



# Catalyzing Innovation

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## UN INTEGRATED GEOSPATIAL INFORMATION FRAMEWORK TOWARDS ACHIEVING THE 2030 AGENDA – FROM GLOBAL TO NATIONAL. GUYANA EXPERIENCE

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**Abstract**



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In August 2018, the United Nations endorsed an Integrated Geospatial Information Framework (IGIF), which provides a strategic guidance that enables country specific action plans to be prepared and implemented. The Cooperative Republic of Guyana is one of the first countries in the world, which is taking action to align its national policy on geospatial information management to the newly endorsed UN Integrated Geospatial Information Framework and to develop an Action Plan that can serve as an example to other countries and regions. The Guyana Lands and Surveys Commission in cooperation with the FAO will present how the IGIF coupled with an SDI Analysis methodology developed by the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), World Bank and FAO is being applied in Guyana to help rapidly accelerate delivery of a fit for purpose infrastructure.

**Key Words:** Integrated Geospatial Information Framework, NSDI, SDI, Geospatial information



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## I. Preface

The world is experiencing a fourth industrial revolution as we transition to what is dubbed the information age. This revolution is built upon the internet and an infrastructure of fundamental datasets. The term infrastructure is used here in the same sense as the road network is part of the fundamental infrastructure required to support transportation.

To help achieve this transition, many countries are building national data infrastructures. For instance, the United Kingdom has recently recognised that integrating authoritative key data registers into a coherent data infrastructure will, not only make Government more cost-effective, but also the interaction for citizens and businesses with Government quicker and more efficient<sup>1</sup>.

One of the primary components of a data infrastructure is the location of a nation's assets including land, natural resources, the built environment; the results of high impact processes such as climate change and urban planning; and events, such as flooding. This is because "everything happens somewhere" and without knowledge of location (or spatial position) decision making on many matters of national importance is significantly impaired. We use the term National Spatial Data Infrastructure (NSDI) as a short hand for the policy, capacity building, technical and economic activities necessary to create the required location (spatial) information to underpin social and economic development.

In August 2018, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) endorsed an Integrated Geospatial Information Framework (IGIF), which provides the strategic guidance that enables country specific action plans to be prepared and implemented. Direct benefits will include encapsulating new and innovative approaches to national geospatial information management, implementing integrated evidence based decision-making solutions, and maximizing and leveraging national information systems that are tailored to individual country's situations and circumstances.

The Framework aims to assist countries to move towards e-economies, e-service and e-commerce to improve services to citizens, build capacity for using geospatial technology, enhance informed government decision making processes, facilitate private sector development, take practical actions to achieve a digital transformation, and to bridge the geospatial digital divide in the implementation of national strategic priorities and the 2030 Agenda for Sustainable Development.

The Integrated Geospatial Information Framework comprises of three (3) parts as separate, but connected, documents:

- Part 1: Overarching Strategic Framework presents a forward-looking Framework built on national needs and circumstances, focusing on policy, perspectives and elements of geospatial information. It sets the context of 'why' geospatial information management is a critical element of national social, economic and environmental development.
- Part 2: Implementation Guide is the detail document that provides the 'what', the specific guidance and actions to be taken in implementing the Framework. The aim is to provide guidance for governments to establish 'nationally' integrated geospatial information frameworks in such a way that transformational, albeit staged, change is enabled, visible and sustainable.
- Part 3: Country-level Action Plans will provide templates and guides to operationalize the Framework in a national and sub-national context. Providing the 'how, when and who' approach, this document

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<sup>1</sup> <https://gds.blog.gov.uk/2015/11/03/making-data-a-public-asset-through-infrastructure/>



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will assist countries to prepare and implement their own country-level Action Plans taking into consideration national circumstances and priorities.

This paper presents Guyana’s Action Plan, which is based on the IGIF, for development of a National Spatial Data Infrastructure (NSDI) over a 5-year period and outlines its socio-economic benefits.

## Integrated Geospatial Information Framework (IGIF)

The IGIF is anchored by nine strategic pathways within three main areas of influence: governance; technology; and people. These nine strategic pathways seek to maximize the innovative and integral nature of geospatial information by making it available and accessible to governments, communities, businesses, academia, and civil societies. This provision serves to innovate, co-create and develop new products, services, and applications that deliver new knowledge for evidence-based policy and decision-making.

