

Key outcomes of the Study on Applications of Geospatial Technologies and Data in support of Disaster Risk Management

Workshop2: Technical Issues Towards Effective Applications of Geospatial Technologies and Data in DRM

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Goal and Scope

The goal of the project is to improve the applications of Geospatial Technologies and Data in support of Disaster Risk Management in the Caribbean.

The scopes are:

- a. Study of the status of the applications of Geospatial Technologies and Data in support of Disaster Risk Management in the Caribbean;
- b. Conducting training workshops to enhance the knowledge base of policymakers and practitioners on the applications of Geospatial Technologies and Data for Disaster Risk Management.

The Questionnaire

The questionnaire was divided into seven (7) sections based on the following themes necessary to meet the study objectives:

- a. General information**
- b. Geospatial technologies**
- c. Application of geospatial technologies and data**
- d. SWOT analysis**
- e. Human resource capacity**
- f. Policy and standards**
- g. Access to Geospatial data**

Responses to the Questionnaire

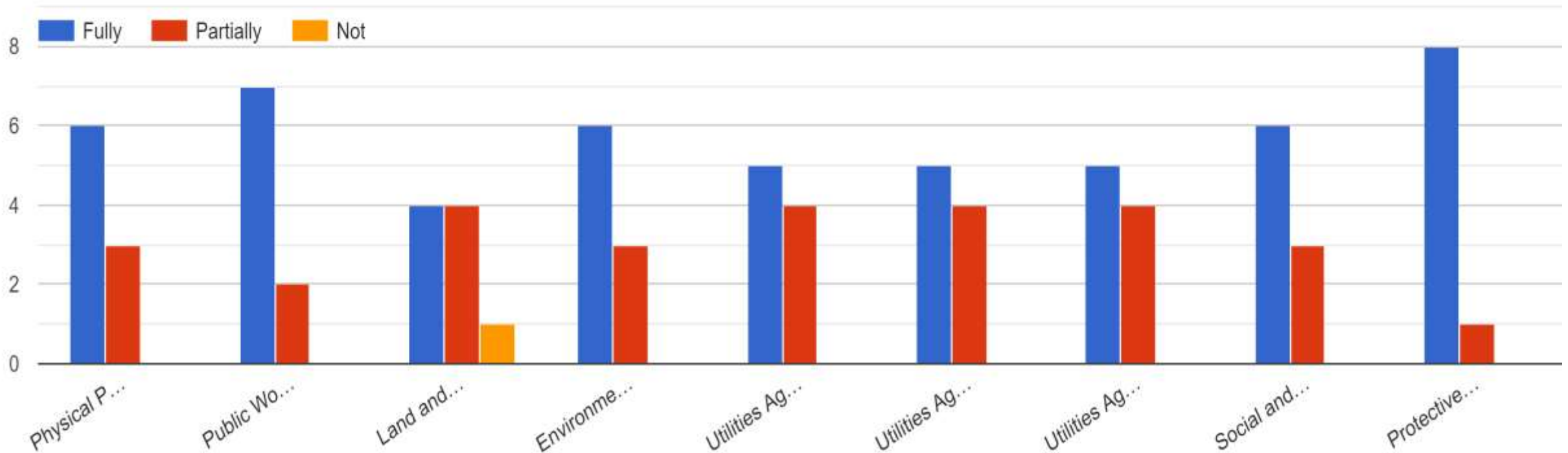
| List of Countries | Responded |
|--------------------------------|------------|
| • Antigua and Barbuda | Awaiting |
| • Bahamas | Yes |
| • Barbados | Yes |
| • Belize | Awaiting |
| • British Virgin Islands | Yes |
| • Dominica | Awaiting |
| • Grenada | Yes |
| • Guyana | Yes |
| • Jamaica | Yes |
| • St. Kitts and Nevis | Yes |
| • Saint Lucia | Awaiting |
| • St. Vincent & the Grenadines | Awaiting |
| • Trinidad and Tobago | Yes |
| • Turks & Caicos Islands | Yes |
| • Suriname | Awaiting |
| • Sint Marteen | Yes |

The Key Five GST/D Environment

- a. Institutional environment**
- b. Geospatial technologies environment**
- c. Geospatial Data management environment**
- d. Human capacity environment**
- e. DRM Applications development environment**

