HIGH LEVEL FORUM ON GLOBAL GEOSPATIAL MANAGEMENT INFORMATION

CONFERENCE ROOM PAPER NO. 3

First Forum
Seoul, Republic of Korea, 24-26 October 2011

Country Report of Bahrain *

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National Spatial Data Infrastructure (NSDI)
For the Kingdom of Bahrain

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1. Introduction

The GIS Directorate of the Central Informatics Organization - CIO, Kingdom of Bahrain, in concordance of a Government Decree and directives of National GIS Steering Committee (NGISSC) officially implemented National Spatial Data Infrastructure (NSDI) at the national level, for the Kingdom of Bahrain, in February 2005. Bahrain Spatial Data Infrastructure (BSDI) Portal – is a manifestation of National Spatial Data Infrastructure (NSDI) to serve Government Organizations, Private Sectors and Academic Institutions of the Kingdom of Bahrain.

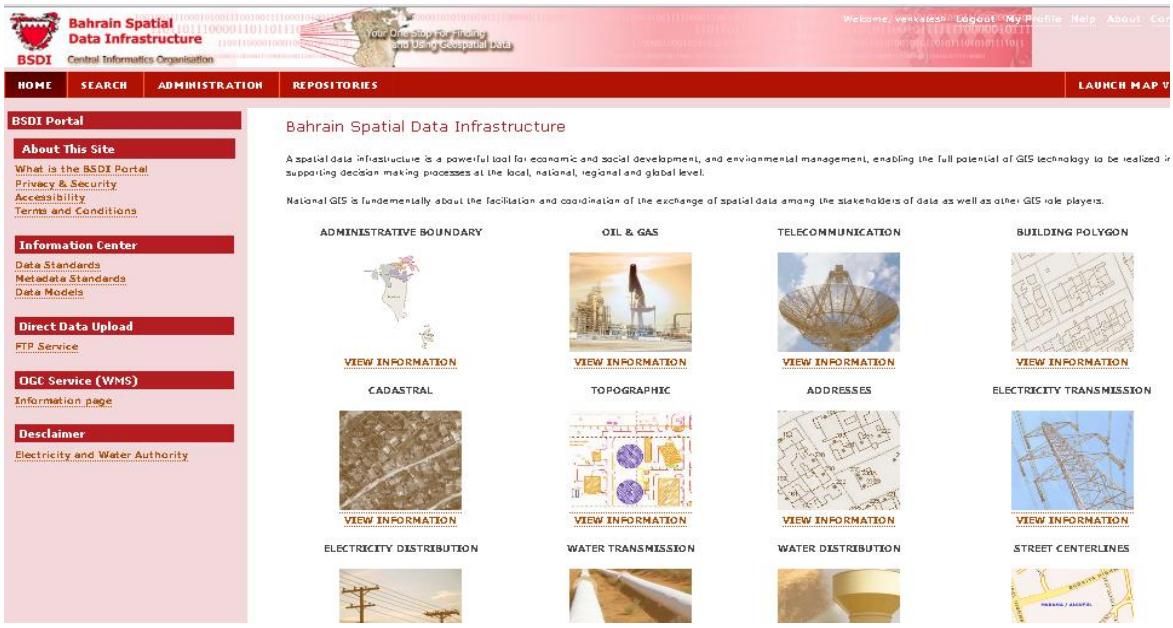
BSDI Portal operates on a GIS database of data layers containing important information such as Street Centerlines, Addresses, Electricity & Water Transmission and Distribution, Telecommunications Infrastructure, Gas & Oil Pipelines, Sewerage & Drainage, and others. Currently, more than thirty government and private organizations are benefiting from the portal of Bahrain Spatial Data Infrastructure (BSDI). These organizations include but are not limited to: Central Informatics Organization, Ministry of Municipalities Affairs & Agriculture, Electricity & Water Authority, Bahrain Telecommunications Company, Survey & land registration Bureau, Bahrain Petroleum Company, Ministry of Works, and Ministry of Housing.

In line with the implementation of BSDI Portal the National GIS steering committee (NGISSC) promotes the use of standards and policies (e.g. ISO, OGC, Inc.) around which the infrastructure is built. These have been successfully developed and adopted at the National level by geospatial data users. This includes metadata, data content, data classification, copyright, responsibilities etc. The NGISSC approved the adoption of Data Exchange policy which will ensure that management practices for fundamental spatial data are nationally consistent to achieve the benefits of the Bahrain Spatial Data Infrastructure. Moreover, it avoids wasteful duplication of resources and facilitates data integration. This has been nationally in practice by all stakeholders.

