How to Avoid National Spatial Data Infrastructure (NSDI) Cul-de-sacs

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SUMMARY

If the benefits of the wider usage of geo-spatial information within countries are to be realised then good quality and current geo-spatial information must be widely available to all stakeholders, easily accessible and interoperable with business information, applications and services. The National Spatial Data Infrastructures (NSDIs) currently being implemented are not achieving all these objectives due to inhibitors such as incompatible business models adopted across government and difficulties in forming partnerships across stakeholder communities. If the vision of pervasive geo-spatial information is to be achieved then countries need to remove inhibitors and enable the much wider exploitation of geo-spatial information across the public, private and voluntary sectors.

The challenge is to formulate NSDI strategies that: are supportive of the existing local Geographic Information initiatives; provide the wider information requirements of the Regional SDI; are compatible with public and private sector cultures; are enthusiastically supported by the wide range of stakeholders; create a model for voluntary participation and cooperation in a federated political situation; can be implemented; are driven by the application of data and not just the creation of data itself; and enable significant economic, social and environmental benefits in the short as well as the longer term.

The paper provides guidance on how to eliminate current NSDI inhibitors and create a new generation of NSDIs that will realise the expected benefits across all stakeholder communities.

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1. INTRODUCTION

The importance of geo-spatial information in the management of today's modern society is recognised by the majority of the developed nations and a number of emerging nations. This is evident from surveys [Onsrud, 2001] on Spatial Data Infrastructure (SDI)[1] implementation in various countries. These surveys revealed that more than half of the nations of the world have undertaken some form of initiative to better access and disseminate their geo-spatial information. Decision-makers have realised that geo-spatial information is a useful tool in the enablement of the information society, crucial in the provision of good governance, environmental and social management, and a useful tool to support economic growth.

If the benefits of the wider usage of geo-spatial information within countries are to be realised then good quality and current geo-spatial information must be widely available to all stakeholders, easily accessible and interoperable with business information, applications and services. Despite the existence of NSDIs in many countries, this is not currently the situation due to inhibitors such as weak governance, incompatible business models adopted across government and difficulties in forming partnerships across stakeholder communities. If the vision of pervasive geo-spatial information is to be achieved then a new generation of NSDIs is required to remove these inhibitors and enable the much wider exploitation of geo-spatial information across the public, private, voluntary and academic sectors and by the citizen.

The most recognisable technique to make geo-spatial information more readily available in spatially enabled business applications and services is through an SDI. This should have the following components [adapted from Giff & Coleman, 2003] and is illustrated in Figure 1:

- Policies / legal framework governing the sharing of geo-spatial information;
- A coordinating body, with sustainable funding;
- Resource capacity to effectively sustain and exploit the SDI;
- Framework and thematic geo-spatial information;
- Component geo-spatial information services to build business applications and services to leverage benefits from the SDI;
- A mechanism for identifying and accessing geo-spatial information and component geo-spatial information services;
- Standards (systems and information) to ensure interoperability; and
- A supportive research and development agenda.

[1] "…*integration of datasets, policies, standards, institutional arrangements, human resources and the technical issues necessary to facilitate the dissemination of current and well defined spatial data throughout a nation, region or the information society in general* [Giff & Coleman, 2003].

