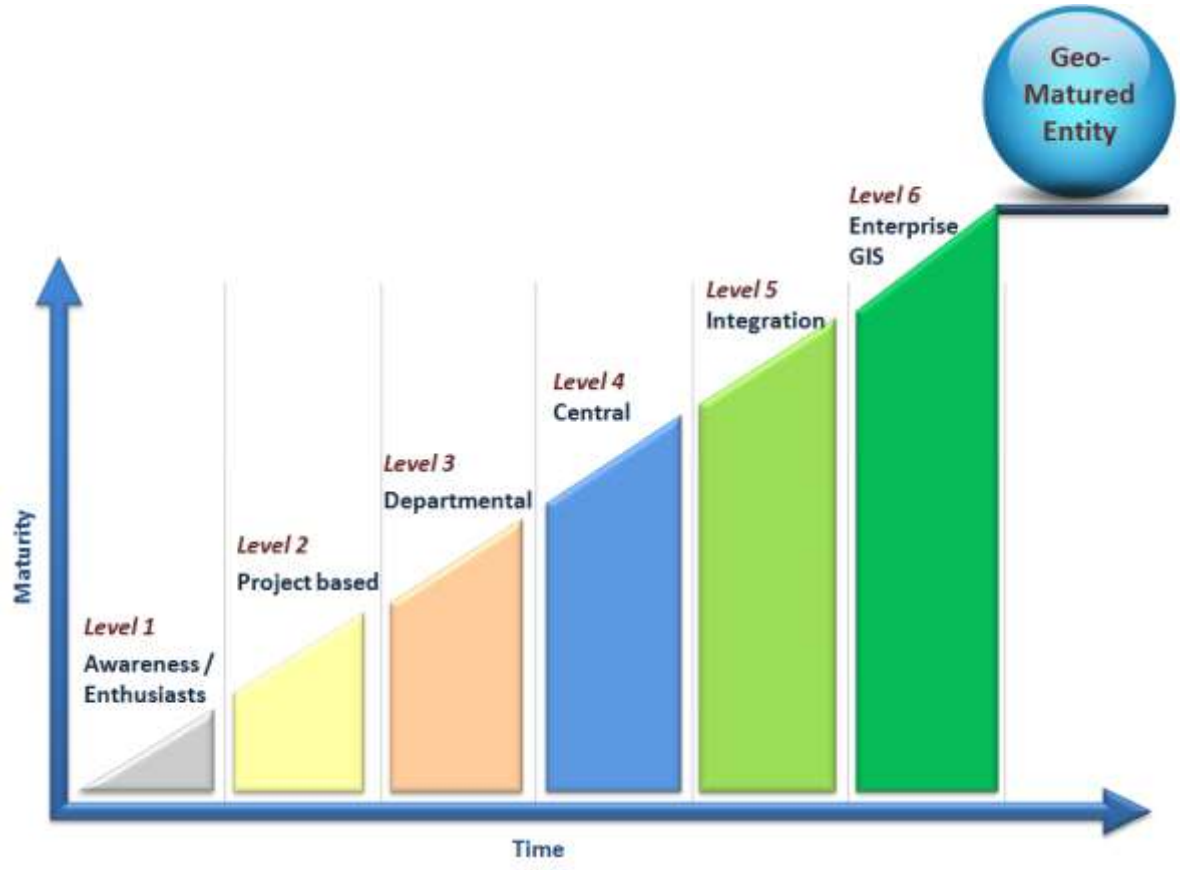
GeoMaturity Assessment Framework

Applying the Model



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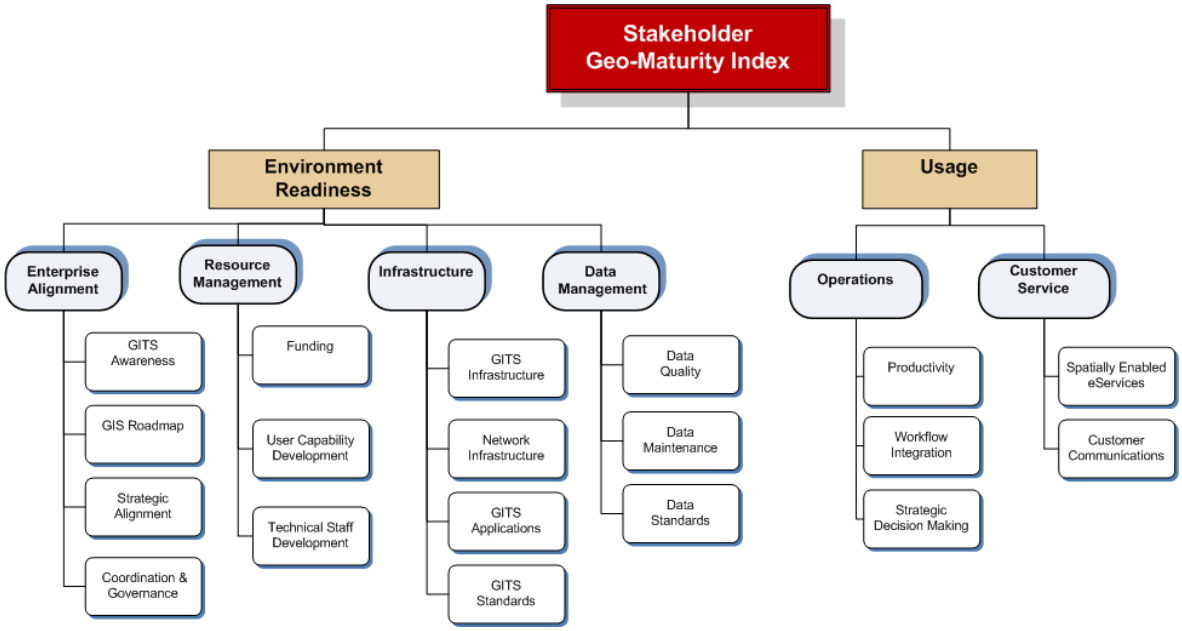
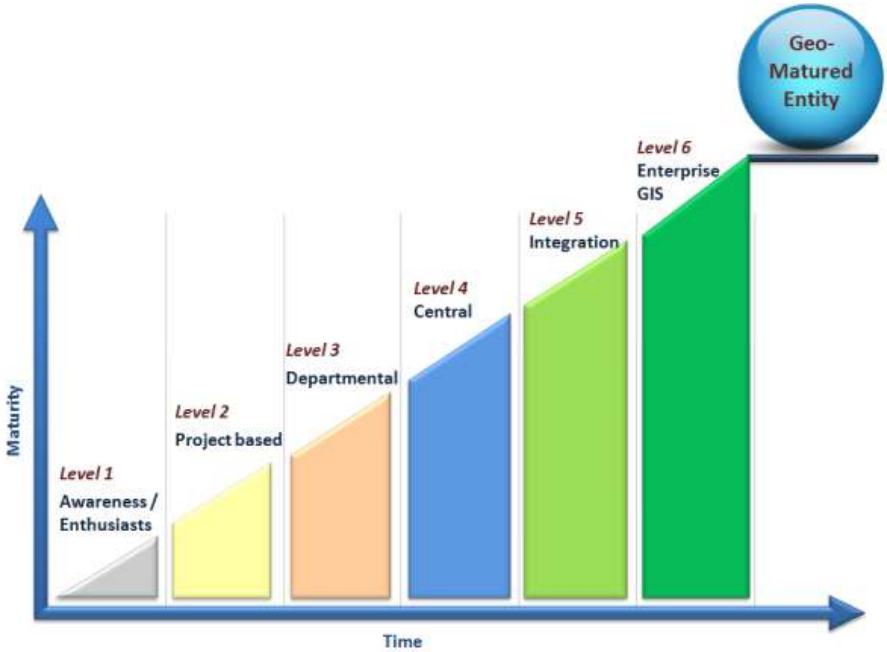
1 OVERVIEW

Many organizations need and objective method to determine how they are leveraging Geographical Information Systems (GIS). The model presented here allows organizations to establish a benchmark set of *GeoMaturity* ratings from which they can monitor progress from year to year.

The GeoMaturity model assesses an entity's *Readiness* through evaluating factors related to Enterprise Alignment, Data Management, Infrastructure, and Resource Management. These factors build the framework necessary for the second component, *Usage*. The *Usage* component evaluates how GIS is used internally to support and enhance operations, and how it is presented externally to support communications and eGovernment initiatives.



