, monitoring physical changes and environmental stresses. This is done through the analysis of the spatial data, whether it proves to be meteoric, radar or spatial.

The remote sensing technology and the geographical information systems are active tools to obtain the required geo-spatial data for planning processes, land management and other natural resources and also for the regular monitoring which assist in the forecasting of the environmental changes for the purpose of early warning. Therefore developing countries must obtain this technology and to simplify its use to support the related institutions and to provide for the required needs. It also

needs a regular spatial survey and the issuing of spatial statistical reports as essential reference for planning and economic/social evaluation in addition to the other environmental and natural resources. It can also be used in producing national data to be compared with international reports such as the economic forum indicators (Davos) and statistical and digital descriptive methods aimed at determining the environmental sustainable level.

Secondly: Establishing geo-spatial data base

Geo-spatial database can be implemented through the establishment of a dynamic and comprehensive information networks for all central, regional and local levels in order to enter, store, retrieve and analyses the correct information at a suitable time. Implementation of a geographical information system (GIS) is possible in case of availability of trained cadres of high qualification on the geo- spatial data systems. The data base and remote sensing technology and geographical information systems can provide a national geo-spatial data network.

1. Fundamental data sets that must be added to the geo-spatial data base at the three levels.

1. This information includes the base maps, statistical data layers, agricultural and natural resources and environmental data (as part of fundamental data set). The detailed information that is related to the local level includes urban and rural, service networks, public utilities and land management information.

2. The information resources related to land management is divided into two data sets:

3. a- Information related to the nature and characteristics of land (Geo-Spatial data)

4. This information affects the value of the land and its use. The remote sensing technology (both aerial and satellite imageries) is considered as the most important information source, as they provide a geographical and topographical data that can be drawn on base and detailed maps which provide information such as land characteristics, ownership and geometrical shape, etc which are referred to as parcels/cadastres.

Professor Stig Enemark indicated that land administration system policies and technologies in most Western European countries are developed from a systematic and complete cadastral map. This was itself originally established as a basis for land valuation and taxation according to the use of land, particularly the yielding capacity of agricultural land.

It known that the basic building block in the cadastre and in any land information system is the 'land parcel'. A parcel-based land information system contains a record of interests in land while a cadastre usually includes a geometric description of land parcels linked to other records describing the nature of interests, ownership or control over these, and often the value of the parcel and its improvements. However, most cadastral registers are linked to both land value/taxation and to the securing of legal rights in land.

The following proposals are for geo-spatial data systems that are required in the developing countries according to established concepts of land administrations:

5. . Moreover, this technology further assists in the identification of land use, occupation and type of development.

6. b- Information related to land use and land management.

7. Land database is usually related to ownership, properties, type and use of land and plot area, nomenclatures and classification; land value and taxation, etc

The above two sets formalise the geographical information systems. Adequate use of these systems is the best indicator for sound land management, because they assist in the speedy induction of the information queries and the analysis of different information layers to reach the best solutions through adequate software and computer ability.

5.1 In the spatial planning field

The reference for sustainable land use correlates with three different elements (Mapping, planning and legislation). Therefore updating of land use maps gives an option for the selection of the appropriate sites for land use plan layouts without transgressing the future potential use. The required infrastructure networks such as water, sewerage, communication, roads, energy and electricity networks have to be taken into account when preparing and approving the plan layouts.

The existence of geo-spatial data in a geographical information systems form comprise different layers of land information such as the layer of the base maps which provide information about land boundaries, topography-classification of land for special purposes, housing, agricultural, industrial, commercial and services, the layer of layer of land surface according to soil or topography, the layers of population census, road networks, electricity services and communication. All these informative layers

assist in the spatial planning processes and facilitate the production of land use maps that are based on site characteristics, general policies of the State and real land value. This leads to the most appropriate use of land, in addition to the optimum control through the usage of software that prevents modification of approved maps.

