National Report of

Kingdom of Bahrain

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1. EXECUTIVE SUMMARY

The GIS Directorate of the Central Informatics Organization - CIO, Kingdom of Bahrain, in compliance to a Government Decree and directives of National GIS Steering Committee (NGISSC) officially implemented National Spatial Data Infrastructure (NSDI) for the Kingdom of Bahrain, in February 2005. **Bahrain Spatial Data Infrastructure (BSDI)** 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. BSDI provides a base or structure of practices and relationships among data producers and users that facilitate data sharing and use. 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. BSDI is considered as a major achievement of the National GIS Steering Committee with leadership being provided by GIS Directorate, CIO.

Over time the Kingdom of Bahrain has taken several progressive steps towards the implementation of Spatial Data Infrastructure in the country and has successfully achieved targeted milestones over the last 5 years. It includes Development of Bahrain Spatial Data Infrastructure Portal, Development of Data Exchange Policy and Data Standards. The GIS implementation has curtailed duplication of data creation and reduced the cost of Ownership of GIS technologies by various Govt. Organizations. The BSDI portal is a sort of "Enterprise Spatial Portal" which not only acts as a spatial catalogue portal, creating, maintaining and cataloguing metadata and data but also integrates spatial data with business enterprise solutions. It serves Government Agencies with Geospatial Intelligent Systems integrated with BSDI spatial data layers and organization business data assisting them to more effectively serve their respective customers. In achieving the targeted milestone, the GIS Directorate, CIO has also reached a level of maturity where spatial datasets are acquired and managed comprehensively and optimized strategically.

2. INTRODUCTION

As key role of spatial data has become increasingly recognized for planning, governance of nation and rendering public services, the government of Kingdom of Bahrain has established a National GIS Steering Committee (NGISSC) with GIS Directorate, Central Information Organisation (CIO) leading all the way, to coordinate the GIS efforts and integrate the spatial data resources of individual Ministries, Public Sector Agencies and Private Entities.

Based on a field survey of various Government sectors – economic and technological, it was revealed that 42 Government cells were using GIS individually. However there was no National framework within which existing arrangements can operate and which can provide the basis for future cooperation at the national, regional and global levels. There was absence of data sharing and systems integration. Different National organizations were using different data formats and further there were no standards for GIS software, procedures, applications, and spatial database. Owing to this scenario the outcome of the situation had resulted in lack of sustainable governance mechanism by all parties leading to duplication of efforts and no coordination between data custodians to ensure that components of the nation's datasets are collected to consistent standards. There was no consultation amongst the community of users to determine specifications and problems. This resulted in poor utilization of human and financial resources.

The GIS Directorate, CIO, which acts as a GIS Center for the Kingdom of Bahrain, in compliance to a Government Decree and directives of National GIS Steering Committee (NGISSC), officially implemented National Spatial Data Infrastructure (NSDI), for the Kingdom of Bahrain, in February 2005.

Bahrain Spatial Data Infrastructure (BSDI) 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. The initially conceived foundation system had been initiated to provide a framework of standards, policies, data procedures, technology and capable staff to facilitate, coordinate and support effective sharing and utilization of geospatial information in the Kingdom of Bahrain.