Some of BSDI Geospatial Data Layers

1	GAS INFRASTRUCTURE	10	DUCT INFRASTRUCTURE	24	DIGITAL ELEVATION MODEL
2	OIL INFRASTRUCTURE	12	JOINT BOXES AND MANHOLES	25	AERIAL PHOTOGRAPHY
3	SEWERAGE	13	ELECTRIC POLES	26	SPATIAL DATA VIDEO RECORDING
4	AGRICULTURE CLASSIFICATION	14	ELECTRICITY TRANSIMISSION	27	HEALTH SERVICES
5	STORM WATER DRAINAGE	15	ELECTRICITY DISTRIBUTION	28	PARKS & GARDENS
6	DEMOGRAPHIC DATA	16	WATER TRANSIMISSION	29	SPOT HEIGHTS
7	CADASTRAL MAPS	17	WATER DISTRIBUTION	30	DEMOGRAPHIC DATA
8	TOPOOGRAPHIC MAPS	18	ADMINSTRATIVE BOUNDARIES	31	TELECOMMUNICATION POLES
9	DRINAGE	19	ADDRESSES	32	HOUSING PROJECTS
		20	BUILDINGS	33	ZONING MAPS
		21	STREET CENTERLINES	34	COMMUNICATION DUCTS
		22	POINTS OF INTEREST	33	TELECOM TOWERS
		23	SATELLITE IMAGES		

One of the objects of BSDI initiative is to emphasize the concept of a single, consistent, accessible, government funded infrastructure as a basis for developing competitive, private sector, value adding services towards sustainable development.



The Interface-Bahrain Spatial Data Infrastructure Portal

2. Importance of National Spatial Data Infrastructure

National Spatial Data Infrastructure (NSDI) – is as an innovative endeavor in conformance to the policies of the Government of Bahrain, in effectively recognizing the significance of spatial information, to the planning, governance of the nation and provision of public services. NSDI provides a base or structure of practices and relationships among data producers and users that facilitate data sharing and use and it is also a set of actions and new ways of accessing, sharing and using geographic data that enables far more comprehensive analysis of data to help decision-makers chose the best course of action.

In addition Bahrain Spatial Data Infrastructure (BSDI) Portal is a powerful tool for economic and social development, and environmental management, enabling the full potential of GIS technology. It is structured as a network of databases throughout the Kingdom, which collectively provide the fundamental data required for achieving diversified national objectives like: socio-economic human resources, surveying and mapping, facilities management, demand for analysis and modeling to support resource management and planning, transportation, automation of land records, multipurpose cadastral, development and environmental mapping.

3. Objectives of Bahrain Spatial Data Infrastructure (BSDI) Portal

The implementation of BSDI Portal has resulted in substantial reduction in the cost of development of digital geospatial data, quick delivery of services, easy accessibility to geospatial data for the Government and general public. Owing to BSDI Portal easily available information will help the decision makers towards efficient planning and studies and coordination of government services. It also eliminates duplication of effort in the development and capture of geospatial layers.

BSDI aims towards facilitating and co-coordinating the exchange and sharing of spatial data among the stakeholders of Government and Private Sectors as well as other GIS role players in the Kingdom of Bahrain, thus creating an information highway and facilitating smooth transaction and integration of sophisticated geospatial data sets. Activities of BSDI are focused towards being used as an indispensable resource for decision-making across all sectors of business, industry and the community and also to help in the development of an innovative and competitive spatial data industry. BSDI represent the platform for leveraging the national investment in GIS technology and database by establishing a necessary framework of policies, partnerships, standards, data, procedures, technology and institutional capabilities that are needed to support more effective data sharing and utilization of Geographic Information (GI) in Kingdom of Bahrain.

As a future endeavor BSDI aims towards enabling the Kingdom of Bahrain to participate constructively in regional and global initiatives of spatial data infrastructures and, thereby, to assist countries in the region, in developing their economies. It is also aimed at providing a regional framework within which all existing arrangements can operate and which can provide the basis for future cooperation at the national, regional and global levels. The implementation of Bahrain Spatial Data Infrastructure (BSDI) aims at creating a fully integrated GIS system to be shared by a community of collaborating stakeholders in the Government and Public Sectors.