5.2 Land Development Control

a) Provision of land plot data such as those included in the parcel or the cadastre.
b) Setting of criteria and physical development regulations. This system must consider the land zoning to determine the specified land use and its status (used, allocated, classified for investment or comes under local management), likewise which is free land or land allocated for a public right of way such as shepherd paths and public walkways. This system ensures the specified use of the land and prevent each category from transgressing of another through incorporation of all land use maps in the geographic information systems (GIS,LIS) which determine and control land use.

c) Use of information for Squatter treatment and upgrading:

The information systems technology is important in squatter treatment and village reorganization by using the remote sensing systems to draw the prerequisite maps and to identify unauthorized settlements and the time of land occupation, while using GIS to link each land plot and its owner and the input data of the social survey completed forms. All the input information comprised by together with the plan layouts explain the physical treatment operations. Thus GIS determines the land plots that are affected by the treatment process, the cost of the demolitions and the value of compensations. Moreover, the system allows for squatter and village organization criteria to be applied to each settlement. Furthermore, the layouts determine the service lines, area coverage, and the required service utilities to be installed.

5.3 Benefits of geo-spatial data systems

a- Storing of all information obtained through the comprehensive spatial survey to determine the level of sustainable development according to the international economic forum indicators (Davos)
b- Regular environmental stress monitoring records to assess and identify pollution sources resulting from the numerous economic activities.
c- Regular evaluation of the total volume of compensation to be used for reconstruction and treatment of the pollution.
d- Analysis of information produced from the evaluation effects of disasters and environmental natural changes to support the existence of integrated mechanism for managing disasters and emergencies.
e- Storing and saving of all information produced from digital mapping of land use layouts to enhance land management and prepare sound plan layouts.
f- Saving of legislation records of site characteristics and land use inventories.
g- Facilitating retrieval of spatial information from the centre, states and localities.
h- Preparation of geo-spatial data and environmental information to be ready for the decision makers, research and academic corporations.
i- Facilitating comprehensive national planning processes
j- Production of maps: The advancement in space and information technologies (GPS,GIS and Remote Sensing) paved the way for a great mutation in the field of production and updating maps, whereas the satellite high resolution imagery has become the most fast means in production of both base and thematic maps as well as, the real time GPS systems which provide high spatial accuracy and decrease the ordinary land survey work.
k- Protection of community and individuals properties from transgression. (land registration system including the data of land circulation and transferring of property by selling or purchasing according to an informational system that authenticates the properties and save the rights, as well as protecting land documents from transgression through recovery of data related to the owner and if this information linked to the state civilian file it could be compared with the archive to be easy for recovery in demand, in this case the forgery can be discovered, double owners and any other violations)
l- Fair distribution and allocation of land according to the conditions of entitlement and allocation, through computerizing all procedures to impede personal interventions.

m- Determining land values and all issues related to taxation and fees by estimating land values in accordance with clear and fixed criteria.

n- Conducting settlements and compensations in case of conflicts in addition to squatter treatment and organization of villages according to correct information.

o- Controlling physical development, preventing violation of plot boundaries and breaching of construction license. Information systems can be used in revision of approved physical structures through transferring of the regulations and rules into criteria in the form digital data and linking the related buildings information particularly, building heights, parking and green areas to the system which determines the built area ratio as well as the required services such as water supply and electricity.

5.4 Applying Geo-Spatial Data Systems:

Some developing countries may not be able to establish comprehensive systems because of the scarcity of funds and manpower, whereas establishing of such systems needs an infrastructure as it described in the annexes. However, these countries can implement a part of a programmers according to their priority based on selecting an information system compatible with the selected location of implementation and the objective of the programmers. For the example the following is an information system that is implemented in Greater Khartoum. This system is called the "Housing Plan Computerization". This is an informational system for allocation and distribution of land plots mechanically.