Institutional Environment

1. Which of the following National Agencies are integrated into the Disaster Risk Management system of your country?



Other agencies fully integrated into DRM

- Ministry of rural development and Local Government**
- The Red Cross Society**
- Agriculture Department**
- Coastal Zone Management Unit, Natural Resource Department**
- Meteorological Department**
- Ministry of Agriculture**
- Ministry of Tourism**
- Civil Aviation Department**
- Airport Authorities**
- Customs and Excise Departments**
- Attorney General Department**
- The Salvation Army**
- Ministry of Foreign Affairs- Information Technology Unit**
- Ministry of Agriculture and Marine Resources**

Availability of policies and standards in support of GST/D

| Policy/Standards for GST/D | Available | Unavailable |
|--|-----------|-------------|
| Metadata standards | 45% | 55% |
| Data access and confidentiality policies | 55% | 45% |
| Data backup policy | 55% | 45% |
| Data sharing policy | 55% | 45% |
| Cartographic standards | 35% | 65% |
| Process mapping policy | 35% | 65% |
| Data dictionary standards | 35% | 65% |
| Data maintenance policy | 45% | 55% |

Availability of policies and standards in support of Disaster Risk Management

| Policy/Standards for DRM | Available | Unavailable |
|---|-----------|-------------|
| Hazard mapping policy/regulations | 55% | 45% |
| Vulnerability assessment policy/regulations | 45% | 55% |
| Damage assessment policy/methods | 75% | 25% |
| Disaster management plan | 100% | |
| Disaster mitigation plan | 75% | 25% |
| Evacuation management plan/policy | 75% | 25% |
| Contingency planning and policy | 55% | 45% |

Technological Environment

- Investment in geospatial technologies is a major financial outlay that some Caribbean States are unable to finance from their regular national budget.
- Many member countries rely on regional or international projects to augment their aging technologies.
- The segregated institutional environment and the protection of Departmental owned technologies has closed its doors to the notion of community use of available technologies.
- Geospatial technologies like GNSS and Drones are protected from shared use
- With the exception of Jamaica, Trinidad and Tobago, The Bahamas, and Barbados, most DRM Agencies in the region do not have dedicated geospatial technologies of their own but rely on the goodwill of other agencies to develop geospatial products and services.
- Access to technical support is mostly on an informal or on a project basis.
- Only 25% of the countries surveyed so far have budget for technical support and with an average annual budget of \$6,000 UDS for the acquisition of hardware and software.
- Access to software is generally not a problem except the lack of funding for upgrade
- The use of open-source software is gaining grounds

Issues with data and database management

- Maintaining the database system and its datasets
- Updating and integrating databases
- Browsing and querying the database
- Obtaining reports from the database
- Importing or exporting data to or from the databases
- Need for scaling horizontally; instead of having a GIS server and database on one machine
- The Non-Spatial data is stored in Microsoft Excel

Human Capacity Environment

Training Needs Assessment

| Rating of knowledge on the use of the following Geospatial Technologies and Data for disaster risk management | Below average | Average | Fair | Good | Very good |
|---|---------------|---------|------|------|-----------|
| Knowledge of geographic information systems | 12% | 12% | 14% | 35% | 26% |
| Knowledge of spatial analysis tools | 14% | 17% | 22% | 29% | 16% |
| Knowledge of satellite remote sensing | 22% | 21% | 32% | 20% | 5% |
| Knowledge of global navigation satellite systems | 17% | 17% | 25% | 26% | 12% |
| Unmanned aerial vehicle (Drone technology) | 40% | 20% | 23% | 11% | 4% |
| Processing of satellite imageries | 33% | 23% | 25% | 11% | 8% |
| Database design and management | 23% | 25% | 21% | 20% | 11% |

Number of technical staff trained in the application of Geospatial Technologies

| Human Capacity | # of staff | | |
|--|------------|-----|-----|
| | 0 | 1-2 | 3-4 |
| Use of GIS software | 1 | 3 | 5 |
| Use of Remote Sensing software | 3 | 4 | 2 |
| Use of Spatial Database software | 2 | 4 | 3 |
| Use of GPS mapping equipment | 2 | 2 | 3 |
| Use of Drone mapping system | 3 | 6 | |
| Preparation of hazard maps | 1 | 6 | 1 |
| Vulnerability assessment | 1 | 3 | 5 |
| Creating orthophotos from raw satellite images | 7 | 1 | 1 |
| Georeferencing and mosaicking of images | 2 | 4 | 3 |
| Satellite image analysis | 3 | 4 | 2 |
| Satellite image classification | 4 | 4 | 1 |
| Performing raster to vector conversion | 1 | 6 | 2 |
| Processing of drone image to produce orthophoto maps | 5 | 4 | |
| GPS errors processing | 3 | 4 | 2 |
| Database design and management | 3 | 5 | 1 |
| GIS applications programming | 4 | 5 | |
| Metadata creation and management | 1 | 5 | 3 |
| Spatial data analysis and modelling | 2 | 5 | 2 |
| Map datum and map projections | 2 | 4 | 3 |
| Database integration and migration | 3 | 4 | 2 |

