Sustainable Land Administration Infrastructures to support Natural Disaster Prevention and Management

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1. INTRODUCTION

All countries have to deal with the management of land. They have to deal with the four functions of land tenure, land value, land use, and land development in some way or another. A country's capacity may be advanced and combine all the activities in one conceptual framework supported by sophisticated ICT models. More likely, however, capacity will involve very fragmented and basically analogue approaches. Different countries will also put varying emphasis on each of the four functions, depending on their cultural basis and level of economic development.

Land Administration Systems are the basis for conceptualizing rights, restrictions and responsibilities related to people, policies and places. Property rights are normally concerned with ownership and tenure whereas restrictions usually control use and activities on land. Responsibilities relate more to a social, ethical commitment or attitude to environmental sustainability and good husbandry.

This paper provides an overall understanding of the land management paradigm towards spatially enabled government. Place matters! Everything happens somewhere. If we can understand more about the nature of "place" where things happen, and the impact on the people and assets on that location, we can plan better, manage risk better, and use our resources better.

Sustainable Land Administration Systems are also a key component in support of natural disaster prevention and management. The land management perspective and the operational component of land administration systems therefore need high-level political support and recognition.

2. LAND GOVERNANCE

Arguably sound land governance is the key to achieve sustainable development and to support the global agenda set by adoption of the Millennium Development Goals (MDGs). Land governance is about the policies, processes and institutions by which land, property and natural resources are managed. This includes decisions on access to land, land rights, land use, and land development. Land governance is basically about determining and implementing sustainable land policies. Such a global perspective for Land Governance or Land Management is shown in figure 1.
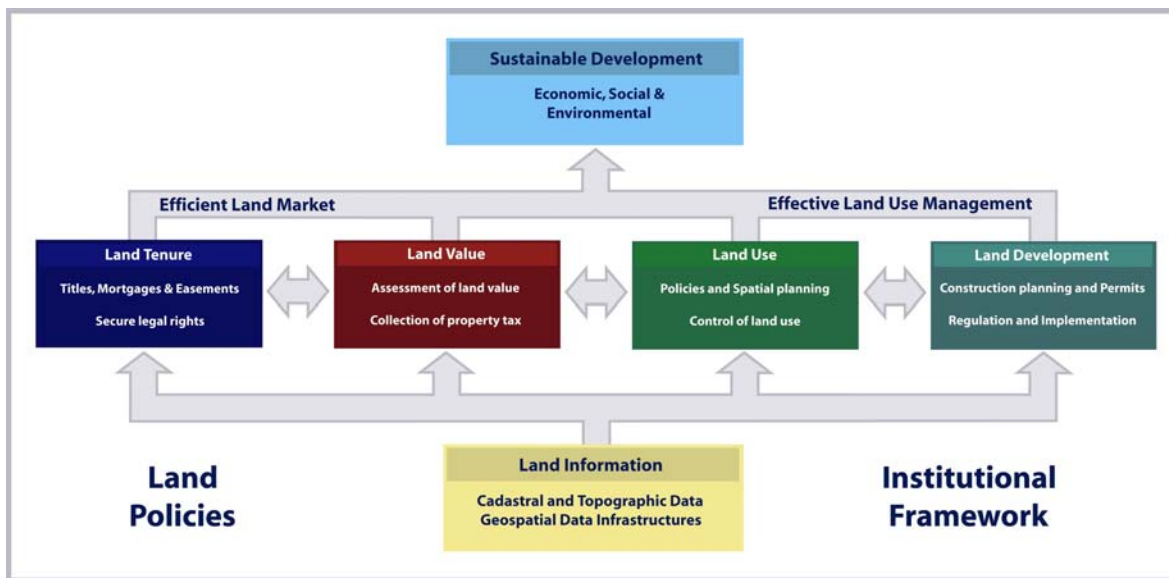

Figure 1. A Global Land Management Perspective (Enemark, 2004).

Land governance and management covers all activities associated with the management of land and natural resources that are required to fulfil political and social objectives and achieve sustainable development. Land management requires inter-disciplinary skills that include technical, natural, and social sciences. The operational component of the land management concept is the range of land administration functions that include the areas of land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and land development (implementing utilities, infrastructure, construction planning, and schemes for renewal and change of existing land use).