Bahrain Spatial Data Infrastructure (BSDI) Portal, a manifestation of NSDI is meant to fulfill the mandates of NGISSC and thereby NSDI. It is a Process-based initiative emphasizing partnerships, social networks, and multi-sectorial collaboration rather than just being product oriented. The portal operates on a GIS database of geospatial data layers such as Street Centerlines, Addresses, Electricity & Water Transmission and Distribution, Telecommunications Infrastructure, Gas & Oil Pipelines, Sewerage & Drainage, and others, serves Government Organizations, Private Sectors and Academic Institutions of the Kingdom of Bahrain. In fact, it acts as a **Geospatial One Stop Shop (GOSS)** whereby the participating stakeholders, both Government and Private, share and access Spatial Data, Map Services and other business process oriented applications. BSDI build with an infrastructure conforming to the stipulations of **ISO, OGC, Inc.** functions as a powerful tool for economic and social development and environmental management, enabling the full potential of GIS technology. BSDI portal facilitates and co-coordinates the exchange and sharing of spatial data among the stakeholders in Government, Business Sectors and Citizens (G2G; G2B and G2C), resulting in substantial reduction in the cost of development and arresting duplication of data. One of the objects of this project is to emphasize the concept of a single, consistent and accessible, government funded infrastructure as a basis for developing competitive and value adding services towards sustainable development.
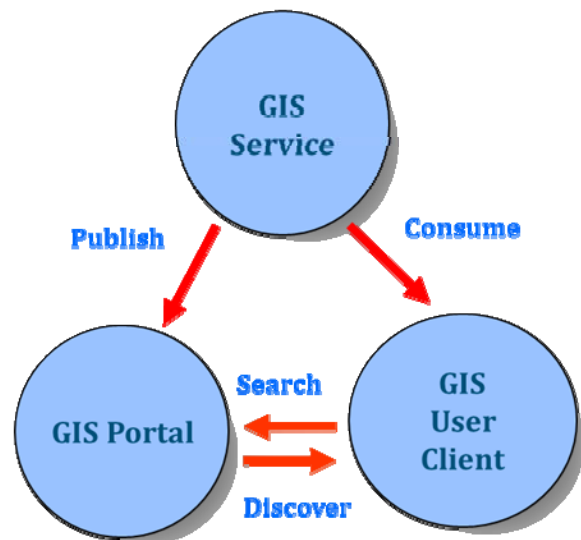
Since its initial implementation BSDI has undergone a rapid but natural evolution. Since early days of BSDI various seminars, workshops and capacity building programs has been conducted on a regular basis in raising the awareness and building the initial support for the initiative at multiple levels. 2009-2010 onward there has been a tremendous expansion of technical work force in the domain ready to take the advantage of the spatial infrastructure.
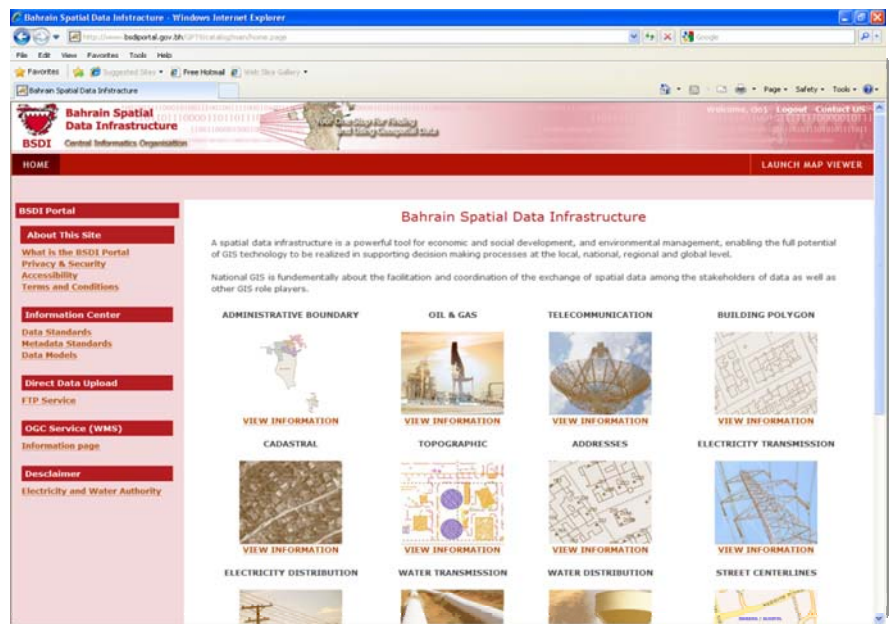

There has also been a steady growth of Stakeholder entity participation in the program which currently has crossed **42**. BSDI over the years has also seen the establishment of **Bahrain Data Standards** and formalization of **Bahrain Data Exchange Policy** and **Bahrain Data Exchange Agreement**. From the initial 40/50 data layers, there has been an expansion of data clearing house to over **157** data layers.

3. LEGAL AND POLICY FRAMEWORK

The government of Bahrain has long recognized the significance of spatial information to the planning, governance of the nation and provision of public services. This has resulted in the formation of the National GIS Steering Committee in compliance to the decree issued by the Prime Minister in the year 2004. The GIS Directorate, CIO at the helm of the initiative, with directives from NGISSC has taken several progressive steps towards the implementation of Spatial Data Infrastructure in the Kingdom to address the issues pertaining to geospatial data, standards, copy right, licensing, data liability, data security,