Six GeoMaturity Levels have been defined to represent the normal evolution of GIS within an organization. The characteristics of each level lead to indicators and targets that can provide guidance to organizations implementing GIS. *Level 6, Enterprise GIS is the ultimate goal, and as such the hardest to attain.*

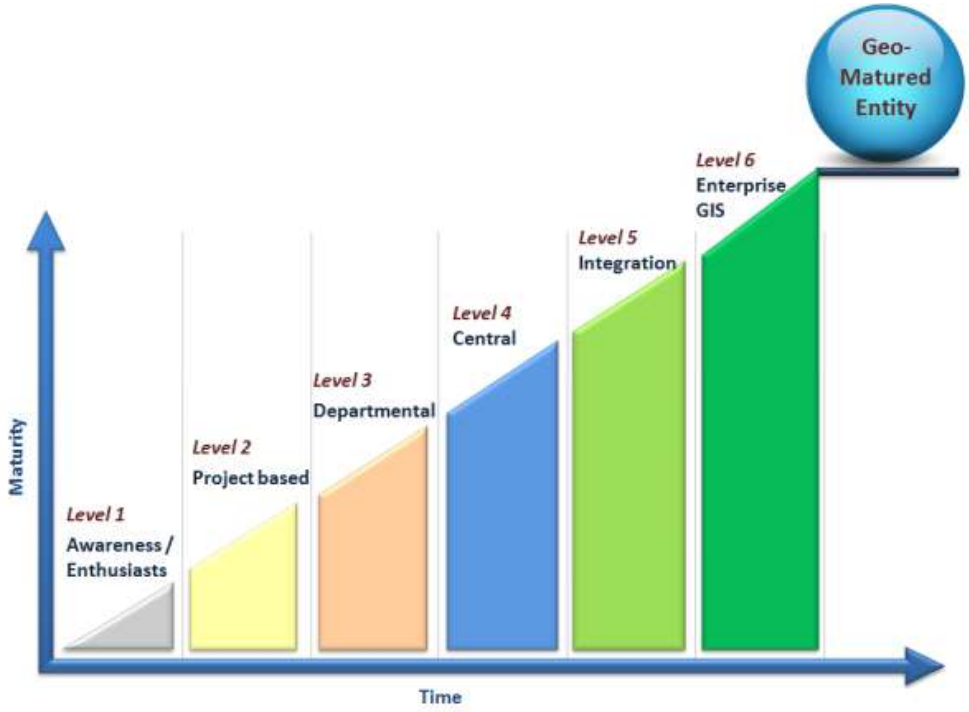


2 GEOMATURITY FRAMEWORK

The implementation of GIS technology within organizations tends to follow a natural continuum. "***GeoMaturity***" is a term used to describe the continuum and the characteristics of each evolving stage.

2.1 GeoMaturity Levels

The GeoMaturity levels below identify and describe the phases of this continuum. The characteristics of each level are used to benchmark the current state of an entity's GIS program, and to provide guidance for advancing to the next phase. The relevance and impact of the technology to the primary business functions will determine the speed in which the use of GIS evolves.



Level 1 – Awareness / Enthusiasts

This first phase is the period in which individuals in the organization start to learn about the capabilities of GIS. Enthusiasts may invest personal time in learning more about the technology and how similar organizations have deployed it. The first maps that present operational data are circulated. This is the period during which an initial pilot or proof-of-concept project is considered.

Level 2 – Project-Based

During the Project-Based phase, enough interest in GIS has been garnered to support a pilot project. These projects typically consist of spatially rendering a subset of existing data, and demonstrating potential operational and analytical results. Individual desktop licenses of GIS software may be purchased at this time. Pilot Data is acquired for one-time use and discarded. GIS usage tends to be limited to producing static maps for presentations and reports. In some cases a packaged system is purchased that provides an interactive map based on commercial data.

Level 3 – Departmental

Level 3 occurs when specific departments or operations within the larger organization recognize the value of building GIS capability for their internal use. The Department may invest in GIS infrastructure and platforms to support its workflows, outside of any enterprise Information Technology unit. Relevant GIS data to the department is authored and stored at the department level. As multiple departments begin to embrace GIS, multiple versions of base data proliferate.

Informal user groups start to meet and share best practices. Individual departments designate or hire their own GIS analysts.