Constraints affecting staff capacity development

- a. Lack of budgetary allocation for capacity development
- b. Understaffing: where only one or two persons are available to be trained.
- c. Inadequate prerequisite qualifications to support advance learning.
- d. Lack of access to in- country training institutions
- e. High- cost of overseas training
- f. Unwillingness to release staff for training and education programmes that are more than 3 weeks in duration.
- g. High rate of staff mobility that affects the ability of the department to gain from its training investment.
- h. Senior managers are sometimes too busy to further their education.
- i. Inadequate succession planning.

It impacts the agencies' ability to:

- a. Generate geospatial technology products and services
- b. Ensure that their datasets are accurate and current
- c. Use the right tools for the right tasks
- d. Mainstream GST/D into the operations
- e. Deliver efficiently due to outsourcing of services

DRM Applications Environment

Hazard Vulnerability assessments

Hazard Mapping

Vulnerability Assessment

Disaster Risk Assessment

Land use/Land cover mapping

Critical facilities

Evacuation routes

Shelter mapping

Early warning mapping

New Flood Assessment

Geological hazard maps, micro- zonation/ seismicity study

Tracking systems for vehicles to support logistics

Risk assessments reports

Hydrographic maps and reports and apply to physical development

Webapps for infrastructure management, disaster management, spatial planning, utilities, meteorological dashboard, fire department dashboard, police dispatch viewer

Hazard impact reports, relief distribution reports, shelter management reports, etc

Frequency of Use of DRM products and Services

| | GST/D Products | More than 5 times a year | Often: 2-3 times a year | Occasionally: Only when triggers by an event | Never |
|----|--------------------------|--------------------------|-------------------------|--|-------|
| a. | Flood Hazard Map | 66.6% | | 33.3% | |
| a. | Landslides Hazard Map | 33.3% | 44.4% | | 22.2% |
| a. | Drought Hazard Map | 11.1% | | 55.5% | 33.3% |
| a. | Storm Surge Hazard Map | 33.3% | 22.2% | 33.3% | 11.1% |
| a. | Earthquake Hazard Map | 22.2% | | 44.4% | 33.3% |
| a. | Volcano Hazard Map | 11.1% | | 22.2% | 66.6% |
| a. | Land Use Map | 33.3% | 11.1% | 55.5% | |
| a. | Land Cover Map | 33.3% | 11.1% | 44.4% | 11.1% |
| a. | Vulnerability Assessment | 44.4% | 33.3% | 22.2% | |
| a. | Disaster Risk Assessment | 33.3% | 22.2% | 44.4% | |
| a. | Damage Assessment | 33.3% | | 66.6% | |
| a. | Critical Facilities Map | 33.3% | 33.3% | 33.3% | |
| a. | Evacuation Routes Map | 11.1% | 44.4% | 44.4% | |

Users

- **Office of Disaster Preparedness and Management, other state agencies, and NGOs**
- **Lands and Survey Department**
- **Town and Country Planning Department**
- **Physical Planning, NEMA, School Safety Teams**
- **Coastal Planner, Coastal Information Systems Manager, Research Officers, Data Technicians, Petroleum Officers, Geologists,**
- **Department heads, managers, GIS users, emergency operations staff**
- **DRM Stakeholders**
- **Staff and volunteers**

Uses

Vulnerability Assessments, Risk Assessments

Tsunami Evacuation Maps, Hazard Maps

Early Warning Analysis and Damage Assessments

Simulation exercises; Consideration for new development

Creation of Risk and Vulnerability Assessments Reports & Disaster Risk Reduction Plans

Situation Awareness and Database Development

Emergency operations

Development Planning, Disaster Risk Assessment, Pre-Event Planning

Assist in Development and risk reduction

Sensitization of the public and stakeholders, for planning of exercises and development of emergency plans for both businesses and families.