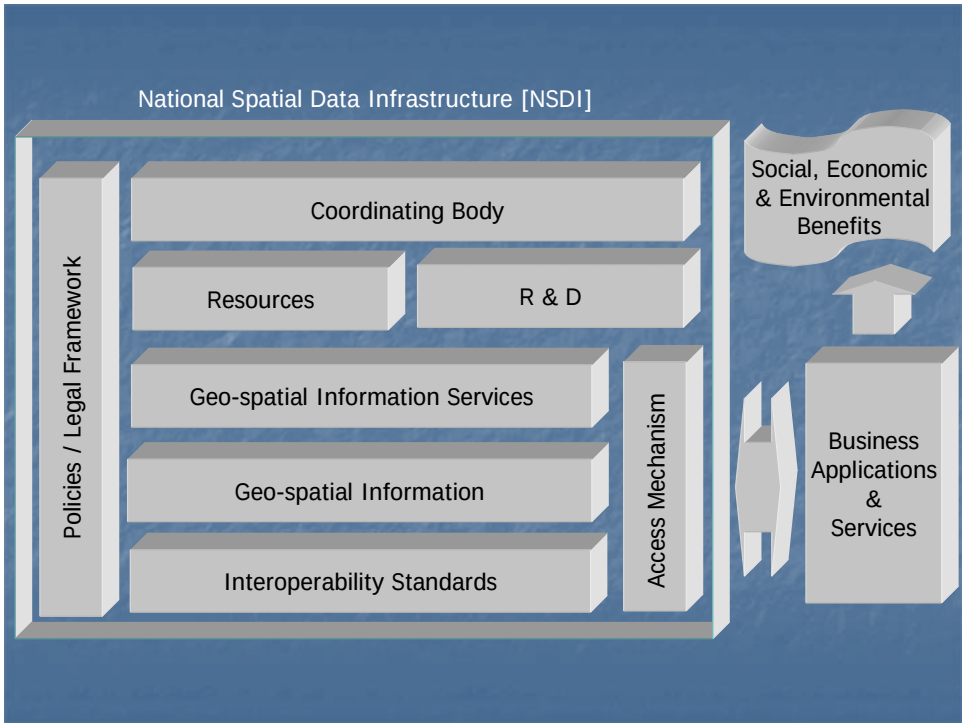

Figure 1: Components of a NSDI

The current generation of NSDIs have these components in some form. However, a number of key inhibitors are restricting the use of the NSDI to deliver meaningful benefits and directing NSDIs towards an inevitable cul-de-sac. This paper discusses the opportunities for removing these barriers and creating a new generation of NSDIs that are inclusive and diffused across wider stakeholder communities. This new generation of NSDIs would be characterised by:

- A process based model rather than a product based model;
- A services oriented architecture;
- A model for voluntary participation and cooperation in a federated political situation across the public, private and voluntary sectors;
- Access, connectivity and interoperability;
- Driven by the business use / application of information and not the information;
- Socio-technical viewpoint that is inclusive, with a rich, broad view of the beneficiary communities; and
- Benefits more holistic and measured in environmental, economic and social terms rather than simply through productivity efficiencies and information sharing.

2. REMOVING THE INHIBITORS

The current generation of NSDI have inherent weaknesses in their design and operation that will limit their usefulness and ultimately reduce the delivery of their potential benefits. The following sections highlight these deficiencies and provide guidance for their potential

mitigation.

2.1 Governance

The governance of a NSDI normally undergoes a transition as it matures, as illustrated in Figure 2. At the start, a single organisation, in most cases the National Mapping Agency, is the dominant player and leads the early adopters involved in NSDI. However, as the NSDI diffusion increases and more diverse stakeholder communities are involved in supplying and exploiting geo-spatial information then this governance model is challenged and fragmentation normally takes place. The role of the National Mapping Agency is often pressurised into just being a geo-spatial information supplier as other new, prominent stakeholders involved in delivering geo-spatial information based services gain prominence and power.

A new shared leadership model of governance is required to include the increasing number and diversity of stakeholders and fuel the diffusion and associated benefits. A model encompassing the public, private and voluntary sectors is essential. Without this transition, a consistent NSDI strategy will not be implemented and significant benefits will be lost. The shared governance model must involve a strong, recognised leader, must be empowered to invoke change through political support and provide clarity on the roles and responsibilities of the stakeholders.