Level 4 – Central

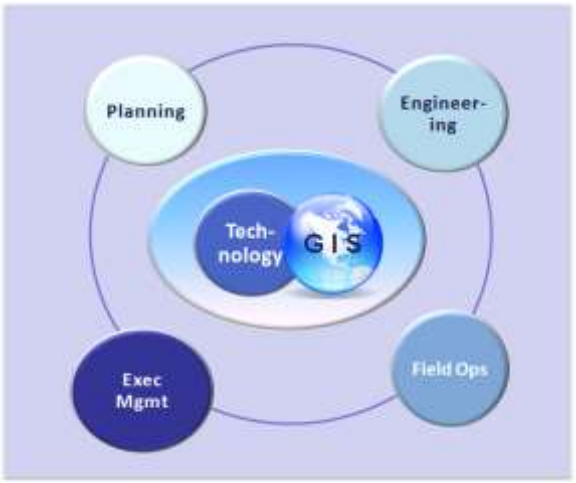
Centralization often occurs when the entity realizes that multiple departments are spending resources for redundant infrastructure and capabilities. Standardization and ownership of basemap data is recognized as critical to looking at a common map across departments. Alternatively, a newly formed organization may already understand the value of GIS to their business sector. These entities are able to invest in a central GIS infrastructure up front, benefiting from the lessons learned by their colleagues.

The Central GIS begins to set standards that improve data quality and internal GIS workflows. GIS software platforms and technical infrastructure are centralized, producing cost savings. Formal request mechanisms are established. The GIS organization starts to develop a strategic plan for the technical development and sustainability of its operations. Central data repositories and an internal interactive map viewer application are typical at this level.

Level 5 – Integrated

The Integration Phase level is challenging and often misunderstood. During the Central phase, applications are developed to improve access to GIS information and streamline the GIS data maintenance processes. Integration looks for opportunities to imbed GIS data maintenance and functionality into the core business process that creates or uses this data. Physical GIS editing is now owned by the business user, and integrated into their enterprise application. The goal is for GIS to be a seamless and pervasive component of enterprise applications, not a separate destination.

True integration between enterprise applications and GIS functions will require more advanced data models and technology. Data integration may be necessary both across the Entity's internal databases and in coordination with data owned by external entities. GIS Steering Committees are established to obtain define integration priorities with operational management.