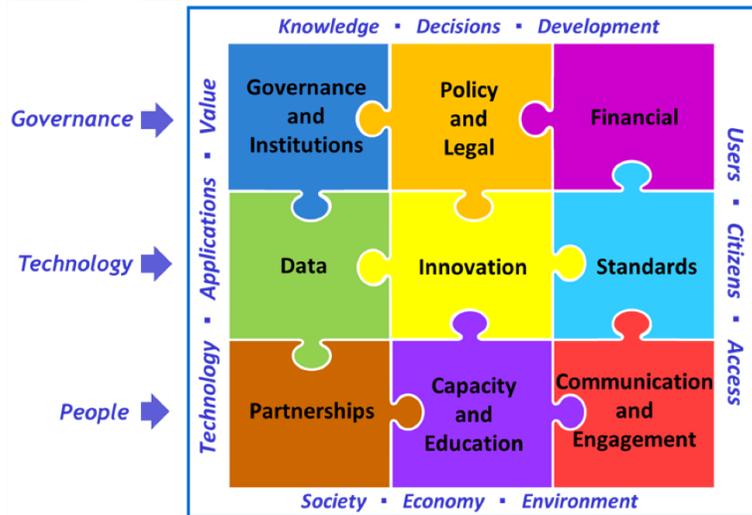


Fig. 1. Integrated Geospatial Information Framework

## II. Guyana Context

The Action Plan of Cooperative Republic of Guyana is created in accordance with the UN-GGIM Integrated Geospatial Information Framework, its principles and methodologies. The Framework has been developed in a shared UN-GGIM – World Bank project and was endorsed by UN-GGIM in August 2018.

The Cooperative Republic of Guyana are engaged in a project, administered by the Food and Agriculture Organization (FAO), titled Mainstreaming Sustainable Land Development and Management (SLDM). Within this project, the need for a set of activities to define an Action Plan for developing a supporting infrastructure of geospatial information was identified. This is referred to throughout this paper as a National Spatial Data Infrastructure (NSDI)<sup>2</sup>. An NSDI can be described as the policy, capacity building, technical and economic activities necessary to create and sustain the required spatial information to underpin National social and economic development.

### Geospatial Information in Guyana

Geographical Information Systems (GIS) have been in use in Guyana for decades for managing and analyzing spatial data on land resources/use status and trends by many sectors. However, it is widely recognized that the country has not built an infrastructure but a series of disconnected “silos” of

<sup>2</sup> The terms spatial, geospatial and geographical are used interchangeably in this document to refer to data and information having an implicit or explicit association with a location relative to the Earth (ISO/TC211).



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Information. There has been a lack of “institutional interoperability” most notably manifest in the reluctance to share information with impacts on capacity of various actors to make informed land administration, management and investment decisions.

Notwithstanding the above, several private and governmental entities have steadily increased their use of GIS technologies. In this respect, the Guyana Lands and Surveys Commission (GLSC), Guyana Geology and Mines Commission (GGMC), Guyana Forestry Commission (GFC), Environmental Protection Agency (EPA), National Drainage and Irrigation Agency (NDIA), Ministry of Natural Resources (MNR), Department of Environment (DoE), Central Housing and Planning Authority (CHPA), Guyana Power and Light (GPL), Guyana Water Inc. (GWI) and Exxon are among the more advanced entities. This reflects a pattern seen in many other countries where central government, natural resources and utilities (water and electricity) have significant business critical reasons to be able to locate their assets in support of internal decision making and operational management. The surprising omission from this list is local government, often one of the earliest adopters of GIS technology, but in Guyana largely still operating in a paper-based environment.

The need for improved data sharing and the creation of a spatial data infrastructure at a national level has been recognized for many years. The first draft of a national policy on Geospatial Information (GI) was prepared in 2012. It was approved by Cabinet in January 2015, however, Parliament was subsequently prorogued<sup>3</sup> and the implementation aspects were never realised.