Land administration systems (LAS) are the basis for conceptualizing rights, restrictions and responsibilities. Property rights are normally concerned with ownership and tenure whereas restrictions usually control use and activities on land. Responsibilities relate more to a social, ethical commitment or attitude to environmental sustainability and good husbandry. In more generic terms, land administration is about managing the relations between people, policies and places in support of sustainability and the global agenda set by the MDGs.

2.1 Property Rights

In the Western cultures it would be hard to imagine a society without having property rights as a basic driver for development and economic growth. Property is not only an economic asset. Secure property rights provide a sense of identity and belonging that goes far beyond and underpins the values of democracy and human freedom. Historically, however, land rights evolved to give incentives for maintaining soil fertility, making land-related investments, and managing natural resources sustainably. Therefore, property rights are normally managed well in modern economies. The main rights are ownership and long term leasehold. These rights are typically managed through the cadastral/land registration systems developed over centuries. Other rights such as easements and mortgage are often included in the registration systems.

The formalized western land registration systems are basically concerned with identification of legal rights in support of an efficient land market, while the systems do not adequately address the more informal and indigenous rights to land that is found especially in developing countries where tenures are predominantly social rather than legal. Therefore, traditional cadastral systems can not adequately supply security of tenure to the vast majority of the low income groups and/or deal quickly enough with the scale of urban problems. A new and innovative approach is found in the continuum of land rights (including perceived tenure, customary, occupancy, adverse possession, group tenure, leases, freehold) where the range of possible forms of tenure is considered as a continuum from informal towards more formal land rights and where each step in the process of securing the tenure can be formalised (UN-Habitat, 2008).

2.2 Property Restrictions

Land-use planning and restrictions are becoming increasingly important as a means to ensure effective management of land-use, provide infrastructure and services, protect and improve the urban and rural environment, prevent pollution, and pursue sustainable development. Planning and regulation of land activities cross-cut tenures and the land rights they support. How these intersect is best explained by describing two conflicting points of view – the free market approach and the central planning approach.

The free market approach argues that land owners should be obligated to no one and should have complete domain over their land. In this extreme position, the government opportunity to take land (eminent domain), or restrict its use (by planning systems), or even regulate how it is used (building controls) should be non-existent or highly limited.

The central planning approach argues that the role of a democratic government includes planning and regulating land systematically for public good purposes. In these jurisdictions the historical assumption that a land owner could do anything than was not expressly forbidden by planning regulations changed into the different principle that land owners could do only what was expressly allowed, everything else being forbidden.

The tension between these two points of view is especially felt by nations seeking economic security. The question however is how to balance owners' rights with the necessity and capacity of the government to regulate land use and development for the best of the society. The answer to this is found in a country's land policy which should set a reasonable balance between the ability of land owners to manage their land and the ability of the government to provide services and regulate growth for sustainable development. This balance is a basis for achieving sustainability and attaining the MDGs.

Informal development may occur in various forms such as squatting where vacant state-owned or private land is occupied and used illegally for housing or any construction works without having formal permission from the planning or building authorities. Such illegal development could be significantly reduced through government interventions supported by the citizens. Underpinning this intervention is the concept of integrated land-use management as a fundamental means to support sustainable development, and at the same time, prevent and legalise informal development (Enemark and McLaren, 2008).

2.3 Property Responsibilities

Property responsibilities are culturally based and relate to a more social, ethical commitment or attitude to environmental sustainability and good husbandry. Individuals and other actors are supposed to treat land and property in a way that conform to cultural traditions and ways of good ethical behaviour. This relates to what is accepted both legally and socially. Therefore, the systems for managing the use of land vary throughout the world according to historical development and cultural traditions. More generally, the human kind to land relationship is to some extent determined by the cultural and administrative development of the country or jurisdiction.

Social responsibilities of land owners have a long heritage in Europe. In Germany, for example, the Constitution is insisting on the land owner's social role. In general, Europe is taking a comprehensive and holistic approach to land management by building integrated information and administration systems. Other regions in the world such as Australia creates separate commodities out of land, using the concept of "unbundling land rights", and is then adapting the land administration systems to accommodate this trading of rights without any national approach.

3. THE LAND MANAGEMENT PARADIGM

Land management underpins distribution and management of a key asset of any society namely its land. For western democracies, with their highly geared economies, land management is a key activity of both government and the private sector. Land management, and especially the central land administration component, aim to deliver efficient land markets and effective management of the use of land in support of economic, social, and environmental sustainability.

