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**Development of a Geospatial Framework to Implement a Regional  
Spatial Data Infrastructure (RSDI) in CARICOM\***

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## **DEVELOPMENT OF A GEOSPATIAL FRAMEWORK TO IMPLEMENT A REGIONAL SPATIAL DATA INFRASTRUCTURE (RSDI) IN CARICOM**

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### **Abstract**

*Almost all human activities take place on land. In fact, human existence is almost impossible without this resource (Ramlal, 2001). As the effects of global climate change are becoming more destructive in small-island states in the Caribbean, Governments are becoming aware of the need to effectively manage this finite resource and its accompanying attribute data. The effective management of land and its resources requires geospatial data that are current, timely, reliable and relevant. The systems currently in place are not responsive to the needs of the timely intervention required for informed policy decisions (Ramlal, 2001). What is needed is a framework to facilitate the coordinated exchange of geospatial information on natural resources, environment, land ownership, land use, transport, communication, demography and socio-economic indicators amongst geospatial data stakeholders within the CARICOM community. A regional coordinating approach to effectively manage information provides viable alternatives to address this problem, not just locally but regionally.*

*This paper discusses a justification for the development of such a regional framework in CARICOM.*

## **Introduction**

Decision Support Systems (DSS) that rely on Geospatial information have proliferated over the past few years and are increasingly embedded in the operations of Regional Governments. Regional demand for wide-ranging and accurate Geospatial data that can be quickly integrated with other socio-economic and demographic data sets has become a high priority for policy makers and the necessary datasets a pre-requisite for informed decision making. This places a premium on effective Geospatial data coordination, central data management, data warehousing and optimum data sharing of priceless information and costly resources. Achieving more cost-effective use of Geospatial data requires concerted and creative efforts to adopt common standards and interoperability across Governments in the CARICOM Region.

Fundamental to the effective execution of Regional policies aimed at optimizing the use of land and land related information, is the knowledge of, and access to accurate, up-to-date, timely, complete and relevant socio-economic, demographic, environmental and geospatial data. Geospatial or Geographic data encompass digital interactive thematic maps with their respective attribute information on natural resources, environment, land ownership, land use, transport, communication, demography and socio-economic factors. Such data can be related to geographic positioning, including, terrestrial, aquatic, atmospheric, and subsurface regions.

Empirical studies have found that approximately 80 percent of Regional Government's administrative decisions are related to, or impact on, the geographic domain of Member States, some examples are municipal, maritime, political, air/sea traffic control, border security, oil/gas exploration and fishing boundaries. Consequently the currency, availability and access to timely information in the region are necessary requirement for management effectiveness for economic, social and environmental planning. One such event to be effectively managed is the occurrence of natural disasters, particularly hurricanes. Natural disasters have become an endemic phenomenon to the region. Consequently, the management of these occurrences can provide sufficient justification for the development of a framework for Regional Geospatial coordination.

## **Background**

The Caribbean Community (CARICOM) Secretariat can play a pivotal role in anchoring the mechanism for sharing information and, where necessary, coordinating the activities of the regional institutions and in so doing, contribute toward reducing duplication and fostering harmonisation of activities. The decision of the Special CARICOM Meeting of the Council For Human and Social Development (COHSOD) on Health, ratified by Heads of Government (June 2007) to consolidate the Regional health institutions, specifically, the Caribbean Epidemiology Centre (CAREC), Caribbean Disaster Emergency Response Agency (CDERA), Caribbean Environmental Health Institute (CEHI), Caribbean Food and Nutrition Institute (CFNI), Caribbean Health Research Council (CHRC) and Caribbean Regional Drug Testing Laboratory (CRDTL) - into one umbrella Regional Public Health Agency to be coordinated by the CARICOM Secretariat, is an example of how effective coordination can be constituted. This provides a strong compelling example of a how a regional data sharing framework can be encouraged and supported.

Further given that the Office of the Secretary-General of CARICOM has recently established a Functional Cooperation Unit within its operations, the coordination of the Regional Institutions towards streamlining greater functional corporation activities as well as between the Institutions and the core functions of the CARICOM Secretariat; provides an additional over-sighting role for the proposed framework. The CARICOM Secretariat can be the umbrella for this framework to be inaugurated.