There are a number of current initiatives that will, as a byproduct, deliver geospatial information useful to the developing NSDI. These include:

- Environmental Information Management and Monitoring System (EIMMS) – led by Department of Environment (DoE) and funded by the Inter-American Development Bank (IDB);
- Improved Property Valuation – led by the Ministry of Communities (MoC) and the Ministry of Finance (MoF) and funded by IDB;
- 3D City model for Georgetown (Central Housing and Planning Authority / IDB);
- Large scale LiDAR 3D survey data – ExxonMobil-funded work being undertaken by Fugro;
- High accuracy Digital Elevation Model – led by Hydromet (Ministry of Agriculture) in collaboration with the International Center for Environmental Monitoring (CIMA), University of Savona, Italy;
- Re-establishment of Continuously Operating Reference Station (CORS) network, being undertaken by GLSC with the support on the Ordnance Survey (GB);
- Revision of Nautical charts in the approach to the port of Georgetown and equipping of a survey vessel, being undertaken by the United Kingdom Hydrographic Office (UKHO) in collaboration with the Maritime Administration Department (MARAD) under the Commonwealth Marine Economies Programme<sup>4</sup>

**A primary recommendation of the study is that these various initiatives are better coordinated to avoid overlap and unnecessary duplication of effort.**

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<sup>3</sup> Prorogued (def): discontinue a session of (a parliament or other legislative assembly) without dissolving it.

<sup>4</sup> Commonwealth Marine Economies Programme (CEMS):

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/568361/CME\\_Programme\\_Factsheet\\_FINAL.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/568361/CME_Programme_Factsheet_FINAL.pdf)



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## III. Methodology used for the development of the Action Plan

The graphic below illustrates the relationship of the analytical tools used to arrive at the Action Plan. The symbology shows the analytical tools (in orange), key inputs (in blue) and outcomes (in green).

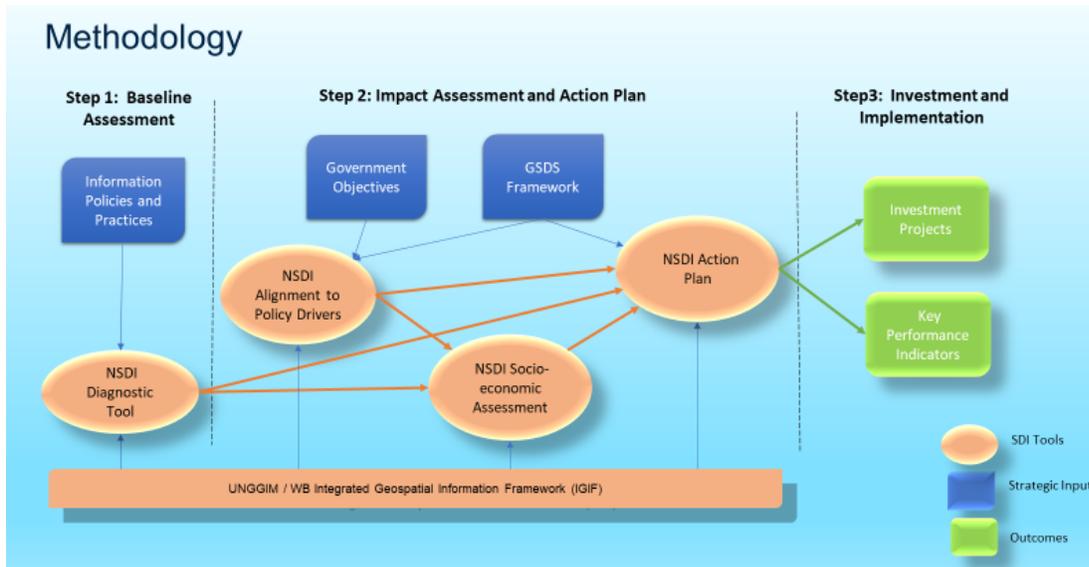


Fig. 2. Methodology for development of an Action Plan in line with the IGIF

Summarizing, this methodology has been applied as follows:

### Step 1: Baseline Assessment

A single integrated tool is used for this purpose:

**Analytical Tool 1 - NSDI Current State Diagnostic:** this provides an assessment of the “as is” position of geospatial information and spatial infrastructure in the country including policy, financial, human capacity and technical perspectives.

### Step 2: Impact Assessment and Action Plan

Three tools are used to build a prioritized, cost-justified roadmap for the NSDI:

**Analytical Tool 2.1 - NSDI Alignment to Government Policy Drivers:** this tool is used to relate Government’s strategic objectives and international commitments to specific spatial use cases and prioritize them based on how they support and accelerate achieving these objectives.

