THE ECONOMICS OF SDI IMPLEMENTATION IN SMALL ISLAND NATIONS

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Workshop Topics

Section 1 (45 minutes)
- The value of Geographic Information
- Valuing intangible assets
- GI markets & market size implications for small island nations

Section 2 (15 minutes)
- SDI and Information Infrastructure
- SDI and e-Government

Section 3 (15 minutes)
- Economic impact indicators and assessment
- Role of industry and business in small economies

Section 4 (15 minutes)
- Cost-benefit methodologies for SDI assessment
- Multi-criteria Analysis (MCA)
- Geo-VMM ROI Methodology

Conclusion

Value of GI in an economy – and to an economy

An **economy** is "the realized system of human activities related to the production, distribution, exchange, and consumption of goods and services of a country or other area."

The implication is that the goods and services are of value to someone – otherwise they would not **be** "produced, distributed, exchanged and consumed."

What type of economy?

- Market economy (e.g. capitalism, i.e. 'government hands off' economic systems)
- Planned economy (e.g. pure socialism)
- Mixed economy (a compromise incorporating market and planned economy elements) - private and state owned enterprises, mixed capitalist and socialist elements – typical
- Economies as diverse as those found in the USA and Cuba have been termed 'mixed economies', with different degrees of market and planned elements.

What type of economy?

- Information-based economies (or segments of economies):
  - Information Society
  - Information Economy
  - Knowledge Economy
- Role of public sector information (PSI) – i.e. any data collected by government bodies – in different types of economic systems
  - Stimulus to/for commercial 'value adding' businesses (which help grow an economy – employment, taxation)
  - Value for more efficient operation (government & industry) and services to citizens based on better quality information and more 'intelligent' use of information

Valuing GI

So - an important issue in examining the role of information – including geospatial information – in/to/for the Information Economy and the Knowledge Economy ....

.... is to have some idea of the value of the information ....

.... for which there is not a simple answer or formula for computing value.

Valuing & Pricing Geographic Information (GI) - global debate

Geographic Information: Value, Pricing, Production and Consumption

by Roger Longhorn and Emeritus Prof. Michael Blakemore
co-Directors, Info-Dynamics Research Associates Ltd (UK)

CRC Press / Taylor & Francis, 2008 - ISBN 0-8493-3414-4
(US$ 83.00 / UK£ 46.50 on Amazon)
(parts can also be read on books.google.com – for free!)

Based on 27-page paper, March 2004 (freely downloadable PDF) in
Journal of Digital Information, vol. 4 issue 2.

Re-visiting the Valuing and Pricing of Digital Geographic Information

at: http://jodi.tamu.edu/Articles/v04/i02/Longhorn/longhorn.pdf

What is 'value'?

- **Value -** worth; intrinsic worth or goodness; recognition of such worth; that which renders something useful or estimable; relative worth; high worth; price; the exact amount of a variable quantity in a particular case.
- **Value -** the importance or worth of something for or to someone; how useful or important something is; the amount of money that can be received for something.
- **Value -** a fair return or equivalent in goods, services, or money for something exchanged; the monetary worth of something, e.g. a market price; relative worth, utility, or importance; a numerical quantity assigned to something or determined by calculation or measurement.

What is 'value'?

- "... the value of the same information differs hugely to different people and for different applications." (Longley et al)
- "Information has no inherent value, it is only of value once used and that value is related to the nature of the use rather than the nature of the information. As a result information has very different values for different users." (Barr & Masser)
- Information has value "... determined by its importance to the decision maker or to the outcome of the decision being made ... professionals require information that is not only accurate, timely, and relevant, but also presented and interpreted in a meaningful way." (US Federal Highway Administration, 1998)

What is 'value'?