Regional Institutions play a pivotal role, individually and collectively, in solidifying the role of functional cooperation. In the execution of their respective roles, they assist the Community in pooling resources and benefiting from the expertise in specific areas such as disaster management, climate change, crime and security, food and nutrition, agricultural research, meteorology, health, education, transportation and other services. In fact, it is recommended that a requirement for being designated a regional institution is an accepted mission to implement functional cooperation in a substantive area of policy importance to the Region. (Executive Summary of the Report of the Task Force on Functional Cooperation, July, 2007)

## Regional Framework

One of the most compelling reasons for the development of a coordinated approach at this juncture is the need for timely, effective, relevant regional data-sets for disaster preparedness with respect to events caused by Climate Change. Disaster preparedness has always been of tremendous importance for the Caribbean, given our exposure to hurricanes and other weather-related events affecting us with sometimes deadly results. The Caribbean has had its full share of storms and hurricanes within the past decade, severely damaging small-island economies. The forecasts suggest that the intensity and regularity of this phenomenon due to global climate change will increase, hence accelerating the need to be ready and proactive than reactive.

The recommendation is for the development and application of a Regional **Spatial Data Infrastructure (RSDI)**. A RSDI can be the framework to facilitate the coordinated exchange of spatial information amongst spatial data stakeholders within the spatial data community. The RSDI will facilitate the implementation of technology, policies, criteria, standards and people necessary to promote geospatial data sharing throughout all levels of government and academia. It will provide a base or structure of practices and relationships among data producers and users that facilitates data sharing and use (Rajabifard et al, 2004). It is within this context and definition of a RSDI that seek to explore a framework for CARICOM Member States and Associate Members to develop a Geospatial strategy that can assist the countries in the Caribbean to strategically plan, share, coordinate and adopt a framework for Disaster Management and its disastrous consequences.

A strategic approach to the management of natural disasters continues to engage the attention of national, regional, and international agencies. The development of Geographic Information Systems (GIS) in Member countries to computerize census and geospatial data-sets has given a stronger impetus for CARICOM coordination. This is further explained by GIS researcher, Opadeyi. He explains, that planned activities that focus on improving human capacity to coordinate and cope with the impact of natural hazards e.g. land use planning, hazard mapping, vulnerability assessment, public awareness programme, early warning systems and data warehousing could mitigate with the impact of natural hazards and can provide communities with adequate protection from perennial loss from the incidence of natural hazards. (Opadeyi, 2008)

The absence of a coordinated approach to sharing vital information, led to the destruction of many lives in the aftermath of the 2004 tsunami that hit several countries in the Asian region and the 2005 Kashmiri earthquake that affected the Northern region of Pakistan. The ability to forecast the path of Hurricane Katrina in 2005 provided ample time for the warning and evacuation of the large population of New Orleans. Effective planning and timely warning provides the opportunity for both the community and the official responders to take appropriate action that will minimize loss of life and properties. The financial cost for disaster recovery considerably out-weights the cost to prepare and plan for a disaster. The CARICOM Region is expected to spend an estimated US\$180 million dollars to conduct a Round of Population and Housing Censuses in the year 2010/2011. This decennial data collection mandate can surely be the catapult for regional data coordination and policy planning, to drive disaster planning in the region.

It is to be noted that not many Member States have implemented or are at any stage of implementing a National SDI, save and except Trinidad and Tobago and Jamaica who have started the process. However, this concept has gained considerable support in the developed world. Countries that have successfully implemented a SDI are Japan, China, India, the United States of America, Malaysia, the Netherlands, Qatar, Jordan, Australia, Portugal, Canada and the United Kingdom. The challenge of designing, building, implementing, and maintaining a Regional Spatial Data Infrastructure draws on many different disciplines and requires examination of a large number of factors and issues. Current research shows that despite considerable interest and activities, the development of an effective and comprehensive SDI is hampered in most cases by a lack of support from stakeholders, which results in this initiative remaining just an innovative concept.

Many Member States and Associate Members have initiated some efforts to institutionalise the collection and management of Geospatial data with the aim to reduce the data collection, retrieval and warehousing cost of national information so vital to efficient planning. However, this needs to be regionally coordinated and at some measure of functional harmonization so as to ensure that Member States and Associate Members can be supported using an efficient, consistent and deliverable constitute framework.

## **The Role of the Caribbean Disaster Emergency Response Agency**

One such coordinating institution in the region is the Caribbean Disaster Emergency Response Agency (CDERA). CDERA is the disaster management Organisation which serves the Caribbean Community. This regional inter-Governmental agency was established in September 1991 by an Agreement of the Conference of Heads of Government of CARICOM to be responsible for disaster management.

However, CDERA's main function is to make an immediate and coordinated response to any disastrous event affecting any participating State, once the state requests such assistance.

Other such functions related to CDERA's mandate include:

- i. Securing, collating and channeling to interested governmental and non-governmental organizations, comprehensive and reliable information on disasters affecting the region;
- ii. Mitigating or eliminating as far as possible, the consequences of disasters affecting Participating States.
- iii. Establishing and maintaining on a sustainable basis, adequate disaster response capabilities among Participating States; and,
- iv. Mobilizing and coordinating disaster relief from governmental and non-governmental organizations for affected Participating States.