Respond to or prepare for the threat of an impending hazard (eg. tropical cyclones)

Mitigation planning.

Preparation and assessment hazard

Hazard impact assessments and monitoring

Logistics, reporting, project planning and reporting, etc

SWOT Analysis

Strengths

- a. Staff are motivated and resourceful in working around challenges**
- b. There is willingness to learn and strong informal inter- agency collaboration.**
- c. High level political support in some countries**
- d. Ability to attract external funding and technical support**
- e. Access to GIS software, computers, some data, and trained in-house geospatial resource personnel**

SWOT Analysis

Weaknesses

- a. Lack of inter- agency collaboration**
- b. Lack of data**
- c. Budget limitations**
- d. Not enough trained GIS staff to mainstream the use of GIS in all sectors**
- e. Limitations in the skillset needed for the application of GST/D in DRM**
- f. Lack of training in interpreting data**
- g. Absence of agency managers with sufficient knowledge in GIS**
- h. Political instability due to frequent changes in government**
- i. Department heads change frequently**
- j. Lack of dedication**
- k. Inadequate hardware and software**
- l. Collaborating with the disaster Coordinator who needs training as well**
- m. Lack of policy that makes geospatial technology the basis for DRM.**

SWOT Analysis

Opportunities

- a. Application of new tools such as Computer tablets and drones, use of different displays to show geospatial data
- b. Access to regional programmes and knowledge sharing initiatives
- c. Increase in demand for geospatial data in disaster risk management, planned trainings for emergency response agencies in hazard map interpretation.
- d. World bank trust fund, new lidar datasets, possibility of expanding GIS function, more cross collaborations with utilities / fire / police / telecommunications, training with Lidar contractor
- e. Visual analysis of weather patterns
- f. Real-time access to data
- g. Easier to read and analyse data
- h. Better Understanding of weather and landscape
- i. Enhance quality of data for analysis
- j. Existence of basic skills among staff and volunteers, availability of basic equipment of support usage, potential partners who can offer support for capacity building

SWOT Analysis

Threats

- a. Lack of inter-agency collaboration
- b. Lack of consistent datasets
- c. Budgetary constraints: there is a lack of financial funding needed to implement GIS projects, and collect new and update current data
- d. Limited human resource, skill set of staff
- e. Political instability
- f. Political will on all levels i.e., ministerial/secretary general/ department head
- g. Demotivation; as seen mainly among aged staff
- h. Unwillingness to embrace the technological advancements that support GIS applications.
- i. E- government threatens personnel's ability to accept the evolution of ICT solutions within DRM; it is found that employees are more receptive to face- to- face training.
- j. Theft
- k. Has to wait on another country for confirmation of emergency advisories
- l. The absence of a dedicated Geospatial unit
- m. Lack of training for the technical officers in the use of the technology
- n. The lack of a policy that requires the use of Geospatial technology to be a part of the core operation of the Corporation

Challenges

| Challenges | Yes % | No % |
|---|-------|------|
| Inaccuracy of data | 35% | 65% |
| Low spatial resolution of data (More than 1:25,000) | 35% | 65% |
| Very old dataset (more than 5 years old in urban areas) | 65% | 35% |
| Incomplete dataset (lack national coverage) | 65% | 35% |
| Lacks relevant attribute data for spatial analysis | 75% | 25% |
| Data not available in digital format | 65% | 35% |
| Lack of metadata | 75% | 25% |
| Data not freely available (must be purchased) | 35% | 65% |
| Map projection issues | 35% | 65% |
| Geodetic reference datum issues | 35% | 65% |

Some Recommendations

- a. **Creation of MOUs between agencies to share data, increased funding at ministerial level**
- b. **To allocate additional funding for GIS software and training.**
- c. **Allocate budget to development of skill set**
- d. **Allocate budget to procurement of equipment**
- e. **Increase number of staff responsible for geospatial analysis.**
- f. **The upgrading of computer systems to accommodate such technologies**
- g. **The promotion of greater inter-agency collaboration relative to data sharing to improve the national and regional databases**
- h. **Establish the NSDI framework**
- i. **Training of staff in the value, use and benefits of Geospatial Technologies**
- j. **Share the value and use of the equipment to the agency superiors**
- k. **Conduct for a needs assessment to understand the best suited systems for the agency**
- l. **Capacity building programme (iterative)**
- m. **Development and implementation of a Geospatial policy to support data maintenance, and data sharing**

Thank you!

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