cost coordination and recovery. BSDI is aligned with the Kingdom's broader policies rather than just immediate problem solving and supports Bahrain 2030 vision in developing a world class infrastructure links to Bahrain Global economy. A strategic plan was developed with a purpose to "Implement Bahrain Spatial Data Infrastructure (BSDI) by creating the national GIS data clearinghouse and foster the development of a fully integrated GIS system".
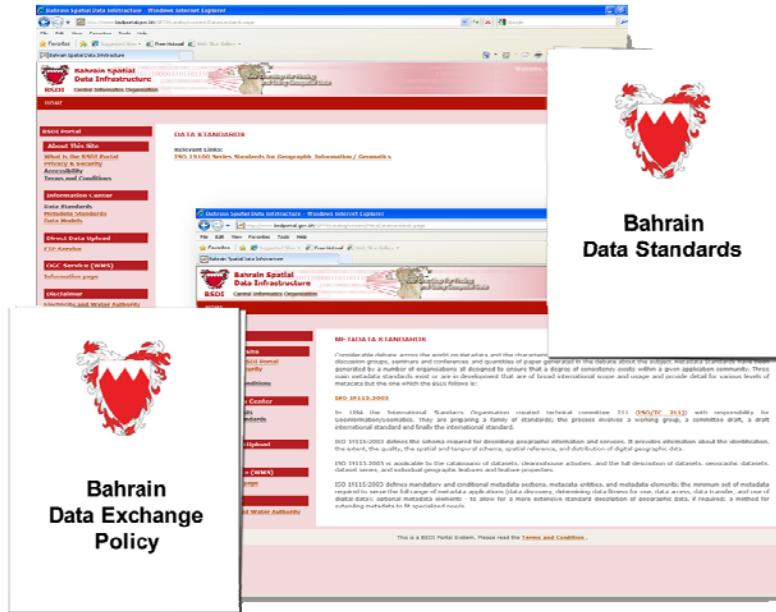
The following specific steps are being conducted:

- Prototype implementation
- Building on the Foundation
- Strengthening the Community

There is a significant level of co-dependencies among the components and tasks. These has been identified and reflected in the development of the plan refinement and an associated work breakdown structure (WBS).

A phased plan is conceived, as follows:

Phase 1 - Initiation (June 2004 to June 2005).

Phase 2 - Building on the Foundation (June 2005 to June 2007).

Phase 3 - Strengthening the Community (June 2007 to June 2009).

Phase 4 -   Creating a unified and integrated National Spatial Data Infrastructure (NSDI) that supports all Governmental and Non-Governmental bodies in Planning, Decision-making and day-to-day management (2009 – 2011).

Phase 5 -   Fully operational SDI database satisfying Public & Private Sector end users (2011 – 2012).

Phase 6 -   Increasing role of Private Sector in Geospatial domain (2012 – 2013).

Phase 7 -   Operational cost recovery (about 40%, 2013 – 2014).

Phase 8 -   New Bahraini citizens qualified graduates to supplement market needs in GIS (2014 – 2016).

The fundamental policies that has been documented in the **"Bahrain Data Exchange Policy"** and that relate to the access and distribution of Geospatial data for the Kingdom of Bahrain includes the following

- All geospatial stakeholders and users should have easy, efficient and equitable access to fundamental datasets through the BSDI portal where technology, data formats, institutional arrangements, location, costs and conditions do not inhibit its use.

- Highly specialized data of a sensitive or proprietary nature may not be made available to all stakeholders. It would be the responsibility of the Custodian to mention these details when sharing data. Sharing of these data may however be subjected to copyright and licensing restriction while distribution with prior consent from the Custodian.

- Data produced and shared by Government Organizations should be made available to all other Government Stakeholders free of charge. For Private entities requesting access to the kingdoms spatial datasets, a reasonable fee may be levied on data sharing.

- Commercial data including satellite images would be procured by CIO and would be provided free of charge to all Government Entities participating in BSDI. However a reasonable fee decided and approved by NGISS would be charged to private organizations that require access to these data.

4. INSTITUTIONAL ARRANGEMENTS

Various stakeholders both government and private entities have participated in the BSDI initiative either as Data Custodians or as Data Users. The Data Custodians has the basic responsibility to create, update and maintain their data as per the guidelines, standards, procedures and policies chartered in the BSDI initiative. The final data products are then shared with all other stakeholders through the CIO implemented BSDI portal which acts as an information highway, facilitating smooth transaction and integration of geospatial data sets and in turn facilitating and coordinating the exchange and sharing of spatial data among the stakeholders.