- Different values apply at different times or when information is in different formats or when used for purposes other than that for which it was first collected.
- Are you valuing data? Information? Actionable knowledge?
- The value of information as a product, sold by a vendor, may not equate to the value of that same information to the final consumer or user.
- Financial value (to the vendor) versus utility value (to the user or consumer)
  - Example: a piece of 'free' information, such as a bus schedule, has real utility value if it prevents you from wasting time waiting for buses that aren't going to arrive!

Valuing GI – a conundrum

We see that the question "What is the value of GI" depends very much on who is asking the question – and why – and even when?

- Financial or monetary value - commercial sales value in a market economy.
- Socioeconomic value - the value of an information good or service in achieving (presumed valuable) societal goals.
- Cultural value - may be measurable only in societal terms.
- Political value - influencing the interests, status or economic viability of organizations, individuals or governments.

Valuing GI – a conundrum

Additional issues for valuing GI

- What is 'geographic information'?
  - Satellite imagery
  - Aerial imagery?
  - Maps? Charts?
  - Databases of addresses?
  - Physical property boundary lines (set of vectors – points, lines, polygons)?
  - Administrative boundary lines (political wards)?

Valuing GI – a conundrum

Additional issues for valuing GI

- All information has a cost, which must be borne by someone, somehow, usually over varying periods of time.
- Value versus cost (to collect? to process? to disseminate?)
- Cost or price that a user is willing to pay "is a valid surrogate for the perceived value of GI." (Joffe & Bacastow)
  - ... in a specific format, of specified quality, for a stated purpose, possibly with leally binding contractual terms.
  - ... but this may apply only to monetary value – and we have already seen that there are other, potentially

Valuing GI – CSGI v. PSGI

- Commercial sector GI (CSGI) is concerned primarily with monetary value of an information product or service (based on that information).
- The actual value of that GI to a user, once sold to the user, may be of no further interest to the commercial vendor – but will be of high interest to the consumer.
- Therefore it is difficult to quantify the direct or indirect value to the economy and society of CSGI.

Valuing GI – CSGI v. PSGI

- Public sector GI (PSGI) usually has a readily identifiable collection, processing, use and dissemination cost.
- PSGI's initial value is intrinsic or inherent to the collecting/using public organisation in carrying out its legally mandated responsibilities.
- Yet the financial value of PSGI is much less easily determined.
  - Value of cost savings (by having/using the GI)?
  - Value of better service provision?

GI value issues – interim summary

- Everyone is a user of information, the heart of the Information Society which underpins the Knowledge Society and Knowledge Economy.
- Geographic information manifests itself in many different forms and formats, for myriad uses, often in combination with other non-geographic information.
- The location attribute that defines information as being geographic is only one of many attributes for that information, each of which has its own unique impact on information value.

GI value issues – interim summary

- The value of information varies with time and according to different uses.
- All information has a range of costs associated with it, which must be covered by someone, although cost recovery alone is not the only measure of value.
- Different information value chains may apply to different stakeholders, and information policy at national level or within organisations can affect that value chain.

Information as an intangible asset

- Information is not something you can touch or feel, like most accounting-based assets (even if you can see it!).
- Yet information is at the heart of most enterprises, whether private industry or government. Lack of adequate information can be fatal to an enterprise.
- Few organisations actually assign any financial value to this key asset – information – including many National Mapping Agencies, satellite image vendors, etc.
- Value chains for different enterprises

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Create	***Manage***	***Integrate***	***Transact***	***Distribute***
Collect, organize, add context	*Store, prepare for multiple uses according to an information model*	*Locate and aggregate from multiple sources; produce information intelligence*	*mechanisms for realizing value and content monetarization*	*Deliver content to end-users in a suitable information package*

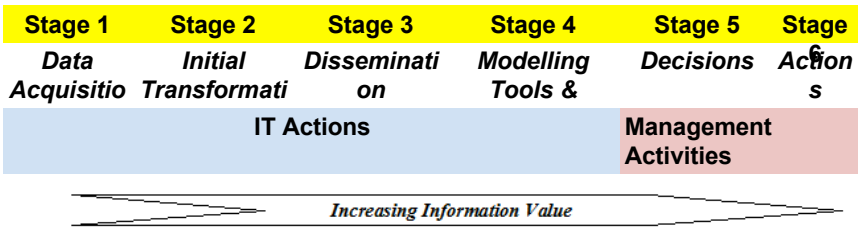
The Content Management Information Value Chain

according to Spataro & Crow (2002)