5.5 Housing Plan Computerization System (Khartoum)

The Khartoum housing policy is based on allocation of land plots with services (site and service system) for citizens according to their needs. Therefore citizens compete for plots and the land administration goal is to choose the eligible people after making an evaluation in accordance with the criteria. This is done by filling out the information form relating to the applicant and his family such as marriage and the number of household members, citizenship, birth certificates, public service and the socio-economic status etc.. There is a system of grading to determine the level of each applicant according to the evaluation. And as per the system of land allocation each citizen reaches the legible degree will be allocated land. The information system automatically identifies and produces the files for the eligible persons without human intervention. It worth mentioning that the informational system is linked to the Internet system therefore the applicant can gain access to the evaluation result whether it is negative or positive. He can also find out how to complete the remaining procedures which is important to obtain property – its location, required fees and the date of receiving the land title, etc,. As a result of the developed telecommunication services in Sudan and the land web site is open at all times and land authorities continuously make weekly updates, the entry into the Housing Plan Web Site is fairly easy and use of the data in the system is simple. The size of the database has reached 150,000 applicants and their input data is dealt with in the central server while thirteen workstations are used to manipulate the server. Now the size of the database will increase up one million applicants and seven servers will be installed (one for each administrative unit or locality) and the number of workstations will increase to 100 distributed among the localities.

6. The Project's Objectives

The project aims to achieve many objectives including:

- Centralizing information for housing plan applicants.
- Justice in eligible applicant's determination.
- Determination of the eligible applicants in accordance with the rules and regulations

Expediting the procedures (The system does the same work of the allocation committees).

- Controlling evaluation operations, reducing mistakes and preventing abuse of allocation rights and duplication.
- Updating information of land register to prevent conflicts resulting from lack of information. However, the implementation of the information system has achieved the above-mentioned objectives and brought great benefits for the state and citizens through the improvement of land allocation procedures and presentation of the required applications over the Internet. The system deals with citizens by

informing them of the requirements and procedures and – obviating the need to visit Land Department Offices, but allowing the monitoring of the situation and responses of the officials. In addition the systems allows the officials to find out the information relating to each case and to discover the facts pertaining to each file present in the system.

- Belittling the volume of work reduces the evaluation process cost for the citizens and the State through time saving.
- Absence of crowds of people in front of Land Department Offices.
- Knowledge of the facts and discovery of fraud because of transparency and accessibility.
- The information system implemented has resulted in some positive social changes among the people and the authorities whereas the citizen has become electronically closer to the land administration and its officials and this response from the applicants has led to the control of the employee's behavior.

The applicants come on time and complete their procedures according the advertisement published on the web site. Likewise, the employees have become more efficient and punctual in providing the information, the queues have disappeared, and the number of people who call at the land administration has considerably reduced except the people who fail to use the Housing Plan Computerization System. Moreover, the employees gain experience in information technology and computer-aided analysis and raise their profiles in the process. However, the most significant political change has been the satisfactions of citizens who have welcome the fair and just procedures relating to land allocation and have emphasized that all operations have been concluded in transparency. This is because assessments of applications are completed mechanically, fairly and without favoritism.

7. Conclusion

In essence, sound land management should promote a positive attitude of environmental thinking and behaviour in all development activities of land in conjunction with socio-economic viability, social acceptability and community endorsement. This is not the way land management is performed in most developing countries at present because of absence of land reforms programmers. Accordingly, a revision process must be undertaken by some developing countries and should lead to new reform laws together with institutional restructuring of government institutions responsible for land management. What is aimed for is the formulation of equitable land policies and legislations that encourages investment in land development to achieve food security, sustain the physical environment and promote social justice. And to put land resources to good effect, effective tools of land management namely, spatial planning and correct information must be utilsed. Use of information technology is facilitating everyday life. Space technology, geographical information systems and computer technology, enables land management to benefit from the geo-spatial data technology for allocation of land, control of its use and development, monitoring of physical changes and environmental stresses. The benefits gained by Greater Khartoum from the process of land plots allocation through application of an integrated information and computer technologies with web communication are good examples.

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