The various Stakeholders for the portal who act as a data custodian include the following:

1	Central Informatics Organization (CIO)	Government
2	Electricity & Water Authority (EWA)	Government
3	Survey & Land Registration Bureau (SLRB)	Government
4	Ministry of Works (MoW)	Government
5	Bahrain Telecommunications Company (BATELCO)	Private
6	Bahrain Petroleum (BAPCO)	Private

Apart from the above, the various organizations that actually are users and rely heavily on spatial information to delivery services to the citizens include but not limited to the following:

1. Crown Prince Office
2. Economic Development Board (EDB)
3. Ministry of Cabinet Affairs
4. Ministry of Education
5. Ministry of Health
6. Ministry of Labour

7. Ministry of Housing

8. Ministry of Interior

9. Ministry of Information

10. Ministry of Industry and Commerce

11. Ministry of Social Development

12. Ministry of Transportation

13. Public Commission for the Protection of Marine Resources, Environment and Wild Life (PMEW)

14. Bahrain Defense Force (BDF)

15. Bahrain National Guards

16. Bahrain Centre for Studies and Research (BCSR)

17. Royal Court

18. Ministry of Municipalities and Agricultural Affairs

19. Muharraq Municipality

20. Northern Municipality

21. Southern Municipality

22. Capital Municipality

23. Central Municipality

24. Capital Governorate

25. Central Governorate

26. Muharraq Governorate

27. Northern Governorate

28. Southern Governorate

29. TRA (Telecom Regulatory Authority)

30. Ministry of Justice

31. Ministry of Foreign Affairs

32. University of Bahrain(Traffic Center)

33. Bahrain Internet Exchange (BIX)

34. National Security Agency (NSA)

35. Ministry of Finance

36. TATWEER Petroleum Company

5. DATA GENERATION/PRODUCTION - STANDARDS

Computerized geographic data is created, collected, processed, disseminated and stored by various public & private agencies in the Kingdom of Bahrain. This is a valuable source of information and sharing these data among various stakeholders is of utmost importance for planning, sustainable management & development of economic and social infrastructure and effective government administration.

The BSDI initiative encourages government, public and private agencies to share in the creation, use and maintenance of GIS datasets at the least possible cost, while providing data users easy access to this resource.

NGISSC in full awareness of the fact that at the foundation of any effective SDI there is always a well-considered framework of standards and policies around which, the infrastructure is built. Hence the committee deemed it critical, that data standards are
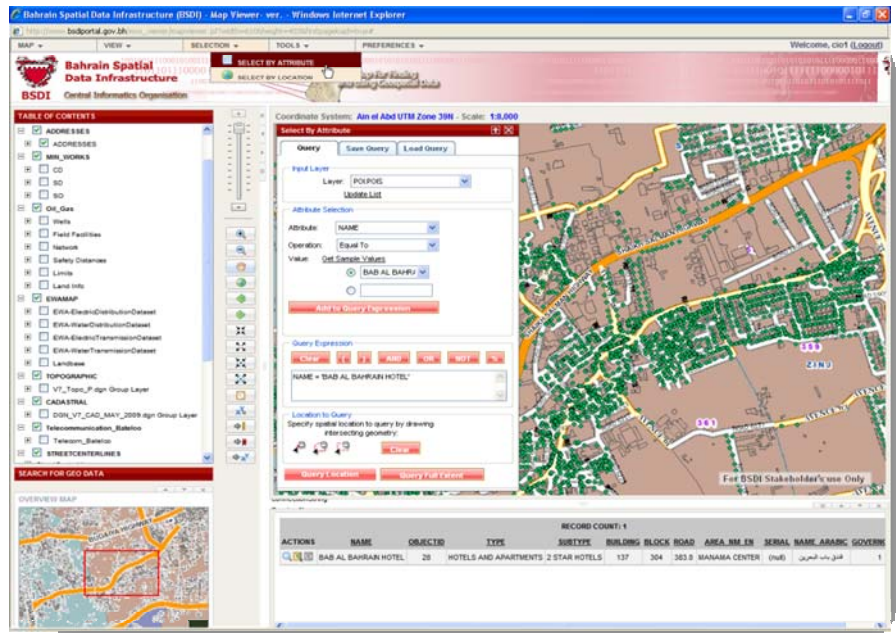

established and are in place for BSDI, to ensure effective sharing and dissemination of conformable data resulting in user satisfaction amongst the stakeholders.