3.1 Specific Objectives of the BSDI

i) Make GIS available to improve the efficiency of ministries and public and private organizations.
ii) Create a Spatial Data Clearing House with a centralized data repository.
iii) Reduction in the cost of development of digital geospatial data.
iv) Quick delivery of services.
v) Easily accessible geospatial data for the government and general public.
vi) Easily available information to the decision makers for better planning and studies.
vii) Eliminate duplication of effort in the development and capture of geospatial layers.
viii) Efficient planning and coordination of government services.
ix) Facilitation and co-ordination of the exchange and sharing of spatial data among the stakeholders of data in Government and Private Sectors as well as other GIS role players in the Kingdom of |Bahrain.

x) Creating an information highway, facilitating smooth transaction and integration of sophisticated geospatial data sets.

xi) Development an innovative and competitive spatial data industry and be used as an indispensable resource for decision-making across all sectors of business, industry and the community.

xii) To establish regional and global spatial data infrastructures and, thereby, to assist countries in the region in developing their economies.

xiii) Use the Bahrain spatial data infrastructure (BSDI) frame work to leverage the national investment in GIS technology and database by establishing a necessary framework of policies, partnerships, standards, data, procedures, technology and institutional capabilities that are needed to support more effective data sharing and utilization of Geographic Information (GI) in Kingdom of Bahrain.

xiv) Provide a regional framework within which all existing arrangements can operate and which can provide the basis for future cooperation at the national, regional and global levels.

xv) Adoption of relevant international and national standards related to geographic information and the method of delivery through the BSDI. This ensures that spatial information is compatible with other datasets and enables use by other systems.

xvi) Use the implementation of Bahrain Spatial Data Infrastructure (BSDI) by creating a fully integrated GIS system to be shared by a community of collaborating stakeholders in the government and general public sectors.

3.2 Clearance System-Way Leave

The main objectives of BSDI Portal are to make GIS available hence improve the efficiency of Ministries and Public and Private Organizations. This is achieved by creating a Spatial Data Clearinghouse with the Way Leave Clearance System that performs as a centralized data repository; directing and supporting the development of integrated GIS systems.

Way Leave utility clearance management system effectively monitors and facilitates project requests and approval procedures online, using the Bahrain Spatial Data Infrastructure (BSDI) Portal. Currently, the Way Leave system helps the stakeholders to post a request for a Way Leave and obtain immediate approval. This is an advantageous system to bring about an informed decision making process by the stakeholders in the Government.

Clearance System-Way Leave

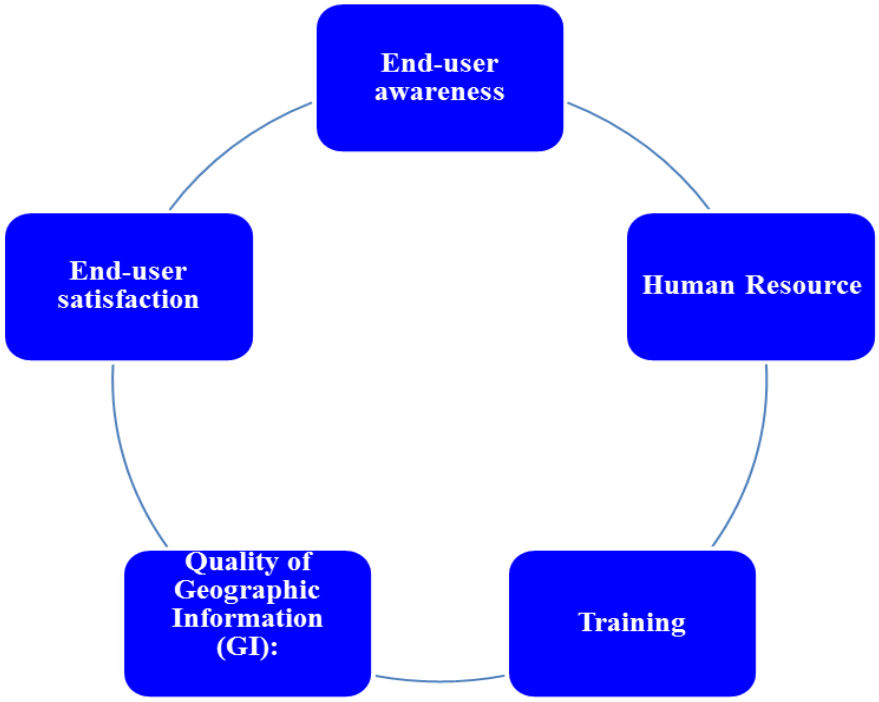
4. Key Performance Indicators- Bahrain Spatial Data Infrastructure (BSDI)