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Unstructured Data	***Structured Data***	***Contextual Information***	***Business Information***	***Knowledge***	***Active Insight***

Information Value Chain

according to Oelschlager (2004)



(MIVC) Management Information Value Chain
according to Phillips (2001)

Components of GI value

- Value of the location attribute – underpinning framework versus location of a feature itself.
- Time dependency value – stock prices, weather reports
- Value due to cost savings.
- Adding value via information management techniques and tools – formats, media, etc.
- Value due to legal or other mandatory usage requirements – “unfair monopolies”.
- Value due to network effects, i.e. added value because used by large numbers of people, a standard.
- Value due to quality of the information source – trusted providers

GI value to economies and society

- **Commercial** value – Daratech (2006) "in 2004, global geospatial data revenue was US$ 677 million, one-quarter of total forecast global market revenue of US$ 2.82 billion for the geospatial technology industry comprising software, data, services and hardware."
- 17% increase in market size experienced in 2005, to US$ 3.3 billion, was led by growth in data products.
- Government was the largest single sector, accounting for one-third of total revenue in the industry, forecast to produce revenues of US$ 3.6 billion in 2006 across all sectors.

GI value to economies and society

- **Economic** value – focusing on GI place- or location-based attributes, in relation to whole economies or as a component of the total market for all types of information or especially for public sector information, i.e. information collected by public bodies (Pira 2001, OXERA 1999).
- Studies tend to focus on added value for GI due to the ease of access to the information and ability of others to easily acquire and exploit public sector GI at minimal cost (typically cost of distribution only).
- Improving access to and exploitation of PSI in the UK could "double in terms of the value it (PSI) contributes to the UK economy to a figure of £1 billion annually." (APPSI, 2006)

GI value to economies and society

- **Socioeconomic** value – focus on the social impact of some sort of economic change, such as advances in information and communications technology (ICT), changes in intellectual property (IP) law or changes in government information access law or privacy laws.
- Socioeconomic impacts "... may affect patterns of consumption, the distribution of incomes and wealth, the way in which people behave (both in terms of purchase decisions and the way in which they choose to spend their time), and the overall quality of life."

GI value to economies and society

- By these definitions, most, if not all, public sector GI has **socioeconomic** value. It is necessary for governance of society and that is its primary legitimate use and rationale for collection using tax-payers' money.
- Commercial GI also has socioeconomic value or no one would pay for the products and services on offer.
- Many of the value added information products and services that industry produces are extremely important to society and directly or indirectly impact on how society functions.

Increasing the value of GI

- If you have not already done so, create and publish metadata, preferably using international standards, such as Dublin Core (ISO 8601) for discovery purposes, especially information that will help users – or in the future, automated search engines – identify appropriate uses for your information.
- Use industry-standard formats or mark-up languages, such as GML (Geography Markup Language) to make your data more accessible and easier to use in evolving new service architectures.
- Re-examine your access and re-use policies to see if relaxation of restrictive policies could in fact generate wider use and greater benefits, especially socio-economic benefits if you are a provider of public sector GI.

Increasing the value of GI

- Adopt technology and policies that increase prospects for interoperability of your datasets with others.
- Externalities that can lead to added value, i.e. events, changes or evolution in the information market itself, that could lead to increased value of your GI include wider adoption of standardised digital rights management (DRM) technology, including the mark-up and automated management frameworks or infrastructure that remove fears by data owners over loss of control of their intellectual property.
- “Data value can increase when users have the ability to see its potential when displayed with other available (atlas) layers.” (O'Dea et al 2004)

Restricting the value of GI

- Lack of (published) metadata so reduced ability to discover important data resources.
- “The current inability to confidently control the description, trading, protection, monitoring, and tracking of intellectual property rights has been a barrier to broader adoption of web-based geospatial data distribution. ... a vast amount of public geodata remains unavailable ...” Joffe & Bacastow (2005)
- Over zealous application of personal data privacy regulations can also restrict the value of information.