The BSDI portal operates on a GIS database of the following spatial data layers:

- Oil and Gas Infrastructure.
- Cadastral.
- Topographic.
- Sewage.
- Electricity Transmission and Distribution.
- Water Transmission and Distribution.
- Telecommunication.
- Administrative Boundaries.
- Addresses.
- Buildings.
- Street Centre-lines.
- Points of Interest (PoI).
- Satellite Image 2005; 2006; 2009; 2010; 2011; 2012
- Demography (Population)
- Marine Datasets
- Environment Data

قاعدة المعلومات الجغرافية الوطنية
Bahrain Spatial Data Infrastructure (BSDI)

GIS Directorate, CIO took the initiative to develop the Geospatial Data Standards for the Kingdom **(Bahrain Data Standards)** and to pass the directive to promote the use of standards for implementing various components of the BSDI. Standards followed by BSDI are officially mandated according to the specifications stipulated by Open Geospatial Consortium (OGC) and International Standard Organization (ISO).

6. DATA PUBLISHING & SHARING

BSDI portal supports Stakeholders and Users with the much needed geo-information and spatial data for e-governance. Currently more than thirty government and private authorities are benefiting from e-government initiatives of the BSDI portal. Primary delivery models and interaction domains of typical and ideal BSDI e-Governance has provided a common framework and direction in implementation of Bahraini government

policies. The BSDI Portal is a mixture of G2G, G2B, G2C and G2E. Stakeholders and Users belong to both Government and Private Organizations.

The BSDI operation model enables unhampered real-time use and sharing of spatial information to various stakeholders. The in-house basic framework data produced by CIO and the collated geospatial data from various Government Organization, Public and Private Sectors forms the major part of the GIS Directorate's common data warehouse. Innovativeness as part of GIS maturity is also reflected in the fact that the organization strives and successfully uses alternative spatial datasets like Remote Sensing Data for their internal business process as well as sharing value added products to various stakeholders participating in the BSDI initiative.

7. USE OF GEOSPATIAL DATA – GEOSPATIAL APPLICATIONS

The GIS Directorate, CIO functions under a chartered mandate for supporting existing and new GIS users in the Government, over the years has developed and implemented various Geospatial Intelligent applications for various ministries across the Kingdom. These applications integrated the BSDI geospatial data layers with organization business data assisting them to more effectively serve their respective customers

With SDI available to wider user community outside the professional group and the demand for more diverse services for decision making, the strategic objectives of the GIS Directorate 2011 onward underwent a paradigm shift from "data-centric" focus to **Service-centric**" mode. This focus currently is basically to strengthen cross organizational coordination, interdisciplinary problem solving, planning and policy making. This has been manifested by developing **process oriented geospatial application** that supports public service delivery, ultimately to promote economic development, stimulate better government and foster economic sustainability. The BSDI portal has evolved into an **"Enterprise Spatial Portal"** which not only acts as a spatial catalogue portal, creating, maintaining and cataloguing metadata and data but also integrates spatial data with business enterprise solutions. **E-WayLeave Clearance**

System is one of the main implementation in this section. E-WayLeave application integrated to the BSDI is a web based solution through which stakeholders can manage their Way-Leaves allowing them to create, search, comment, track, edit, print and approve Way-Leaves. Other process oriented automation applications integrated with the WayLeave Clearance System and Bahrain Spatial Data
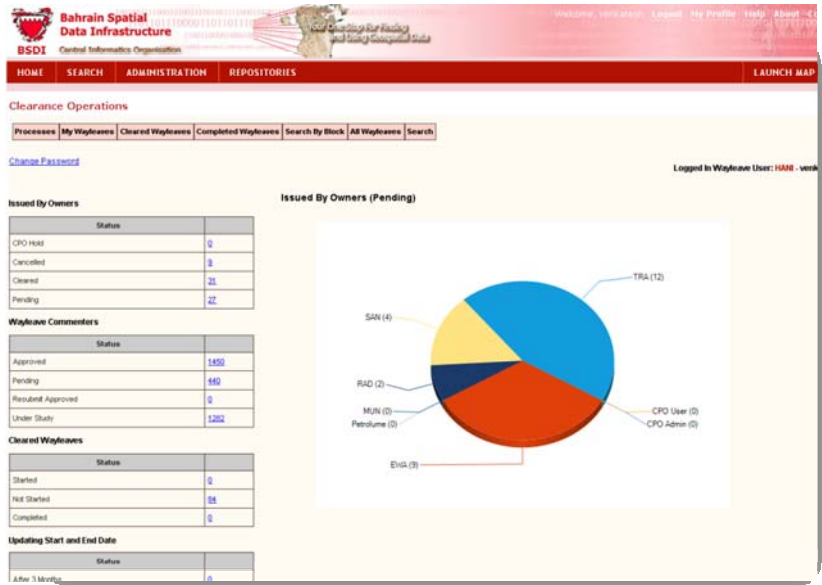
Infrastructure Portal has already been initialized and currently in development phase. They are General Service Certification, Planning Permission, Emergency Excavation, Asphalt Reinstatement to name a few.