BSDI portal enables geospatial data layers mentioned above, to be accessed by the stakeholders and the users according to the stipulated data exchange policy and privileges pertaining to them, for the purpose of economic, social and environmental management and development. This facility of the BSDI Portal envisages the potential of geospatial technology to be realized in supporting decision- making processes at the Local, National, Regional (GCC) and Global levels.

Towards this end, a strategic plan had been developed for effective implementation of the Bahrain Spatial Data Infrastructure (BSDI). The plan included a phased development strategy to be coordinated by the CIO and overseen by the National GIS Steering Committee (NGISSC). Each phase comprised a series of "program components" around which resources assigned, and specific tasks and results accomplished. The phasing strategy described here is intended to represent the range of incremental considerations and dependencies that will be necessary for the implementation of the NSDI. These are also considered as the measuring yard sticks of performance levels of the BSDI Project. Hence, the success of all the KPIs is dependent on the statistics of categories of KPI's for BSDI

KPIS' of BSDI: the Five Level Components: End-user awareness, End-user satisfaction, Training, Human resource, Quality of Geographic Information (GI). Bahrain Spatial Data Infrastructure (BSDI) collects and maintains enormous amount of spatial data. However the information on availability of data is not available to the common users, thereby depriving the utility of this precious information at the right place at the

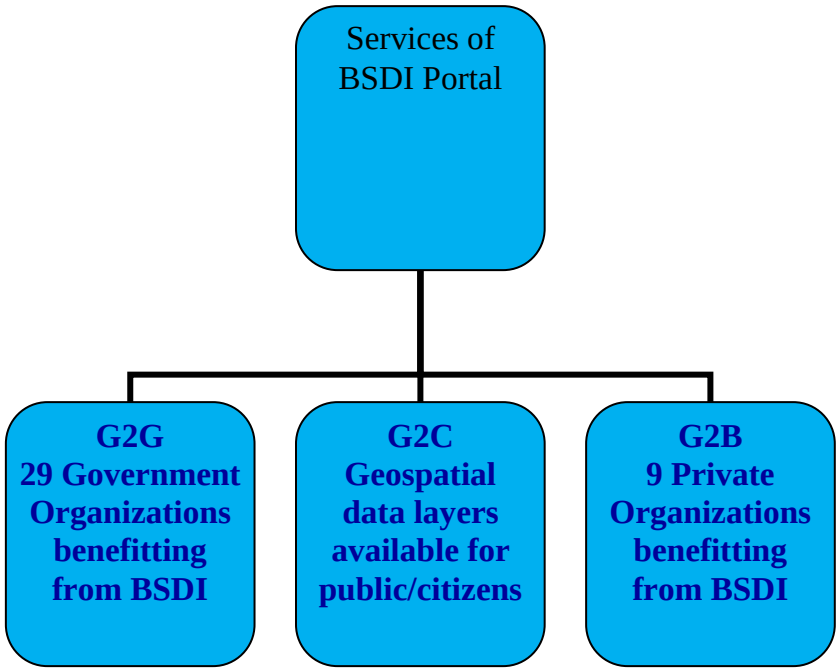
required time. The policies of BSDI envisage ensuring that spatial data generated is made available to the end user for developmental needs by the following procedures of end user awareness, satisfaction, training, communication management and maintaining quality of data.