CDERA has started the process of coordination in CARICOM with the implementation of one of their sub-regional focal points, which refers to; *“the acquisition and maintenance on an updated basis, comprehensive information on the facilities and services available in each of the participating States for which they bear responsibility”*, this mandate however, is restricted to disaster management and subsequent cannot drive any data management policies as it pertains to classification of content related standards and data sharing.

## **Problem Definition**

In the absence of a Regional data sharing policy on land and land related Geospatial information many debilitating factors for data management have developed. The following issues have precipitated the Regional need for a systematic policy framework for land information systems through geographic data management systems and are as follows:

- Data comparison and cross-correlation are severely hindered by the several non-standardized referencing systems, platforms and operating systems, software and map projections across Government agencies.
- Lack of knowledge and inaccessibility to existing data stores has resulted in difficulties in compiling basic inventories of land assets including government social infrastructure.
- Interagency coordination does not exist and in the few areas, is restricted to facilitate the ease of sharing government collected information, therefore leading to costly duplication of data collection, redundancy and analysis.
- Delays in the development of National Physical Development Plans due to the limited access to up-to-date, timely, relevant socio-economic, geographic data, modern technology and satellite imagery.
- Critical shortage of Geographic Information Systems (GIS) management specialists and skilled operational technical staff.
- The lack of metadata or information on the "who, what, when, where, why, and how" of databases inhibits one's ability to find and use data, and consequently, makes data sharing among organizations harder.
- No data ware-housing and Archiving of historical data

Many countries are developing spatial data infrastructures (SDIs) in order to better manage their spatial datasets (Rajabifard and Williamson 2004) for supporting various applications. The development of these datasets is often done with little coordination among various organizations, and as a consequence duplication of effort and wasting of resources occur (Warnecke et al. 1998; Wehn de Montalvo 2003a; Omran et al. 2006). In order to reduce this duplication, spatial data sharing (SDS) is essential. In many instances individuals and organizations are unwilling to share data across and within organizations. SDS behavior is strongly related to socio-cultural context. Understanding and changing individual and organizational behaviors could be the key to improving spatial data sharing.



Another issue common to spatial data sharing is the question of organizational resistance to sharing data. Resistance to share data may be due to a lack of motivation. Organizations are motivated by organizational needs and capabilities (Calkins and Weatherbe 1995), the advantages of synergisms (Craig 1995), and appeals to professionalism and common goals (Obermeyer 1995). These common or “super-ordinate” objectives are among the non-economic reasons for sharing (Tjosvold 1988; Pinto and Onsrud 1995). Appropriate organizational motivation is required for data sharing; incentives can also motivate the organizations to share their data. The CARICOM RSDI will develop policies for the sharing and confidentiality of collected data. CARICOM will act as a facilitator for the development of the RSDI framework.

### **Framework Solution**

The role of CARICOM as a facilitator of the RSDI Framework can be similar to the scope of the United Nations Spatial Data Infrastructure (UNSDI). The UNSDI scope aims to disclose and exchange Geospatial data and information between the different UN bodies and between the different UN bodies and their Member States. This role is outlined as the Secretary General recommendation of “delivering as one” under a Resident Coordinator. Consequently the following recommendations are outlined for discussion:

- i. Facilitate the National and Regional portal.
- ii. Create operational links with the (sub) National Geo-information stakeholders
- iii. Contribute to the realization of National Government’s policies and needs with respect to issues relying on the use of Geo-information
- iv. Coordination and execution of geo-information disclosure activities for large enterprises, companies or multi-nationals in order to fulfill their Corporate Governance goals
- v. Capacity Building activities

The hierarchical structure developed by Rajabifard, Williamson, Holland and Johnstone explains the strong relationship among different political/administrative levels of spatial data concepts. Based on this hierarchical relationship a pyramid of building blocks can be formed by taking a perspective that starts at a local level and proceeds through state, national and regional levels and is completed by developing a Global Spatial Data Infrastructure (GSDI). Therefore, it is argued that by better understanding and demonstrating the nature of this hierarchical relationship, RSDI development can gain support from a wider community of both government and non-government data users and providers. The hierarchical structure can take the shape of a pyramid with SDI development at every level. Figure 1 explains.