The land management paradigm as illustrated in figure 2 below allows everyone to understand the role of the land administration functions (land tenure, land value, land use, and land development) and how land administration institutions relate to the historical circumstances of a country and its policy decisions. Importantly, the paradigm provides a framework to facilitate the processes of integrating new needs into traditionally organised systems without disturbing the fundamental security these systems provide.
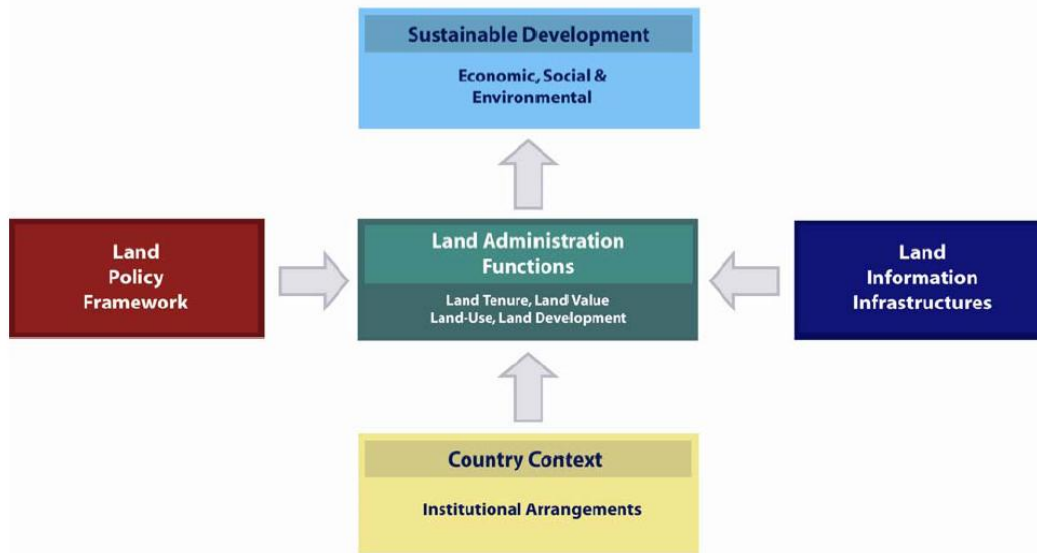

Figure 2. The land management paradigm (Enemark, 2004)

Sound land management requires operational processes to implement land policies in comprehensive and sustainable ways. Many countries, however, tend to separate land tenure rights from land use opportunities, undermining their capacity to link planning and land use controls with land values and the operation of the land market. These problems are often compounded by poor administrative and management procedures that fail to deliver required services. Investment in new technology will only go a small way towards solving a much deeper problem: the failure to treat land and its resources as a coherent whole.

3.1 Hierarchy of land issues

The response to change pressures in any particular jurisdiction will depend on how local leaders understand the vision. While the larger theoretical framework described above is futuristic for many countries, they must still design their land administration systems around the land management paradigm. A simple entry point showing how to do this uses a hierarchy of land issues in figure 3 showing how the concepts involved in the paradigm fit together in a hierarchical manner ranging from land policies to the land parcel.
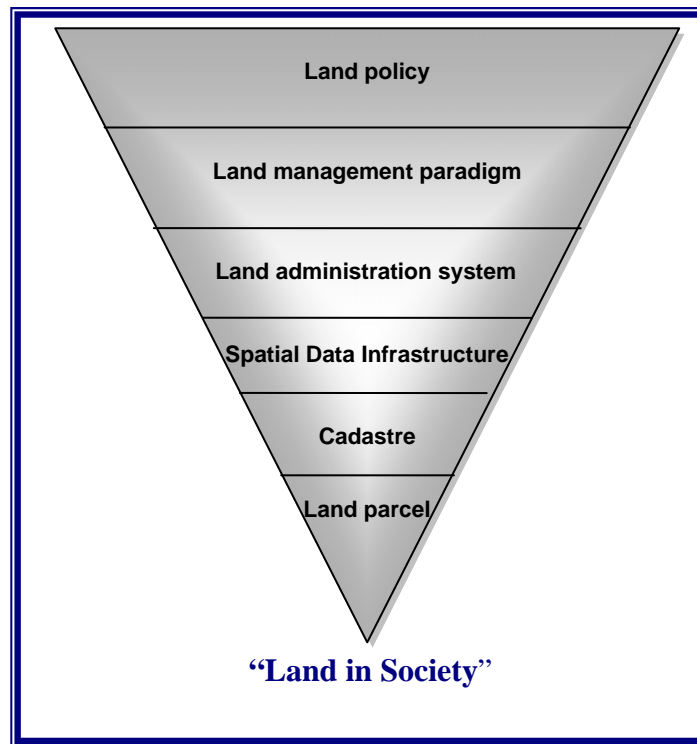
Figure 3. Hierarchy of land issues (Enemark, 2006)

Land policy determines values, objectives and the legal regulatory framework for management of a society's major asset, its land.