The 5 KPI's of BSDI

5. BSDI Portal End users

Capitalization of three "Ps" Public; Private and Partnership: Bahrain Spatial Data Infrastructure (BSDI) Portal. Conforming to BSDI's initial initiatives of making GIS available to improve the efficiency of ministries and public and private organizations; creating a spatial data clearing house with a centralized data repository; directing and supporting the development of integrated GIS system; defining the priorities in the development of GIS databases and studying and evaluating GIS development proposals; proposing strategies and standards for GIS data exchange, following are few user benefits for all stakeholders:



BSDI-User Benefits

i) <u>Services of BSDI Portal: G2G</u>

BSDI portal is a powerful tool for economic and social development, and environmental management, enabling the full potential of GIS technology to be realized in supporting decision-making process at the local, national, regional, and global levels. Currently, more than twenty governmental and private authorities are benefiting from the portal. For Example: Survey & Land Registration Bureau (SLRB), Electricity and Water Authority (EWA), andMinistry of Works (MoW).

ii) <u>Services of BSDI Portal: G2C</u>

Example of data layers available to public/citizens for use:

- Street Centerlines
- Addresses
- Satellite Image
- Topographic
- Building polygons
- Administrative Boundaries

iii) <u>Services of BSDI Portal: G2B</u>

The BSDI portal supports private sector businesses by providing relevant data. E.g. cadastral information, street network, center lines, administrative boundaries and addresses. For example: Telecommunication companies and oil and gas industry are benefiting from the BSDI.

6. BSDI Portal a new approach to an existing problem and its success

6.1 Pre Implementation of BSDI

Status of Spatial Data in 1990s:

- Bahrain government's entities had invested heavily in GIS technology but lacked in centralization of data.
- Database had restricted distribution amongst the ministries and public and private organizations owing to cost of development – data creation and maintenance of digital geospatial data.
- Inaccessibility of geospatial data for general public.
- Duplication of effort in the development and capture of geospatial layers resulting in inefficient planning and coordination of government services and also non conformity of data standards.
- Standalone databases lacked in uniform standards of database management systems, quality assurance and quality control and data exchange policies.

6.1.1 Outcome of the Situation

- Lack of sustainable governance mechanism by all the parties leading to duplication of efforts.
- No coordination between custodians of data to ensure that components of the nation datasets are collected to consistent standards.
- No consultation amongst the community of users to determine specifications and problems.
- Access to the data was not provided in accordance with the policies determined for the countries spatial data infrastructure; and
- The Kingdom's data set did not conform to a set of standards that ensure that it could be combined with other components of the Kingdom's spatial data infrastructure to create value added products.
- Poor utilization of human and financial resources.
- Lack of Geospatial data standards resulting in bad services by Governmental organizations.
- Non-existence of data standards at National level.
- Absence of Geospatial data sharing and exchange.
- Non-existence of Kingdom-wide enterprise GIS.

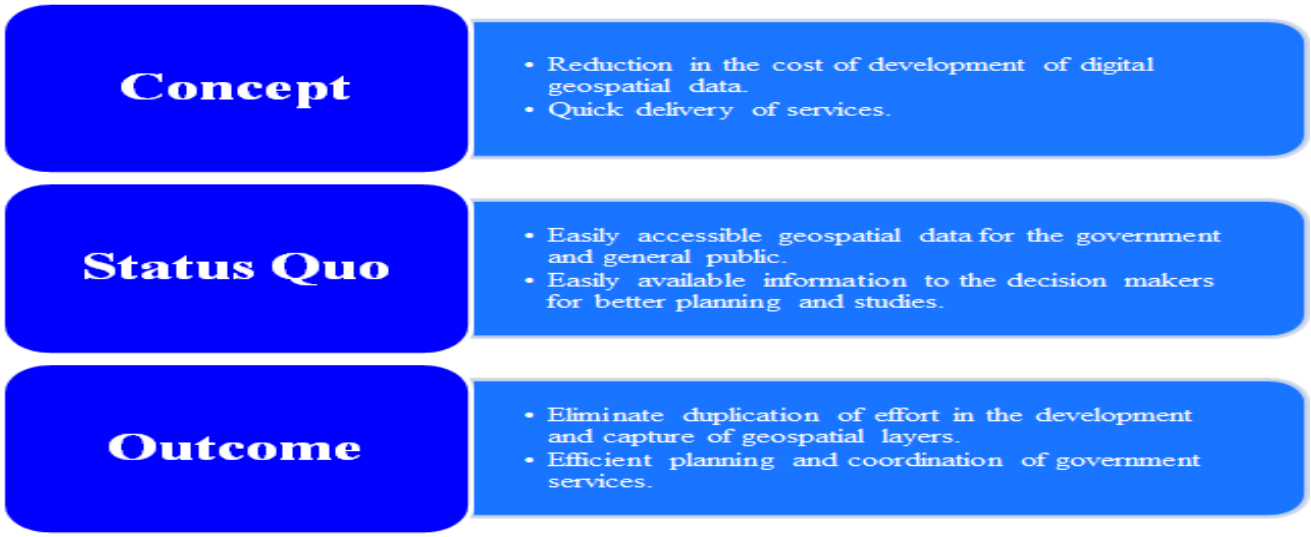
From the above, it was obvious that in the context of Bahrain, the fundamental datasets of the country were scattered in several locations. Although, the private sector plays an important role, most of the datasets were provided by Government agencies as part of their responsibilities to the society.