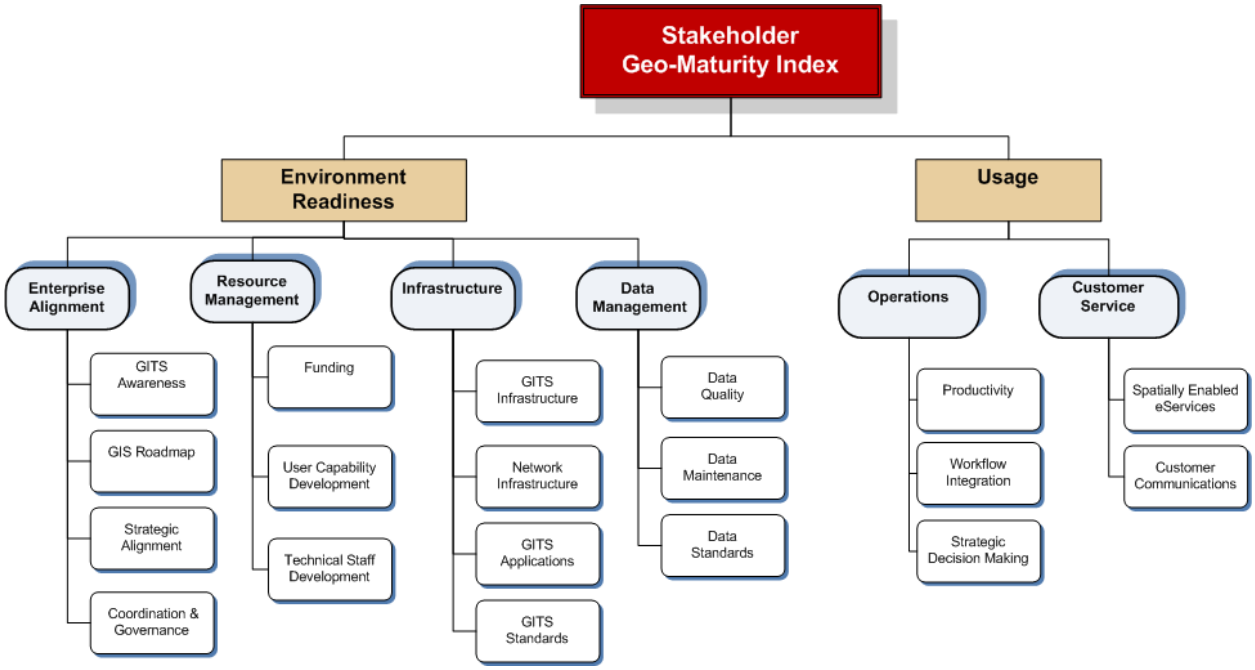
Level 6 – Enterprise

An Enterprise GIS is the most difficult level to achieve. It assumes that GIS integration is now seamless with enterprise and mission-critical systems. The distinction between GIS databases and Enterprise databases has been blurred as logical keys link spatial and non-spatial data without duplication. GIS capability is on-demand, wherever demanded, as the focus on mobile applications and personalized tools increases. The GIS organization itself has become more technical and project oriented. GIS Power Users have emerged from subject matter experts throughout operations.

At the Enterprise level, GIS strategic goals are imbedded in the enterprise strategic plan. GIS is used at the executive level as a spatial dashboard for current operations and as a modeling tool for evaluating future operations. GIS management is recognized as part of the organization's executive team.

2.2 GeoMaturity Indicators

The approach to benchmarking each stakeholder's current GeoMaturity level requires the examination of several technical and managerial aspects of their use of *Geographic Information, Technology and Services* (GITS). These aspects are grouped into two main components, Readiness and Usage. *Readiness* measures the extent to which necessary infrastructure, base data, and resources support development and usage of GITS. *Usage* measures how the entity has leveraged its GIS infrastructure to enhance operations, decision making and customer service.



The following sections describe the six primary sub-indicies and their related domains. Each domain is further associated with detailed indicators and targets. This detail is available in the appendices.

2.2.1 Enterprise Alignment

The **Enterprise Alignment** Sub-Index measures how well the stakeholders' GITS or planned GITS reflects the overall goals and priorities of their entity. Domains were defined to measure the four aspects listed below:

- ***Strategic Alignment*** measures how well the GITS approach supports the overall vision, priorities and operations of the entity.
- ***GITS Awareness*** measures the extent to which the entity is aware of GITS technology, the AD-SDI offerings, and how GITS might enhance their internal operations.
- ***GIS Roadmap*** measures the existence, depth, and implementation of the entity's strategic plan for GITS implementation.
- ***Coordination & Governance*** measures implementation of policies, sharing agreements and best practices to manage and track the GITS implementation.

2.2.2 Resource Management

This sub-index assesses whether the organization has obtained the necessary commitment of funding, staffing, training, shared resources, and user support to be successful. It includes the following domains:

- ***Funding*** reviews not only whether a sufficient budget is in place to support planned GITS activities, but also whether sustained funding will be available to support ongoing operations and maintenance. Return on Investment (ROI) tracking for existing and proposed projects are seen as a tool to prioritize and justify needed investments.
- ***Technical Expertise Development*** reviews not only the level of staffing devoted to GITS, but also the skillsets, roles, and ongoing training necessary. Staff roles and skillsets demands become more complex as organizations strive towards higher levels of GeoMaturity.
- ***User Capacity Development*** measures the level of GIS functionality that is made available to end-users with minimal training. As the organization's technical side becomes more complex, this should enable rich end-user applications that are less complex for the business users.

2.2.3 Data Management

Data Management addresses the many aspects of acquiring and maintaining quality data sets. GIS is a data-centric technology with specialized data maintenance methods and standards. This does not preclude however, the application of data best practices based in information technology. Normalization of data, elimination of data redundancies, data entry systems with built in validation, are all important for GIS data management.

- ***Data Quality*** indicators measure whether spatial and business validation rules have been defined, how they are verified, and when they are verified. The emphasis is on building rules into the editing process in the beginning, to reduce the reliance on inspecting for quality at the end.
- ***Data Maintenance*** reviews the methods and procedures used to create and update GIS data. It looks for procedures and automation that link the GIS Data editing to any related non-spatial data. The goal is define methods where spatial and non-spatial data are created and maintained simultaneously.
- ***Data Standards*** focus on the accuracy and completeness of the data model. GIS data should follow spatial projection, precision, and topology standards that are both consistent within the organization, and across related organizations. Data documentation should define the context of data, its data design, and policies for security, retention, and access.