The *land management paradigm* applies to LAS design to drive a holistic approach to the LAS, and forces its processes to contribute to sustainable development. The paradigm allows LAS to assist land management generally. Land management activities include the core land administration functions: land tenure, value, use and development, and encompass all activities associated with the management of land and natural resources that are required to achieve sustainable development.

The *land administration system* provides the infrastructure for implementation of land policies and land management strategies, and underpins the operation of efficient land markets and effective land use management. The cadastre is at the core of any LAS.

The *spatial data infrastructure* provides access to and interoperability of the cadastral information and other land information.

The *cadastre* provides the spatial integrity and unique identification of every land parcel usually through a cadastral map updated by cadastral surveys. The parcel identification provides the link for securing rights in land, controlling the use of land and connecting the ways people use their land with their understanding of land.

The *land parcel* is the foundation of the hierarchy because it reflects the way people use land in their daily lives. It is the key object for identification of land rights and administration of restrictions and responsibilities in the use of land. The land parcel links the system with the people.

The hierarchy illustrates the complexity of organizing policies, institutions, processes, and information for dealing with land in society. But it also illustrates an orderly approach represented by the six levels. This conceptual understanding provides the overall guidance for building LAS in any society, no matter the level of development. The hierarchy also provides guidance for adjustment or reengineering of existing LAS. This process of adjustment should be based on constant monitoring of the results of the land administration and land management activities. The land policies may then be revised and adapted to meet the changing needs in society. The change of land policies will require adjustment of the LAS processes and practices that, in turn, will affect the way land parcels are held, assessed, used, or developed.

4. SPATIALLY ENABLED GOVERNMENT

Place matters! Everything happens somewhere. If we can understand more about the nature of "place" where things happen, and the impact on the people and assets on that location, we can plan better, manage risk better, and use our resources better (Communities and Local Government, 2008). Spatially enabled government is achieved when governments use **place** as the key means of organising their activities in addition to information, and when location and spatial information are available to citizens and businesses to encourage creativity.

New distribution concepts such as Google Earth provide user friendly information in a very accessible way. We should consider the option where spatial data from such concepts are merged with built and natural environment data. This unleashes the power of both technologies in relation to emergency response, taxation assessment, environmental monitoring and conservation, economic planning and assessment, social services planning, infrastructure planning, etc. This also include designing and implementing a suitable service oriented IT-architecture for organising spatial information that can improve the communication between administrative systems and also establish more reliable data based on the use of the original data instead of copies.

Spatial enablement offers opportunities for visualisation, scalability, and user functionalities. This is related to institutional challenges with a range of stakeholder interests. This includes Ministries/Departments such as: Justice; Taxation; Planning; Environment; Transport; Agriculture; Housing; Regional and Local Authorities; Utilities; and civil society interests such as businesses and citizens. Creating awareness of the benefits of developing a shared platform for Integrated Land Information Management takes time. The Mapping/Cadastral Agencies have a key role to play in this regard. The technical core of Spatially Enabling Government is the spatially enabled cadastre.