**Analytical Tool 2.2 - NSDI Socio-economic Analysis:** this tool delivers an assessment of the economic business case for investment in SDI from both qualitative and quantitative perspectives. It is informed by the outputs of the two tools outlined above.

**Analytical Tool 2.3 - NSDI Action Plan:** builds on the previous deliverables to create a costed roadmap for SDI enhancements, presented as a series of interdependent policy interventions and implementation projects. This report is the output from this analytical tool.

### Step 3: Investment and Implementation



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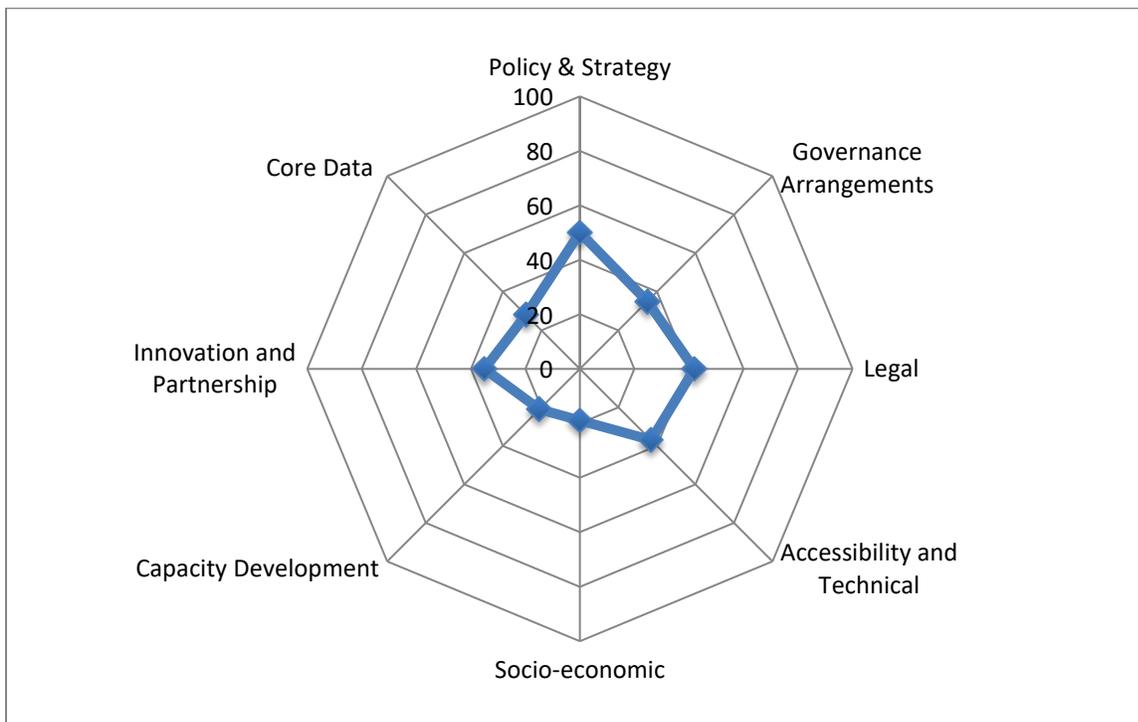


Once the Action Plan is approved in terms of scope and priorities, then work will commence to identify sources of funding, commencing with the SLDM program itself. Individual actions will also need to be specified in greater detail to support implementation and Key Performance Indicators (KPIs) defined.

## IV. Baseline Assessment

A detailed assessment of the current state of NSDI in Guyana was conducted using what is referred to as the Diagnostic Tool. The diagnostic questionnaire was completed after interviews with over 30 different stakeholders including both suppliers and users of geospatial information.

The results reflect an NSDI that is in the early stages of creation, they are graphically represented in the “spider diagram” shown as *Fig* below. The scales represent assessment of the degree to which indicators of geospatial maturity have currently been achieved, expressed as a percentage. Maximum score for each topic is 100. Eight different perspectives are represented by values plotted against separate axes. The value for each axis is a mean score for the indicators under that heading. For full details the reader should refer to the package of deliverables and a set of three outputs under the heading of Current State Diagnostic.



*Fig. 3: Summary of Current State Diagnostic*

The narrative report produced from the questionnaire results highlights the following key points.