2.2.4 Infrastructure

The Infrastructure sub-index assesses whether the appropriate hardware, software, bandwidth, and application architecture are in place to support the organization's GIS needs. The size and complexity of the necessary infrastructure is directly proportional to the relevance of GIS technology to the primary operational functions.

- ***GITS Infrastructure*** reviews the GIS-specific hardware and software platforms in place to support data editing and applications. Platforms should be consistent with overall supported platforms in both the entity and the industry. The software and applications should be accessible as needed throughout the entity. Sufficient support for upgrades, testing, and backups should be in place.
- ***Network Infrastructure***, while not specific to GIS, is an important enabler to ensure that distributed office locations have access to GIS functionality and that cross-entity and public applications can support expected demand.
- ***GITS Standards*** measure the practices in place to ensure the integrity and availability of the overall infrastructure. It considers backup and recovery practices, failover capability and authentication methods.
- ***GITS Applications*** indicators assess the application technology architecture in place. This area looks for the use or development of common web services, open source protocols, and geocoding tools.

2.2.5 Operations

The Operations sub-index, within the Usage component, assesses how the overall GIS program supports and enhances internal operations and decision making, which is the ultimate goal of any technology implementation.

- ***Workflow Integration*** measures how GITS capabilities are used within both mission-critical and secondary operations. Early levels integrate GITS as a coordinated step, whereas more advanced levels seamlessly imbed GITS within the normal workflow.
- ***Productivity*** assesses the improvements in turn-around time, elimination of redundant tasks, and streamlining of tasks that have resulted from GITS integration.
- ***Strategic Decision Making*** reviews how GITS is used to analyze current operations, identify trends and issues, and plan for the future.

2.2.6 Customer Service

The Customer Service sub-index measures the impact that GIS has on the productivity and experience of the external customer or general public when interacting with the entity.

- ***Customer Communications*** pertains to the level at which relevant spatial information is provided in the entity's website, publications, and offices. It reviews how GITS is used to better inform customers and potentially reduce related inquiries to entity staff.
- ***Spatially Enabled e-Services*** reviews how GIS is used to streamline or otherwise enhance transactions between the entity and its external customers. It measures the extent that spatially-enabled transactions can reduce trips and turnaround time for the customer.

2.3 GIS Relevancy Categorization

As with any technology, GIS should be used as a tool only where it will have a positive impact on the organization's mission. Its relevance to a particular entity depends upon the extent that spatial information is valuable to its operations and decision making and assists the organization in achieving its goals. GIS Relevancy is not uniform across organizations. Its value to an engineering or infrastructure organization will be much higher than its value to a financial or administrative organization.

Recognizing this, the GeoMaturity framework has defined the following three relevance categories. The expectations for GIS use and investment also vary according to the relevance.

Relevance	Category Description	Target GeoMaturity Level
Core	GIS is a vital technology necessary to support mission critical operations and decision making in this sector.	**6 – Enterprise**
Moderate	GIS is important to one or more operations, but is not mission critical to the sector.	**4 – Central**
Low / Beneficial	GIS is useful and beneficial, but not a key tool to the sector.	**2 – Project Based**

GIS Relevance categories have been assigned to overall sector definitions. Each entity's relevance level is derived from their related sector. For purposes of this assignment, the *International Standard Industrial Classification (ISIC Rev.4)*[1] published by the United Nations was used to define the sectors.

[1] A detailed list of the United Nations ISIC classifications is provided in the Appendices.

3 ASSESSMENT APPROACH

Before beginning an assessment, the team should meet with stakeholders to review and refine the framework model. Workshops or small group sessions can be used to apply some of the indicators and provided feedback related to relevance and practicality.

Stakeholder entities are interviewed regarding their use of GIS. Interviews are typically conducted with the GIS team and Operations management and last from two to three hours. Information gathered during the interview is supplemented with reviews of available strategic plans, websites, GIS infrastructure, and previous assessment reports.

Each participating entity will receive a resulting assessment report that includes maturity rankings at indicator and domain levels. The report indicates targets met for each indicator, and provides the next target to achieve. Recommendations for next steps are provided to each entity. These detailed assessments are not published as part of the final report to allow the assessment to be an internal learning tool for the stakeholder. Results in the final report are presented at the aggregate level.

