

07. Running A Spatial Project

GE3238 GIS Design and Practices
Geography@NUS
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Learning Objectives

- Understand basic spatial project management considerations
- Within these considerations, appreciate the role of spatial thinking that affects your choice of data/tools

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TOC of *The Design and Implementation of GIS*

- Needs assessment and requirements analysis
- Designing the GIS database schema
- Designing spatial data and attribute data
- Remotely sensed data as background layers and data sources
- Implementation: data development and conversion
- Implementation: hardware and software
- Designing the organization for GIS
- Management concerns

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- ←
- In GE3238
 - Week 2-3 Network data model
 - Week 4 GIServices
 - Week 5 VGI
 - Week 6 Automation or customization

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Needs Assessment

- What applications?
 - What exists at or near a particular location?
 - Where are all the places where this exists?
 - What geographic areas meet the following criteria?
 - What has changed in this area or region over time?
 - What spatial patterns exist?
 - If we were to do this, what would the result be?

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REPORT

EVOLVING ROLE OF NATIONAL MAPPING AGENCIES


Transitioning to Geospatial Knowledge Infrastructure

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ADVANCING KNOWLEDGE FOR SUSTAINABILITY

Evolving Role of National Mapping Agencies

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OVERVIEW

The geospatial landscape is undergoing a rapid transformation, driven by technological advancements and the increasing demand for accurate and accessible geospatial data. At the heart of this evolution are National Mapping Agencies (NMAs), which play a pivotal role in supporting economic growth, sustainable development, and societal well-being.

Geospatial World's recent Thought Leadership Report "Evolving Role of National Mapping Agencies: Transitioning to Geospatial Knowledge Infrastructure", released on the eve of the Fourteenth Session of the UNGGEM Plenary, delves into the value of enhanced collaboration between National Mapping Agencies (NMAs) and industry in reshaping geospatial capabilities across diverse economic strata. These collaborations underscore a growing trend in leveraging industry expertise to enhance national mapping capabilities across various economic contexts, supporting economic growth, sustainable development, and capacity building. As the geospatial technology landscape continues to evolve, this Thought Leadership Report aims to provide in-depth insights into the current state of strategic opportunities, partnerships, and industry convergence that are shaping the future of NMAs.

DOWNLOAD REPORT

• Key point

– A development is always connected to a set of specified applications

• Quote from 1989

– There is no theory-neutral GIS

<https://geospatialworld.net/consulting/reports/evolving-role-of-national-mapping-agencies/2024/>

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Translating needs assessment to your projects

- Define the scope of your project
 - Using spatial thinking/terms
 - Associating with a domain question – what is your domain of interest
 - Intended audience

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Data and “know thy data”

- Data take 80% of the “budget”
- What data do you need to address the question
 - E.g. network dataset for spatial optimization
- Purpose: Viewing or analyzing?
- Available or accessible?
 - What format?
 - Ready to use or require further processing?

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Data – Fitness for use

- GPT-4o model said the following
 - The degree to which data, a product, or a service meets the **specific needs and requirements** of its **users** or **consumers**
 - This concept is often applied in the context of **data quality**, product design, and service delivery to ensure that the end result is both effective and satisfactory for its **intended purpose**

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Choosing the Appropriate (Mix of) Data Model(s)

- Fundamental: vector and raster
 - What exactly do vector/raster tell you?
 - Discrete versus continuous
- Those built on top of the fundamental
 - Transportation network was introduced; relations are important
 - But what about bus route?
 - Vector and raster together?

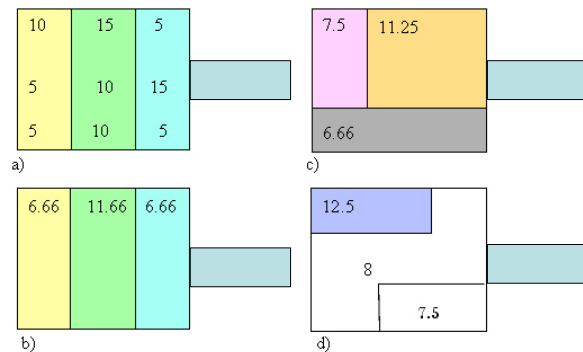
↑
Database schema

(we will have 2-3 more lectures on data models)

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Data Attributes

- Are they readily available?
- Are they really what you want? Be aware of idiosyncrasies in
 - Definition
 - Granularity
- Can they be enriched via VGI?



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Remote Sensing Data as Background Layers Only?

- Background layer – see Esri's Living Atlas
 - WMTS (Web Map Tile Service)
- The answer is of course NO. It provides data on, e.g.,
 - Land use/land cover
 - Urban functional zone
 - ...
 - But you need skills from GE4214 Remote Sensing of Environment

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Expectation of the Final Deliverables

- Do not wait until the last minute!
- Final deliverables
 - Static map versus interactive map
 - Storymap – “map that tell a story”
 - <https://search.nlb.gov.sg/spatialdiscovery/storymaps/mapbox/index.html>
 - Sensitivity of the output (crucial if you work as an intern)

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How many considerations go into the four steps to design geodatabases below?