**The main strengths** in the current situation, although the scores are still low, can be seen in:



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i) Policy and Strategy: scored relatively high because the draft geospatial policy exists in draft and is close to approval. There are also some encouraging stakeholder engagement initiatives, although not formalized. Further, open data is considered within the NSDI policy, although it is not yet clear whether it will be implemented.

ii) Legal component: scored relatively well due to the existence of the necessary underpinning laws. The stated policy of the NDMA supports accessibility of digital data if it is accessible in paper form.

## **The main weaknesses are:**

i) Education/capacity building: Guyana has insufficient staff capacities and skills to support the creation and maintenance of a sustainable NSDI system. There are also only limited formal education and training plans and programs for providing a rapid injection of suitably qualified staff. Knowledge on the benefits of an NSDI is increasing, however it is still at a low level in user organisations.

ii) Socio-economic/financial: is scored low mainly because the business model for geospatial information for Guyana is not clear, yet crucial for incentivizing investment. However, an analysis of socio-economic benefits and the return of the investments in NSDI activities is part of this study for which some credit is given.

iii) Core Data: is scored low due to the limited and uncoordinated digitization of fundamental datasets, and low level of automation of business processes.

## **V. Strategic Alignment with Government Policy Drivers**

The following key themes are identified as those where the NSDI use cases can have the most significant impact on national and departmental objectives:

- Green State and Low Carbon Development – Guyana’s overarching development framework;
- Sustainable Land Management
- E-Government
- Sustainable Development Goals
- Climate Change and Disaster Risks Management
- Environmental Management
- Enhancing Human Capacity
- Managing Economic Growth

Each task in the Action plan is tied back to one or more use cases identified by the strategic alignment analysis to clearly demonstrate the national importance of the NSDI.

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## NSDI Vision and Mission

Emulating the vision and mission for NSDI set out in IGIF, we offer the following:

*The vision for the NSDI is to deliver optimal use of geospatial information within Guyana to effectively measure, analyze, monitor and achieve sustainable social, economic and environmental development – leaving no one behind.*

*Its mission is to promote and support innovation and provide the leadership, coordination and standards necessary to deliver integrated geospatial information that can be leveraged in sustainable development solutions.*

## Goals: What will NSDI success look like?

This vision will be delivered by achieving the following practical goals:

- An agreed Geospatial Policy (mandate to move forward)
- Effective high-level coordination group with wide stakeholder involvement
- Implemented data sharing agreements between the main suppliers of fundamental geospatial data
- A distributed architecture-based NSDI system of federated systems
- Up to date topographic base map
- Fixed cadastre based on the National Geodetic Reference Frame (prioritised regional program)
- New land management computer system based on streamlined business processes
- Single National Address Database
- Upgraded National Gazetteer (including Point of Interest)
- Statistical and marine information integrated with other fundamental data themes (including land use data)

Supported by

Enhanced human capacity with skills and knowledge to sustainably support the NSDI

Outreach to promote on-going collaboration between stakeholders

## VI. Socioeconomic and Environmental Benefits

A wide range of potential strategic and quantifiable economic benefits have been identified, in short these include:

### Economic

- Increased rate of granting leases to state land, leading to higher Government rental income
- Cost savings in transport, energy and coastal defenses design and construction
- Improved billing rates for utilities
- Land market growth – reduced threat of development of a shadow (unregulated) market
- Increase revenue from forestry and mining concessions
- Improved agricultural production
- Reduced Data Procurement Costs
- Enhanced Support for Aviation Industry in Drone management



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## Societal

- Additional jobs and economic growth from new software products and services
- Reduced numbers of Land and Property-related Court Cases
- Improved water services through better planning and lower costs of maintenance
- Improved Sustainable Development Goal (SDG) reporting
- Enhanced preparedness and response for flood and other disaster risks

## Environmental

- Smarter and more sustainable Urban Development Planning and agricultural land use
- Better support for Climate Change Adaption
- Reduced rates of land degradation
- Improved control of aquifer pollution from mining

## Socio-economic Impact Assessment

The implementation of the action plan will require an indicative level of investment of US\$7.8m over a 5-year period. The quantitative analysis using a cost-benefit approach indicates, for the mean case, a Net Present Value (NPV) of approximately US\$13m million and a benefit-cost ratio (BCR) of 2.7, indicating the economic feasibility of the project. The Internal Rate of Return (IRR) is 26%. However, the results of the cost-benefit analysis almost certainly under-estimate the total value of the NSDI investment as some market benefits were not able to be quantified for lack access to information, often because the data had not been collected in a suitable form or was confidential and not able to be released. These could reasonably have been expected to increase the estimated return on investment.