4 APPENDICES

4.1 Sector Definitions - United Nations ISIC Rev 4

The United Nations Statistics Division maintains the International Standard Industrial Classification of All Economic Activities, Rev.4 (ISIC). Full documentation of this classification system is available on their website at: http://unstats.un.org/unsd/cr/registry/ . An index of the primary classification levels is provided below and the related GIS Relevance assignment is provided below.

ICIC Code	ICIC Sector Classifications	GIS Relevance
A	Agriculture, Forestry and Fishing	Moderate
B	**Mining, Drilling and Quarrying**	Core
C	Manufacturing	*Beneficial*
D	**Electricity, Gas, Steam and Cooling**	Core
E	**Water Supply, Sewerage, & Sanitation**	Core
F	**Construction**	Core
G	Wholesale and retail trade	*Beneficial*
H	Transportation and storage	** Multiple
H-49	***Land transport and transport via pipelines***	Core
H-50	*Water transport*	Moderate
H-51	*Air transport*	Moderate
H-52	*Warehousing and support for transportation*	*Beneficial*
H-53	*Postal and courier activities*	Moderate
I	Accommodation and Food Services	*Beneficial*
J	Information and communication	Moderate
K	Financial and Insurance	*Beneficial*
L	Real estate	Moderate
M	Professional, Scientific and Technical	** Multiple
M-69	*Legal and Accounting*	*Beneficial*
M-70	*Head offices; Management Consultancies*	*Beneficial*
M-71	*Architectural and Engineering*	Moderate
M-72	*Scientific research and development*	Moderate
M-73	*Advertising and market research*	Moderate
M-75	*Veterinary*	Moderate
N	Administrative and Support	** Multiple
N-77	*Rental and Leasing*	Moderate
N-78	*Employment activities*	*Beneficial*
N-79	*Travel agency and related activities*	*Beneficial*
N-80	*Security and Investigation*	Moderate
N-81	*Services to Buildings and Landscape*	Moderate
N-82	*Office Administrative*	*Beneficial*
O	Public administration and Defense	** Multiple
O-a	***Municipal Management***	Core
O-b	***Urban Planning***	Core
O-c	*Economic Development*	Moderate
O-d	***Natural Resources Management***	Core
O-e	***Emergency Management & Defense***	Core
P	Education	*Beneficial*
Q	Human Health and Social Work	Moderate

ICIC Code	ICIC Sector Classifications	GIS Relevance
R	Arts, Entertainment and Recreation	*Beneficial*
S	Other Services	*Beneficial*
T	Households as Employers	*Beneficial*
U	Extraterritorial Organizations	**Moderate**

4.2 References and Recommended Links

Data Quality Assurance

ArcGIS Data Reviewer - http://www.esri.com/software/arcgis/extensions/arcgis-data-reviewer/index.html "*ArcGIS Data Reviewer provides a variety of automated checks that can immediately improve your data integrity such as spatial, attribute, topology, connectivity, database validation, and z-value, that users from any industry can easily configure and run on their data.*"

ArcGIS Workflow Manager - http://www.esri.com/software/arcgis/extensions/arcgis-workflow-manager/index.html "*Is an extension to ArcGIS Desktop and ArcGIS Server that lets organizations develop and enforce standard, repeatable GIS workflows across the enterprise.*"

"***Validating Geodatabase Topology***", ESRI ArcGIS 10 Resource Center; http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/Validating_a_geodatabase_topology/001t000000sq000000/

Mapping Productivity & Accessibility (Free or inexpensive)

GeoCommunity Review of "***Geo-Viewing Tools You Shouldn't Be Without***", http://spatialnews.geocomm.com/features/viewers2002/

Geospatial GeoPDF - http://www.terragotech.com/

Project Management Practices

Project Management Institute – ***Project Management Body of Knowledge*** (PMBOK), http://www.pmi.org/

International Project Management Association - http://www.ipma.ch/

GIS Maturity Models

"***The Application of Maturity Models to GIS***", URISA, James Russell, 2006. http://www.urisa.org/russell

"***Introducing a Maturity Model for Enterprise GIS",*** W4Sight 2009. http://w4sight.com/GISLinks/Reference%20Library/W4Paper_GISMaturity.pdf

"***Spatial Data Infrastructure Cookbook***", GSDI – Global Spatial Data Infrastructure Association, 2009. http://memberservices.gsdi.org/files/?artifact_id=655

4.3 Detailed Indicators and Targets

Available on request.