4.1 Significance of the Cadastre

The land management paradigm makes a national cadastre the engine of the entire LAS, underpinning the country's capacity to deliver sustainable development. The role of the cadastre as the engine of LAS is neutral in terms of the historical development of any national system, though systems based on the German and Torrens approaches, are much more easily focused on land management than systems based on the French/Latin approach. The cadastre as an engine of LAS is shown diagrammatically in figure4.
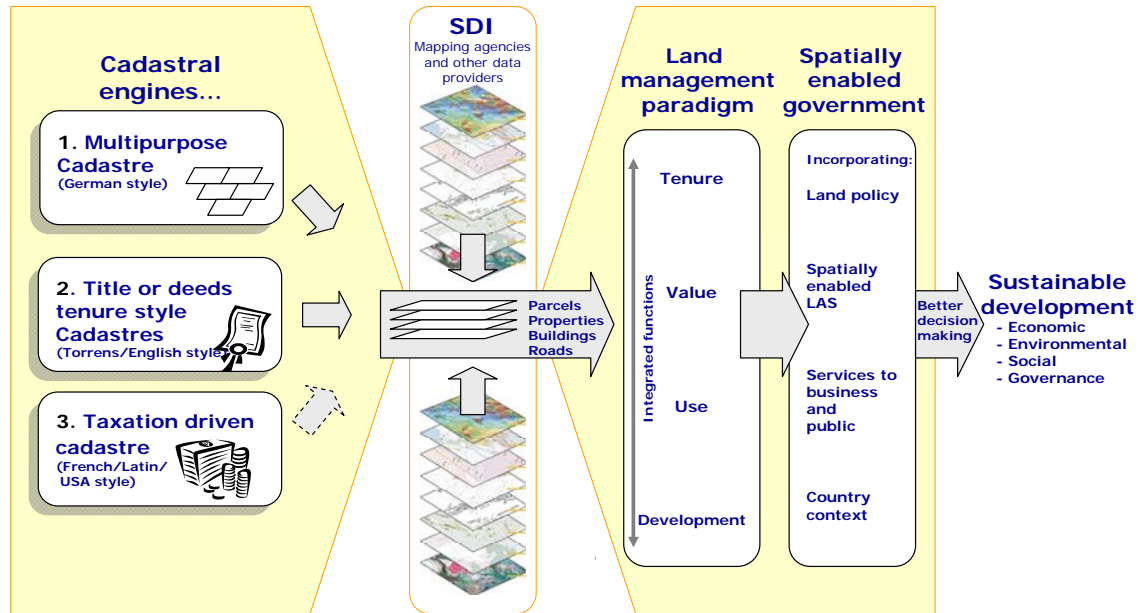

Figure 4. Significance of the Cadastre (Williamson, Enemark, Wallace, Rajabifard, 2009)

The diagram highlights the usefulness of the large scale cadastral map as a tool by exposing its power as the representation of the human scale of land use and how people are connected to their land. The digital cadastral representation of the human scale of the built environment, and the cognitive understanding of land use patterns in peoples' farms, businesses, homes, and other developments, then form the core information sets that enable a country to build an overall administrative framework to deliver sustainable development.

The diagram demonstrates that the cadastral information layer cannot be replaced by a different spatial information layer derived from geographic information systems (GIS). The unique cadastral capacity is to identify a parcel of land both on the ground and in the system in terms that all stakeholders can relate to, typically an address plus a systematically generated identifier (given addresses are often duplicated or are otherwise imprecise). The core cadastral information of parcels, properties and buildings, and in many cases legal roads, thus becomes the core of SDI information, feeding into utility infrastructure, hydrological, vegetation, topographical, images, and dozens of other datasets.

4.2 Good governance

Governance refers to the manner in which power is exercised by governments in managing a country's social, economic, and spatial recourses. It simply means: the process of decision-making and the process by which decisions are implemented. This indicates that government is just one of the actors in governance. The concept of governance includes formal as well as informal actors involved in decision-making and implementation of decisions made, and the formal and informal structures that have been set in place to arrive at and implement the decision. Good governance is a qualitative term or an ideal which may be difficult to achieve. The term includes a number of characteristics: (adapted from FAO, 2007):

- *Sustainable and locally responsive:* It balances the economic, social, and environmental needs of present and future generations, and locates its service provision at the closest level to citizens.
- *Legitimate and equitable:* It has been endorsed by society through democratic processes and deals fairly and impartially with individuals and groups providing non-discriminatory access to services.
- *Efficient, effective and competent***:** It formulates policy and implements it efficiently by delivering services of high quality
- *Transparent, accountable and predictable:* It is open and demonstrates stewardship by responding to questioning and providing decisions in accordance with rules and regulations.
- *Participatory and providing security and stability:* It enables citizens to participate in government and provides security of livelihoods, freedom from crime and intolerance.
- *Dedicated to integrity:* Officials perform their duties without bribe and give independent advice and judgements, and respects confidentiality. There is a clear separation between private interests of officials and politicians and the affairs of government.

Once the adjective "good" is added, a normative debate begins. In short: sustainable development is not attainable without sound land administration or, more broadly, sound land management.

5. NATURAL DISASTER PREVENTION AND MANAGEMENT

The key challenges of the new millennium are clearly listed already. They relate to climate change; food shortage; energy scarcity; urban growth; environmental degradation; and natural disasters. These issues all relate to governance and management of land. Land governance is a cross cutting activity that will confront all traditional "silo-organised" land administration systems.