Under their strategic initiatives the Directorate has also built and provided many

Ministries in the Kingdom with Geospatially Intelligent Systems to help in decision making and also to use their existing data in an appropriate and effective manner. These include the following:

- Ministry of Social Development (MOSD) GIS System
- Ministry of Education (MOE) GIS System

- Ministry of Health (MOH) GIS System

- Ministry of Housing (MOHo) GIS System

- Ministry of Labor GIS System

- Ministry of Islamic Affairs GIS System

- Ministry of Information GIS System

- Real Estate GIS System

- Bahrain Internet Exchange GIS Application

- Supreme Council of Environment GIS System for Env. Licensing

- GIS Application for Royal Charity Organization

- Health Locator GIS Application

To cater to general public, the directorate has also implemented a GIS locator application in form of **Bahrain Locator**. Bahrain Locator has been an initiative by the GIS Directorate, CIO to provide the best possible government service directly to the citizens through the use of spatial technology. The current Version II of Bahrain Locator is an all improved version, with features handling positional referenced data and spatial analysis functions, facilitating enhanced location based services delivering geographic information and geo-processing tools. The utility of services of Bahrain Locator lies in delivering accurate and the latest location-based information to users in day to day situations, hence, geospatially enabling the society. Bahrain Locator provides optimized usage of geospatial data and query services to all sectors of society including Government organizations, public and private sectors and citizens alike by providing them with a one-stop locator to avail spatial information and mapping services. Bahrain Locator has been an endeavor enabling online access of Geodata through web services providing services and transacting with citizens, businesses, and other arms of government, demonstrating the benefits of e-governance, using geospatial technology. Its goal is not only to integrate the existing data but also to establish linkages between people and data. The outcome has been just not linkage into a seamless database but also developed knowledge infrastructure and interoperable data and resource. Bahrain Locator delivers accurate and updated location-based information like i) Advanced Administrative Boundary and landmarks with corresponding map; ii) Address; iii)

Enhanced Points of Interest and Quick Search; iv) Interactive Legend on Demand tool toggles the visibility of the map legend; v) Satellite View toggles the visibility of satellite imagery as a base map overlain by the Administrative boundaries, road network and points of interest (POI); vi) Advanced Selection and Buffer Tool.

As part of internal business process, CIO has made the full use of spatial data in developing various applications enhancing the quality of decision making and efficiency in work. Mention may be made of **Enterprise Address Management System (EAMS)** which automates the process of issuing the Address Card with Building permits.

8. CAPACITY DEVELOPMENT

Since early days of BSDI various seminars, workshops and capacity building programs has been conducted on a regular basis in raising the awareness and building the initial support for the initiative at multiple levels. 2009-2010 onward there has been a tremendous expansion of technical work force in the domain ready to take the advantage of the spatial infrastructure. There has also been a steady growth of Stakeholder entity participation in the program which currently has crossed **42**.

Effective communication with and support for its community and other stakeholders is an integral part of BSDI's mission. There has been an intensive dissemination campaign at all levels among BSDI stakeholders through the NGISSC meetings and workshops. This not only educates the community about the myriad of activities and its benefits, but also engages stakeholder members as active participants. Various communication methods matching user needs and preferences is used as communication mechanism including but not limited to traditional print media, e-news-letters, an interactive website etc. Not only this, the GIS Directorate, CIO has actively participated in various Geospatial Conferences across the globe to showcase the initiative and share the lessons learned.

The GIS Directorate, CIO has already developed a Training plan for its employees and currently in the process of implementation. Various in-house training programs and

knowledge transfer session is organized regularly to keep the employees up to date with the latest developments and lessons learned through day to day business process.