6.2 Post Implementation of BSDI

- This initiative makes it easier, faster, and less expensive for all levels of government and citizens to access geospatial information. Geospatial One-Stop (GOS) brings high-level visibility to the importance of geospatial information.
- From a policy perspective, it adds three unique benefits to the implementation of the BSDI. These include raising the visibility of the strategic value of geographic information, increasing Kingdom accountability for geospatial data stewardship, and establishing a collaborative model for an intergovernmental initiative.
- The priority status of the initiative also brings a sense of urgency to aggressive implementation. From a program perspective, GOS implements the basic elements of the BSDI by providing an Intranet portal (www.bsdi.gov.bh) to facilitate data sharing in favor of decision support and by encouraging partnerships across organizations and bodies at various levels.
- The final outcome was the development of fully functional clearinghouse accessible through the BSDI portal.

6.2.1 Centralization of Distribution of the Data:

- The Bahrain Spatial Data Infrastructure (BSDI) - GIS Directorate-Central Informatics Organization, Kingdom of Bahrain consists of individuals of coordinating agencies, both government and non-government, who generate or use a national spatial data resource, the technology that support its use.
- The development of SDTS which is the transfer standard approved to support the growth of the BSDI had helped immensely in overcoming various above mentioned short comings. It is flexible, extendable, modular, and developed in the spirit of an open GIS. It contains a living registry of defined spatial objects and entity terms, documented metadata, and a well-organized and structured online data dictionary.



Current Outcome – Bahrain Spatial Data Infrastructure (BSDI)

7. Productivity of BSDI Portal and ROI

Fiscal terms of policy and regulations for data costs and service fees of The Bahrain Spatial Data Infrastructure (BSDI) – GIS Directorate-Central Informatics Organization, Kingdom of Bahrain.

7.1 Lack of Productivity Pre implementation of BSDI

- 42 Government cells using GIS individually.
- Absence of data sharing and systems integration.
- Many data formats.
- No standards for: GIS software, procedures, applications, and spatial database.
- Isolated standalone systems.
- No integration amongst other systems.
- Mis-management of resources.
- Geo-spatial data is one example of waste and redundancy across government with different agencies using and each doing their own thing.

7.2 Increased Productivity Post implementation of BSDI:

- 75% reduction in time of service delivery to end-users
- 60% reduction in cost of data creation and maintenance
- Private sectors projects streamlined significantly
- More commitment of stakeholders and various levels.
- Move from Silo-based information into a corporate knowledge base
- Reduction in the Total Cost of Ownership of Technology.
- Enterprise Spatial Intelligence Platform.
- Significance Governance, Partnership, and Collaboration.
- Concurrent easy access to information.
- Reduction in the duplication.
- Help to analyze large catalogues of data.
- Facilitate the use and potential re-use of Geospatial data subject to prevailing data policies.

ROI - BSDI

8. Roles and Responsibilities of BSDI Portal towards a Future of Corporate GIS

With an appropriate growing interest in the adoption of the phenomenon of Cloud Computing the GIS Directorate [CIO] visualizes it as a technically sound process that is cost and time effective for open source application development and thematically processed satellite data. The Directorate is envisaging the role of Cloud Vendor to other Cloud Consumers in government and public organizations and private institutions under the auspices of the Bahraini Government's 2030 vision of further technical enhancement to ensure effective interoperability and integration in terms of geospatial data layers via the Bahrain Spatial Data Infrastructure (BSDI) Portal.

With the migration to the neo-geo-tech process of Cloud enterprising National SDI, the Directorate feels the need to evolve an open environment of cloud computing to

enterprise the geospatial data layers in the BSDI, as this venture is expected to substantially minimize the Government Cloud Vendor and Cloud Client (the stakeholders of BSDI portal) barricades and effectively widen their data access and choices.

GIS Directorate as Cloud Vendor of Geospatial layers