Especially with regard to prevention, mitigation and management of natural disasters sustainable land administration systems play a key role. This role is further increasing due to the increasing frequency of disasters world wide. The total number of disasters (such as drought, earthquake, flood, slide, volcanic eruption, hurricane, etc.) has increased from about 150 in 1980 to more than 400 in 2000. Much of the increase is probably due to significant improvements in information access, but the number of floods and cyclones being reported is still rising compared to earthquakes. This of course leaves the question of the impact of global warming. Furthermore, the humanitarian as well as economic impact of disasters is significant. In the USA, for example, more than 90 weather disasters have occurred the last 30 years with the total costs exceeding 700 billion USD (see figure 5). .
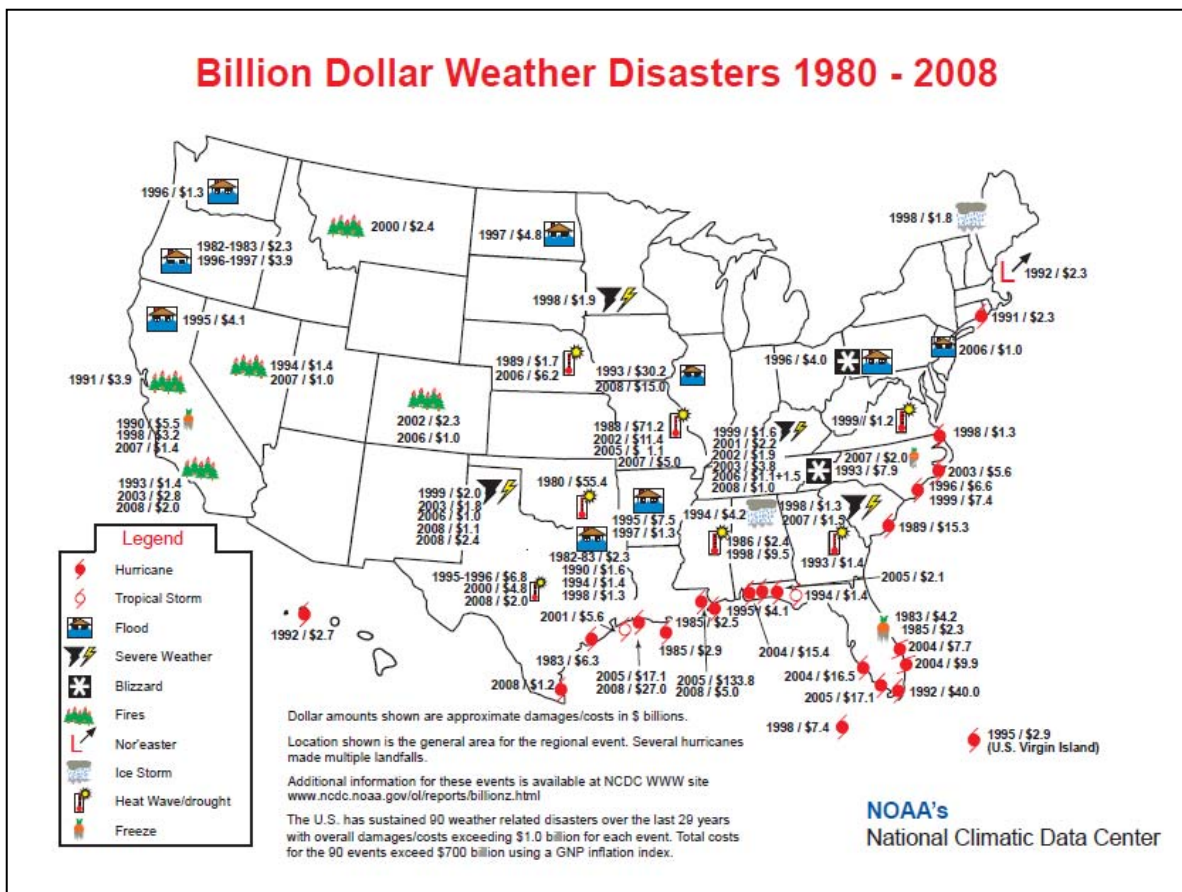

Figure 5. Billion dollar whether disaster in the USA 1980-2008

Due to the increasing frequency of disasters worldwide, a lot of international organizations, governments and NGOs like FIG (the International Federation of Surveyors) are upgrading the priority of disaster risk management for policy, and are developing techniques and tools for disaster risk management such as UN/ISDR (2004), FIG (2006) and RICS (2009).