GI Markets Overview

- Global geospatial data revenue was US$ 677 million in 2004 = 25% of total forecast global market revenue of US$ 2.82 billion for the geospatial technology industry comprising software, data, services and hardware.
- Commercial value of data second only to software and well ahead of services and hardware sales.
- 17% increase in market size experienced in 2005, to US$ 3.3 billion, led by growth in data products.
- Government was the largest single sector, accounting for 33% of total revenue in the industry, forecast at revenues of US$ 3.6 billion in 2006 across all sectors.

All figures from Daratech report of 2006.

GI Markets Overview

- **Investment** value in European PSI was estimated at €9.5 billion per annum in 2000, and €19 billion per annum in the USA.
- In Europe, PIRA estimate that PSI **economic** value was €68 billion in 2000, compared to €750 billion in the USA.
- **PIRA estimated that the GI industry accounted for €36 billion of this €68 billion total (economic value for Europe).**
- **Investment value** is defined by PIRA as the investment in the acquisition of PSI.
- **Economic value** of PSI was "that part of national income attributable to industries and activities built on the exploitation of PSI … the value added by PSI to the economy as a whole".

All figures from "Commercial Exploitation of Europe's Public Sector Information", PIRA International, 2000.

GI market issues for smaller economies

- In virtually all countries, government use of public sector GI is still the largest single usage sector.
- A senior ESRI official recently (2007) stated that penetration of GI and GIS usage in government at all levels "had probably reached only 10% in the USA" and that ESRI saw this as an important growth sector in the coming decade.
- Many government agencies, even in strong economies, decry the cost of acquiring high quality GI, especially where they must pay to acquire that data from outside sources or even other government agencies. They are often forced to use lesser quality GI because that is all their budgets can afford.

GI market issues for smaller economies

- What about economies in which government agencies already face serious funding issues (i.e. budget deficiencies compared to what they believe they need to carry out their legally mandated tasks)?
- What gets funded first – an upgrade to the national health system, e.g. new scanners for hospitals, more doctors, etc. – or expanding primary and secondary education opportunities ...
- ... or committing restricted resources to acquiring higher quality Geographic Information?

GI market issues for smaller economies

- Even in strong regional (sub-national) economies such as Catalonia in Spain (population 10 million), with a highly advanced GIS skills base and relatively high GI-awareness amongst government officials - from local to regional levels – the commercial GI/GIS market size is limited and commercial vendors claim that even wider use of GI at all government levels is needed to spur on GI market development.
- In the UK, local government and federal agencies have enjoyed reduced cost 'service level agreements' by which they can acquire basic GI – i.e. national mapping data from the UK national mapping agency – because they found it too expensive otherwise – and went without.

GI market issues for smaller economies

- If it is true that 'there is no such thing as a free lunch' – i.e. all information has a cost – to collect, process, preserve and disseminate – even if some of those cost elements are small in comparison to other 'asset' costs ...
- ... then who pays for the lunch in small economies?
- How are senior decision makers – those who control national budgets – to be persuaded of the importance of GI to their economies and society in general?
  - Brings up the role of cost-benefit studies – which we shall investigate a bit later in the workshop.

Section Two

- SDI and Information Infrastructure
- SDI and e-Government

SDI and Information Infrastructure

- Spatial Data Infrastructure is first and foremost 'Information Infrastructure' – a fact that many in the GI community seem to forget – and that many others in the public sector seem not to be aware of!
- Information Society initiatives began in the early 90s – about the same time as many of the early(ier) SDI initiatives (USA, Canada, Australia, some European countries, etc.)