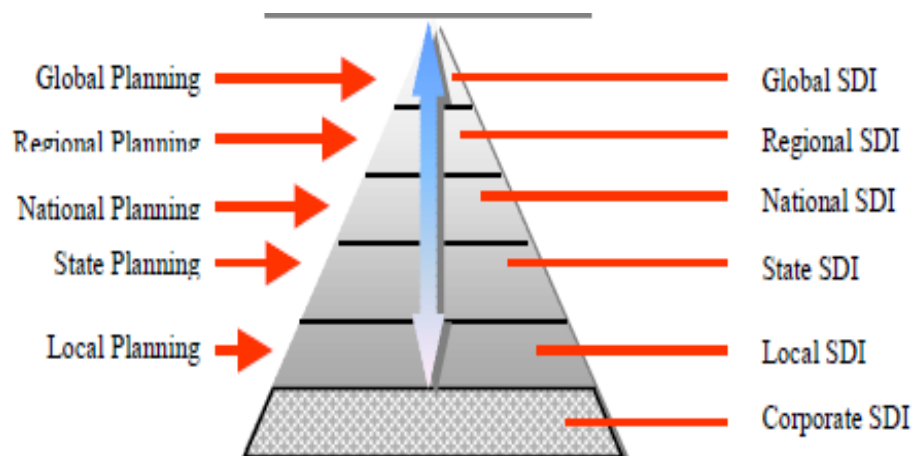


Figure 1 - Different Levels of Spatial Data Infrastructure (Rajabifard et al, 2000)

Other benefits that can be derived from the establishment a RSDI with continuous reengineering and improvements, adding other entities, into the framework are as follows:

#### **Economic Benefits**

- An expanding internal market for products and services
- Greater competitiveness, more opportunities to export of products and services
- Increased efficiency of both public and private sector organizations
- New opportunities for “data” business applications and services
- Improved transport and infrastructure management systems
- Capacity building and Institutional strengthening

**Social Benefits**

- Improved regional and national governance
- More opportunities to engage in the democratic process
- More effective homeland security
- Faster emergency response and mitigation
- Opportunities to target groups and areas with special needs

**Environmental Benefits**

- Promoting sustainable development
- Better natural resource monitoring and management
- Improved coastal zone management

There are at least 40 International Organisations for Standards (ISOs) and ISO Agreements (ISO/TC211) that have completed hundreds of classification of content related standards for SDI development, namely ISO19101 - ISO19140.

These standards can be researched for the preparation of a more comprehensive technical document to be developed and further ratified by a wider regional steering committee. One of main goal of the five goals of ISO/TC 211 is to increase the availability, access, integration and sharing of geographic information and enable inter-operability of geo-spatially enabled computer systems.

**Data Harmonisation Approach**

Since the cooperating entities involved in functional cooperation should have a clear understanding of the modalities of such cooperation, it is useful to outline some approaches that are considered to be essential features of the projects to be implemented. The development of these modalities or approaches of functional cooperation is based on the thesis that functional cooperation will imply activities among Member States, among the institutions themselves, from institutions to Member States and from the CARICOM Secretariat to Member States (Executive Summary of the Report of the Task Force on Functional Cooperation, July, 2007).

One approach, that has started through funding from the Inter-American Development Bank (IDB) and the United Nations Fund for Population Activities (UNFPA) assistance is the Common Census Framework for Population Census project, with specific objectives to develop and adopt a common CARICOM-wide framework for Population Censuses in the Region. The dissemination of Population and Housing Censuses information on the Caribbean should be an important objective of functional cooperation since it will provide a better understanding of the achievements of the Community and give an indication of its impact on the lives of the people of the Region.

This IDB/UNFPA project comprises of three components:

1. **A Common Questionnaire to be used with Core and Non Core questions**
2. **Common Methodologies on Concept and Definitions**
3. **Compatibility of dissemination Tools to ensure ease and access of information**

Member States and Associate Members have adopted and agree to the Common Questionnaire. Presently, consultancy services are on-going to ensure that this process is properly supported and can deliver on its mandate. History can be made with the accomplishment of this project as it would be the first time in the history of Caribbean censuses; that a common approach with common core questions has been attempted.

### **Conclusion**

The growing need to organize data across different disciplines and organizations has resulted in the concept of a Spatial Data Infrastructure. The need to create multi-participant, decision-support environments to address the issues of sustainable development and improving the quality of life creates a growing need to organize data across disciplines and organizations through the application of a coordinated approach to Data Management Systems.

Therefore, a RSDI is fundamentally a concept about facilitation and coordination of the exchange and sharing of data between stakeholders from different jurisdictional levels in the spatial data community. In principle, a RSDI allows the sharing of data, which is extremely useful, as it enables users to save resources, time and effort when trying to acquire new datasets by avoiding duplication of expenses associated with generation and maintenance of data and their integration with other datasets. It can be considered a single point of access for national geographic information. This development entails moving from a product-based approach to a process based-based approach. Current and accurate geospatial data would be readily available to contribute locally, nationally, and globally to economic growth, environmental quality and stability, and social progress if this framework is adopted.

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