Generally, the disaster risk management process (cycle) is composed of the following main elements:

- Risk identification and vulnerability assessment
- Risk prevention and mitigation measures
- Disaster preparedness

- Disaster event and emergency relief

- Early recovery/transition
- Reconstruction
- Review and ongoing risk reduction

The above components are shown in figure 6 as an ongoing circle of activities related to the situation before (risk identification, prevention, preparedness), during (emergency relief) and after a disaster (recovery, reconstruction) where the latter should then feed back into improving the resilience of vulnerable communities and reduce future risks leading towards sustainable development.
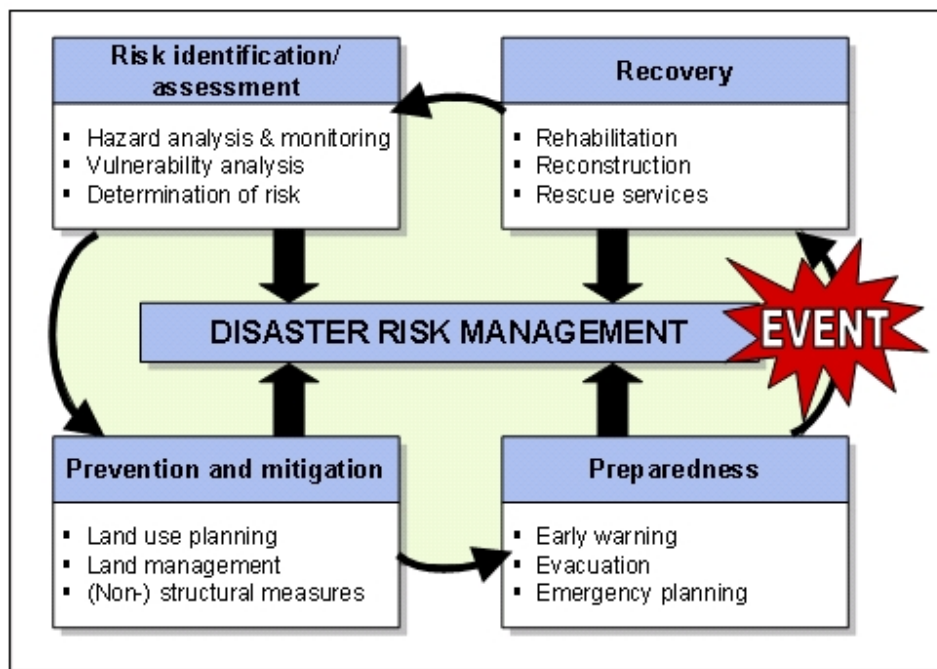

Fig. 6. Key elements of disaster risk management (FIG, 2006)

There is wisdom in the statement (2004) of Kofi Annan, the former UN Secretary General: "While many people are aware of the terrible impact of disasters throughout the world, few realise this is a problem that we can do something about."

5.1 Land administration systems in support of natural disaster risk management

Sustainable land administration systems should include a range of issues and measures relevant to disaster risk management.

Disaster risks must be identified as area zones in the land use plans and land information systems with the relevant risk assessments and information attached. Such disaster risk zones may relate to sea level rise, earthquakes, volcano eruption, flooding, draught, hurricanes, etc, and the information should relate to the predicted risks as known through statistics and positioning measurement systems. By combining the disaster risk information with the relevant information on land tenure, land value, and land use the necessary risk prevention and mitigation measures can be identified and assessed in relation to legal, economic, physical, and social consequences. E.g. measures to prevent collapse of buildings in vulnerable earthquake zones. Ideally, disaster risk management should be an integrated part of land use planning and land management.

In disaster zones relevant measures should be taken to build the preparedness for managing any disaster events. Land issues are an important component in the emergency relief phase. Land is necessary for emergency shelter and protection of displaced persons, and the selection of sites for emergency shelter can lead to long term conflict or tenure insecurity. Land is also necessary for restoration of livelihoods, and land grabbing after a disaster is a key risk to effective protection and emergency shelter activity. Humanitarian actors are therefore confronted with land issues as they undertake emergency shelter and protection activity.