SDI and Information Infrastructure

- Information Infrastructure – as opposed to telecommunications infrastructure - has existed for some decades now, at least as far back as the early 1970s and some contend even the 1960s (digital II).
- Yet early Info Infrastructure was not characterised by the level of interoperability – and need for interoperability – that we see today.
- Standards bodies such as ISO have been important in/to the information industry...
- ... but then so have the de facto 'standards' setters, such as Microsoft – noting that Windows is not the subject of any international standards body.

SDI and Information Infrastructure

- Convergence and innovation are with us to stay – which is great news for innovators in the research and commercial sectors ...
- ... but not so good for those who must make long(er) term decisions on what form their information infrastructure will take over the coming decades.
- GI, GIS and ultimately SDI are affected just as much – perhaps even more so – than any other sector if the information market, e.g. explosion in growth in the 'location-based' industry for hardware (mobile devices), location-based services (navigation, advertising, etc.) – and content.

SDI and Information Infrastructure

- No Spatial Data Infrastructure exists in isolation from the broader Information Infrastructure – whether within a single organisation, or at any level of government.
- Within a single national 'SDI' – there are typically evolving thematic components – marine/coastal SDI, geological SDI, weather related SDI – which need to be developed in close(r) cooperation with both the NSDI and its overarching national Information Infrastructure.

SDI and e-Government

- We have already seen how important the PSI element of Information Infrastructure is to an economy – and to businesses who either build on PSI directly to produce commercial information products – or who benefit from use of such products and services, based on PSI to which value has been added by others.
- For most (all?) governments today, moving towards ‘e-government’ seems to be a major goal.
- Many such initiatives (most?) have missed targets or milestones set in the early to mid-90s, yet progress is steadily made as lessons are learned and barriers continue to fall.

SDI and e-Government

- Barriers that seem difficult to overcome tend to be political or organisational in some (mainly developing) nations.
- Yet technical infrastructure barriers still exist in many developing nation and small(er) economies, e.g. the degree to which the ICT infrastructure can support e-government initiatives and goals.
- Just as adequate Information Infrastructure (both hardware and ‘software’) are critical to success of e-government initiatives, the same applies to SDI.

SDI and e-Government

- In our consulting work with a number of national and regional (sub-national) governments, we have seen (far too often) a total (or near total) lack of cooperation between national e-government (and II generally) initiatives and programmes - and the GI community or others who should be directly concerned with implementing a robust SDI framework.
- Yet SDI concerns the same 'information' issues as II generally (with some added 'technical' considerations) – and should not be developed in ignorance of the wider Information Infrastructure within which that SDI will operate.

SDI and e-Government

- This leads to potentially added costs due to duplication of components in the SDI which are also needed for e-government implementations, e.g. user authentication schemes, information security and privacy management, payment schemes, etc.
- If the GI industry truly believes another of our urban myths – that "80% of all government data has a spatial component (location attribute)" – then it seems quite ridiculous to develop SDI in isolation from II and related e-government initiatives and programmes.

Section Three

- Economic impact indicators and assessment
- Role of industry and business in small economies

Economic impact indicators and assessment

- ***Economic Benefit Appraisal Toolbox*** (New Zealand Trade and Enterprise)
- Economic development = enhancing the factors of productive capacity.
- Key drivers for economic development strategies include enhancing the regions' capacity for growth and attractiveness to business activity targeted by the development strategy.

Economic Benefit Appraisal Toolbox

- The capability and productivity of the labour force through work force preparation and training programmes.
- Infrastructure - access to, capacity, and service of utilities (e.g. electricity, gas, water, steam, effluent, solid waste) as well as transportation and telecommunications.
- Business and community facilities such as business incubators, industrial / technology / science parks, schools / tertiary institutions, sports / tourist / leisure facilities).