Since its inception various capacity building programs has been conducted by CIO. In last two years more than 500 government employees working in various Ministries and Government Organizations who by some way or other, creates, maintains and uses geospatial

information for their day to day business process, have been trained on Basic and Advance GIS concepts through in house GIS Specialists as well as hiring professionals from globally renowned GIS training institutes. Not only these, trainings are also conducted on service oriented Geospatial Applications. Various workshops and seminars

are also conducted from time to time to provide stakeholders with necessary background, knowledge and experience to reap the benefits of the implemented Spatial Data Infrastructure of the Kingdom. Of late CIO in partnership with OGC has also conducted a National Level Workshop on "Open Standards, Policy and Business Value for Benefit of Geospatial entities in Kingdom of Bahrain". The workshop assisted participants in gaining better insights of Open Geospatial Standard, Business Drivers, Supporting policy, etc

The organizational capacity building initiative also includes sending employees at training programs and workshop at regional and global levels. During the year 2012 almost 20 organizational employees got specialized training in advanced geospatial technology and personal development at UAE & Saudi Arabia

CIO as an organization and its staff participates and represent the Kingdom of Bahrain in various Technological Conferences around the Globe. Of late CIO has participated in the following Geospatial Technical Conferences and Symposiums.

    a. GITEX Technology Week, Dubai, UAE – Oct 2012

    b. ESRI European User Conference, Oslo, Norway – Oct 2012

    c. 2nd Annual IT Conference for Government, Dubai, UAE – Nov 2012

    d. ESRI Middle East & Africa User Conference, Abu Dhabi, UAE – Dec 2012

    e. GISWORX – 2012

    f. OGC Technical Committee Meeting, Abu Dhabi, UAE – 2013

    g. Second High Level Forum of UN-GGIM, Doha, Qatar – Jan 2013

CIO has also partnered with King Abdulaziz City for Science and Technology, Saudi Arabia (KACST), Emirates Institution for Advanced Science and Technology, UAE (EIAST), at regional level for bilateral exchange programs.

CIO is also a member of international organizations like OGC, GSDI and Permanent Committee on GIS Infrastructure for Asia and the Pacific

9. CHALLENGES & FUTURE PLAN

Since there were many stakeholders involved in the project, there were Data inconsistency and coordinate system mismatch of the data from various Stakeholders. Spatial data was often missing or incomplete or the same data was collected by different organizations. Also there were inadequate documentation and description of the available

spatial data. Collectively they posed real threat to the initiative. However it was mitigated through development of well-considered framework of standards and policies around which the infrastructure is built. The data standards in terms of appropriate data, technology, and procedures were established and were put in place for BSDI, to ensure effective sharing and dissemination of conformable data resulting in user satisfaction amongst the stakeholders. Stake holders sharing data were also committed to follow the standards through proper legislation.

Cultural, Institutional, Financial and Legal barriers also prevented or delayed the sharing of spatial data. This challenge was overcome through development of Bahrain Data Exchange Policy. It acts as a binding deed for data exchange for parties involved and their agreement regarding exchange procedures and protection of data and data sources.

Integrating existing GIS data and procedures across the BSDI community is a matter of proactive stakeholder engagement and consultation to avoid redundant and often inconsistent spatial datasets. Engaging the stakeholder's to support the initiative was a major challenge. A transaction – based data maintenance approach was taken whereby entities had to streamline their workflows to update the spatial data they are responsible for by recording changes on the ground as they occur as part of their business processes. This approach ensured that the spatial data is updated and delivered to the BSDI community in a timely manner through the BSDI portal.

Data security was also a prime concern for many stakeholders. BSDI portal has thus been hosted within Bahrain Governmental Data Network with highest possible security and network management services with antivirus, firewalls and automated regular backups.

With the number of users and data volume growing day by day it was important that the portal is backed by supportive high end hardware infrastructure to maintain the same quality of service over time. This challenge was overcome through thorough system design and upgrading and enhancing the existing infrastructure to handle additional data volume for the next 20 years

Today's amazing mix of cloud computing, even smarter mobile devices and collaborative tools is changing the consumer landscape and provide both opportunity and challenge. New expectation require BSDI to be ready to deliver and receive digital information and services anytime, anywhere and any device. To keep up with the pace of change of technology, the Kingdom of Bahrain is working towards securely architect our system for interoperability and openness from conceptions. We need to provide better content and data and present it through multiple channels in a program and device-agnostic way. BSDI is currently working on these challenges by adopting a coordinated approach to ensure privacy and security in the digital age.