Sustainable land administration systems provide clear identification of the individual land parcels and land rights attached to these parcels. This information on the people to land relationship is crucial in the immediate post disaster situation. Following the relief and early recovery transition period – where focus is on the overriding humanitarian efforts of saving lives and providing immediate relief – the recovery and reconstruction phase will to a large extent relate to re-establishing the situation of legal rights to land and properties and the reconstruction of buildings and infrastructure. Sustainable land administration systems provide the basis for managing these processes.

Finally, the process of having managed an actual natural disaster should lead to a process of improved risk and vulnerability assessment to be incorporated into the overall land use planning. This should be reflected through the development of ongoing risk reduction measures. Increased sustainability should then be achieved through increasing the resilience of local communities towards the goal of future disaster prevention.

Integration of all aspects of the disaster risk management circle (as shown in figure 6 above) into the overall land administration system will enable a holistic approach that should underpin the general awareness of the need for being prepared for natural disasters and also being able to manage actual disaster events.

5.2 Building the capacity for disaster prevention and management

The capacity to be prepared for and manage natural disasters will of course include the use of early warning systems that provide timely and effective information in due time for taking the necessary actions and preparing for an efficient response.

Another key issue is to establish the necessary political commitment for integrating mitigating measures and disaster risk reduction into the general development planning and sectoral policies, and to implement these policies through organisational structures and regulatory frameworks.

Establishing a general public awareness policy in relation to management of natural disasters is essential. This should lead to information programs, education and training and research in disaster risk reduction.

In the context of disaster risk reduction, capacity building can be achieved through disaster management training and education, public information on disasters, the transfer, provision or access to technology or other forms of technical assistance intended to improve institutional efficiency. The concept also relates to the training of disaster managers, the transfer of technical expertise, the dissemination of traditional knowledge, strengthening infrastructure and enhancing organizational abilities (UN/ISDR 2004).

To achieve improvements concerning these goals, the process of capacity development should be addressed at all levels and all sectors. In the 21st century, the key issues in capacity-building efforts are strengthening the legal and organizational capabilities of institutions in charge of disaster risk management and the networking between them. Figure 7 summarizes good governance and capacity building as a central component regarding the process and implementation of disaster risk management and sustainable development.
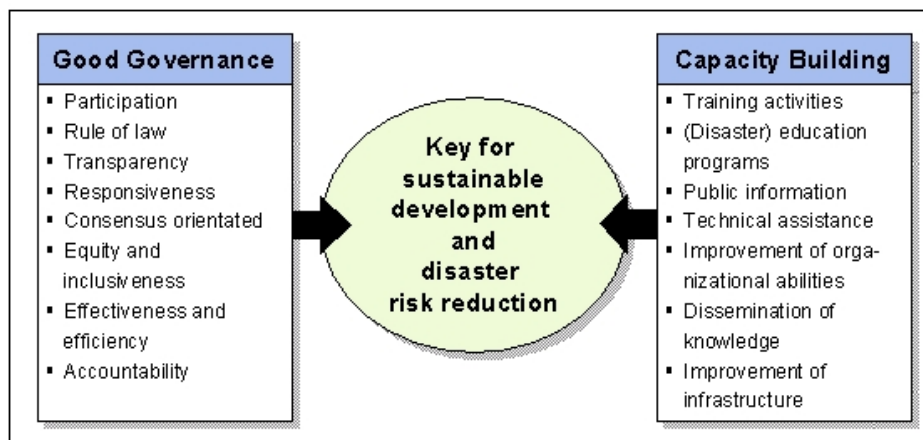

Figure 7 Good governance and capacity building for disaster risk reduction and
sustainable development (FIG 2006).

7.   FINAL REMARKS

No nation can build land management institutions without thinking about integration of activities, policies, and approaches. Technology opportunities provide additional motivation. Careful management of land related activities on the ground are crucial for delivery of sustainability.

Land administration systems, in principle, reflect the social relationship between people and land recognized by any particular jurisdiction or state. Such a system is not just a GIS. On the other hand, Land Administration Systems are not an end in itself but facilitate the implementation of the land policies within the context of a wider national land management framework.

Land administration activities are not just about technical or administrative processes. The activities are basically political and reflect the accepted social concepts concerning people, rights, and land objects with regard to land tenure, land markets, land taxation, land-use control, land development, and environmental management.

Sustainable land administration systems also play a key role in prevention and management of natural disasters. The land management perspective and the operational component of land administration systems therefore need high-level political support and recognition.

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BIOGRAPHICAL NOTES

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