- 1** *Identify the information products that will be produced with your GIS.*
Inventory map products, analytical models, database reports, Web access, data flows, and enterprise requirements.
- 2** *Identify the key thematic layers based on your information requirements.*
Specify the map use, data source, spatial representation, map scale and accuracy, and symbology and annotation.
- 3** *Specify the scale ranges and spatial representations for each thematic layer.*
GIS data is compiled for specific scale use; feature representation often changes between points, lines, and polygons at larger scales. Rasters are sampled to include multiresolution pyramids.
- 4** *Group representations into datasets.*
Discrete features are modeled with feature datasets, feature classes, relationship classes, rules, and domains. Continuous data is modeled with raster datasets. Measurement data is modeled with survey datasets. Surface data is modeled with raster and feature datasets.
- 5** *Define the tabular database structure and behavior for datasets.*
Identify attribute fields, specify valid values and ranges, apply...

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Data are always simplifications of reality...

- Do your data capture key spatial information within the scope of your project?
- Is it at the right level of detail (e.g., scales and resolutions)?
- Is the temporal coverage correct?

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(Geo-)processing Tools to Use

- They are often linked to the data model(s) used
- Often you need to “glue” multiple geoprocessing tools
 - ModelBuilder or Python can help
- Know the underpinning spatial concepts
 - Usually based on distance
 - Tools that sound similar may serve different purposes (see the next slide)

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An Example: Hotspot and density map

- Difference?

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Symbology and Visual Variables

- Demonstrated in Lab03
- Effective symbology connects with
 - geographic phenomena
 - Scale of measurement

Nominal Data

Point	airport	town	mine	capital
Line	river	road	boundary	pipeline
Area	orchard	desert	forest	water

Ordinal Data

Point	Airports ✗ international ✗ national ✗ regional	Oil well production ■ high ■ medium ■ low	Populated places ● large ● medium ● small
Line	Roads — expressway — major — local	Drainage — river — stream — creek	Boundaries — international — provincial — county
Area	Soil quality ■ good ■ fair ■ poor	Cost of living ■ high ■ medium ■ low	Industrial regions ■ major ■ minor

Interval and Ratio Data

Point	Election results % of votes	Mineral production tons	Populated places Persons / km²
Line	Roads: load capacity over 10 tons 5 - 10 tons	Stream flow 1500 1000 500 0	Elevation 60 40 20
Area	Precipitation 25 20 15 10 0 cm.	Elevation 400 metres 300 200 100 0 sea level	Population density Persons / km² 50 - 80 10 - 40 1 - 9

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Communication

- “When it comes to working in the GIS industry, clear communication is often as necessary” <https://www.esri.com/about/newsroom/arcnews/managing-gis-workflows/>
- How data / information were obtained
- This is where metadata (data about data) is important

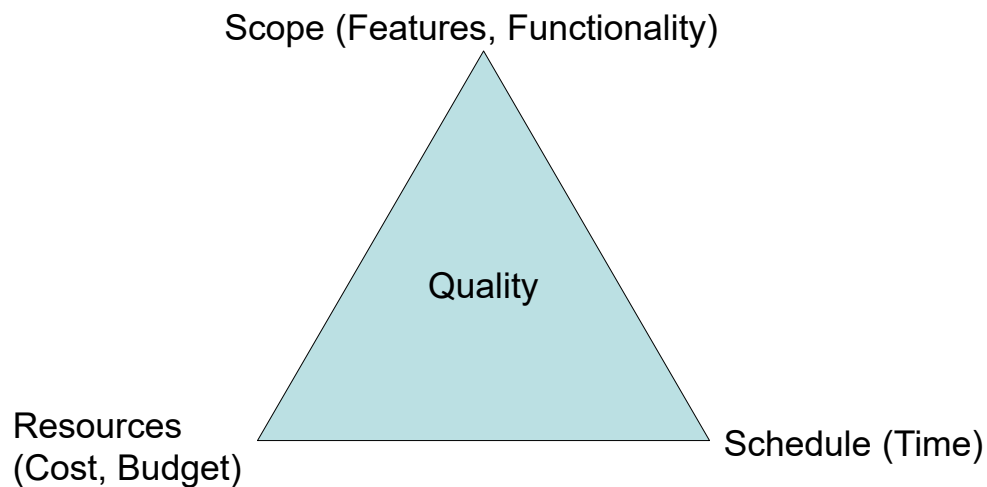
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Archiving Project

- Essentially project submission
- Are metadata available?
- Tidiness
- Completeness
- Share function on ArcGIS Pro?

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Iron Triangle of Project Management



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Final Thoughts

- Often a necessary evil: trial and error
- A real project often involves Gantt or pert charts
 - Collaborative tools are often involved, e.g. kanban style tools
- We emphasize spatial thinking and data model, but visualization is equally important, if not more important
- Cost is of critical importance
 - Open source does is not necessarily cheaper

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