Economic Benefit Appraisal Toolbox

- The physical and social environment, including cultural and entrepreneurial/innovation dimensions (e.g. clusters/incubators/industrial parks).
- Economic structure (depth and diversity / related and supporting industry), planning / regulatory environment and institutional capacity (leadership / knowledge).
- Note that GI or geospatial information plays an important role in many (most?) of these economy growth sectors.

Economic development versus growth

Economic development and economic growth are not necessarily the same thing:

- Development is qualitative, and entails change in the structure of the economy, including institutions, knowledge, behaviour, inclusiveness, and technology.
- Growth is a quantitative change in the scale of the economy in terms of investment, output (contribution to GDP), consumption, and income.

Community economic development

1. Stimulating a self-sustaining process of economic development.
2. Creating jobs at acceptable wages, with appropriate career paths for residents, with a special focus on groups that may face exclusion from society.
3. Producing goods and services that meet social needs, like affordable housing, lowered energy costs, better health care, accessible day care.

Community economic development

4. Greater community control, accountability, and participation in economic decisions.
5. Broadening business and asset (especially housing and financial savings) ownership within ethnic and poor communities.

- What is the role of GI – and SDI principles and practices – in helping to achieve such community-based economic development goals?

Role of industry and business in small economies

- The European Union for the past two decades or more has placed special focus on initiatives to support and foster growth of “small to medium enterprises” (SMEs) in a number of ways and programmes.
- Individual EU member states offer many financial incentives to SMEs, from outright investment, training and development grants to tax breaks (e.g. UK small businesses exempt from corporation tax under certain levels of profit).
- This is overt acknowledgement of the importance of such businesses to the economy, even in these large and well developed economies.

Role of industry and business in small economies

- Businesses have a key role to play in small economies, even micro enterprises.
- GI and GI-based services (especially location-based services) can directly benefit industry and business in increasing efficiency and reducing costs with a value far in excess of the impact that GI (data and information) sales revenue will generate for such economies.
- This is just one more reason that public sector GI (PSGI) should perhaps be subsidized by government at national level in order to increase socioeconomic benefits – even if these are difficult to quantify.

Framework for appraisal of economic benefits

Programme benefits:

- *Intangible or "soft",* i.e. building networks that encourage co-operation between firms, government agencies and individuals.
- *Tangible,* i.e. net increases in income or reduction in cost that are directly attributable to the project over and above the project expenditure.

Framework for appraisal of economic benefits

Credibility

- Include credible estimates of the impact and net benefits of projects. Potential tests include:
- Size of claimed benefits should be reasonable relative to the size of the project funding.
- Explanation of the rationale for linkages between a project and claimed benefits.
- Check benefit estimates for double counting.

Framework for appraisal of economic benefits

Credibility

- Assumptions should be expressed well, supported by facts where possible and believable!
- Consideration of what would happen in the absence of the project.
- Analysis of the sensitivity of the project to variations in the key assumptions.
- Accountability for the success for the project.

Framework for appraisal of economic benefits

Potential indicators of sustainability

- Plans for replacing Central Government funding with private sector funding after a pilot phase.
- Opportunities to re-employ project resources and management expertise released at various stages of the project.
- Retaining some of the benefits generated by the project to support future initiatives.

Framework for appraisal of economic benefits

Role of appraisal techniques - Common foundation

- All appraisal techniques have several common elements that are necessary for valid and informed appraisal. The key elements are:
- Identification of resources that can be re-allocated as part of the project.
- Identification of alternative decisions available especially the next most valuable use of the resource.

Framework for appraisal of economic benefits

Role of appraisal techniques - Common foundation

- Consistent identification and comparison of current and future benefits.
- Identification of all groups affected by the analysis.
- Assessment and management of risk.
- Close linkages with the project plan.
- Regular monitoring of progress.

Framework for appraisal of economic benefits

General issues to be covered

- Alternatives (to the proposed investment)
- Comparing costs and benefits – apples and oranges?
- Honest assessment of resources available
- What groups are affected – have they been consulted?
- Risk assessment!