## VII. Summary of the Action Plan

The Action plan sets out just over 30 key tasks grouped according to the nine IGIF strategic pathways and addressing 15 fundamental data themes. The individual tasks are summarized below:

### Strategic Pathway 1: Governance and Institutions

- Ministerial approval of the National Geospatial Policy
- Establishing a high-level Geospatial Advisory Committee (GAC) to coordinate NSDI development through wide stakeholder representation across public, private and academic sectors.
- Forming working groups to implement the priority initiatives to underpin the practical delivery of the NSDI

### Strategic Pathway 2: Policy and Legal

- Update Guyana Lands and Surveys Commission Act (1999) – to reflect current trends in future process and practice.
- Agree Template Data Sharing Agreement
- Develop NSDI Regulations to support Geospatial Policy
- Participate in Development of Data Protection and Licensing legislation

### Strategic Pathway 3: Finance

- Develop and Package Investment Proposals for activities beyond the SLDM project scope.



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- Develop long-term GLSC Business model that incorporates support for its role in coordinating work on the NSDI.

## Strategic Pathway 4: Data

*This strategic pathway includes most of the core technical implementation activities.*

- Create National Discovery Portal – an online accessible inventory of available geospatial data
- Rationalize State Land Leasing process – coordination of cadastral parcels is a key part of this activity.
- National Access to Satellite Imagery
- National Topographic Basemap production and maintenance – at “fit for purpose” scale.
- Single National Street Address Database – removing huge current duplicated effort
- High accuracy National Digital Elevation Model
- Geostatistical integration – in support of SDG achievement and reporting
- Marine and Terrestrial SDI Integration
- Hardware, Network and Software to support these implementations

## Strategic Pathway 5: Innovation

- Form Guyana Geospatial Centre of Excellence – GLSC in collaboration with other stakeholders

## Strategic Pathway 6: Standards

- Develop and implement standards and guidelines to support the implementation activities

## Strategic Pathway 7: Partnerships

- Define Scope of partnerships with key international NSDI organizations
- Formalize arrangements for gaining access to oil and gas industry geospatial data
- Strengthen international collaboration
- Support creation of Guyana Association for Geospatial Information

## Strategic Pathway 8: Capacity and Education

- Consolidate National Geospatial and Land Administration capabilities at Tertiary level – in conjunction with University of Guyana and other academic institutions
- Update geospatial information teaching in the school curriculum working through the Ministry of Education
- Foster growth of private sector through supporting Geospatial Entrepreneurship

## Strategic Pathway 9: Communication and Engagement

- Create Outreach group to lead communication with stakeholders and promote NSDI
- Develop Monitoring and Evaluation Framework – to show cost effectiveness and how the benefits of NSDI are being realized and identify areas for attention in the road map.



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## VIII. Conclusions and Lessons Learned

The methodology adopted worked well.

Wide stakeholder engagement during the diagnostic of the current situation was critical in enabling the project team to gain an understanding the national situation that would have been extremely difficult, if not impossible, to achieve without in-country visits.

The specific assessment of how geospatial might optimally assist meeting Government and International policy objectives helped to focus discussion with senior decision makers.

The socio-economic analysis was important for guiding the selection of priorities for investment. It was hampered to some extent by lack of national data, necessitating substantial reliance on benefits transfer using evidence from global and other comparable studies. This work will also help creation of the business case for NSDI, so important to underpinning discussion with politicians and funding agencies.

The proposed NSDI action plan is a useful draft for elaboration in the next stage of the project. In particular, identification of “quick wins” capable of completion within the first year will help build confidence. In addition, the draft implementation plan gives a starting point for the incoming project delivery team.

As one of the first practical tests of the GGIM Integrated Geospatial Information Framework (IGIF), hopefully this work will provide useful input to refinement of the framework.

Last but not least, the level of support needed and, in this case provided, by the host country public and private sector has been essential to the success of this work. It should not be under-estimated how important high-level champions are to long-term initiatives such as NSDI creation.