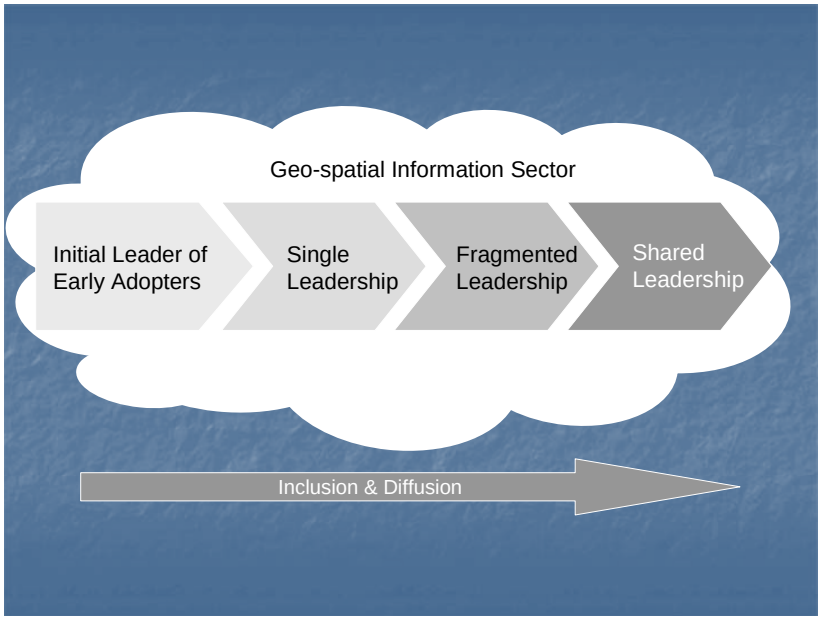

Figure 2: NSDI Governance Transitions

2.2 Services Centric Strategy

The underlying principle of a NSDI is to provide users with the ability to identify, access and exploit geo-spatial information. This is achieved in varying degrees by today's NSDIs. At

one end of the spectrum, users simply have access to geo-spatial data with no inherent intelligence for cross referencing with other geo-spatial data and no tools to build geo-spatial data into services. In the middle of the spectrum, NSDIs are evolving to provide geo-spatial information where the data is structured into meaningful, end user objects and information interoperability is achieved through providing a common referencing framework [Ordnance Survey, 2004]. However, the new vision is one of a NSDI providing a service oriented architecture where geo-spatial information services are accessible to service providers to chain and build value added services and are accessible to end users. A good example of this approach is the 'Norway Direct' initiative within the Norwegian public sector [European Commission, 2005] where ISO and Open Geospatial Consortium standards have been mandated and fully embraced. This transition towards a services centric NSDI is illustrated in Figure 3.

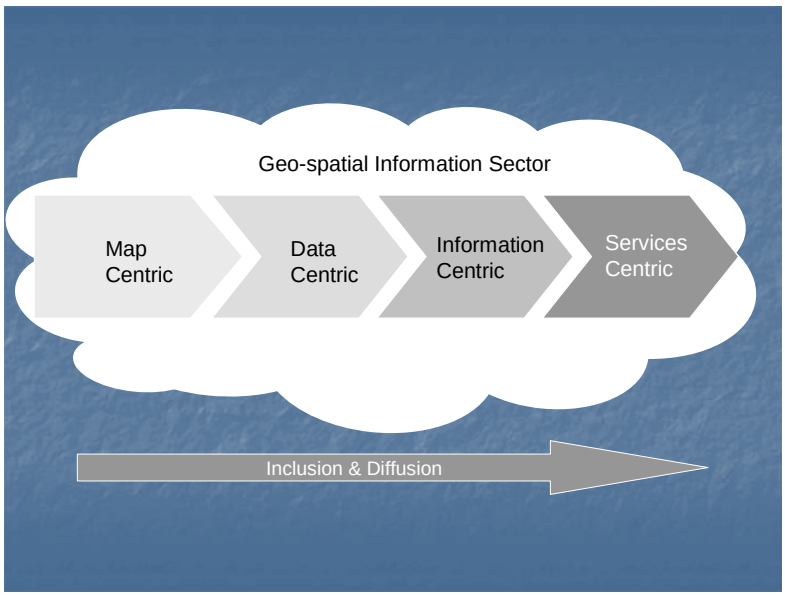

Figure 3: Strategic Transitions Towards a Services Centric NSDI

2.3 Strategic Scope

A significant number of the existing NSDIs are public sector oriented and do not sufficiently include other private and voluntary sector stakeholders in managing and exploiting NSDIs. This short term view is normally artificially imposed by unresolved issues of geo-spatial information licensing, lack of a digital rights management solution and the inability of the public and private sectors to work in partnerships due to the diversity, and occasionally conflicting, business models within the public sector. This narrow approach may be a convenient first step in the evolution of NSDIs, but full engagement with a diverse range of stakeholders is a prerequisite for the full exploitation of a NSDI.

The initial beneficiaries of NSDIs also tend to be in the public sector and focus on efficiency gains in service delivery. Although a quick win to secure funding, a broader base of beneficiaries must be established across the social, economic and environmental domains.

Another restriction in the scope of NSDIs is in the range of geo-spatial datasets available. A typical approach is to create a definitive set of geo-spatial datasets to populate the NSDI, normally provided by the public sector. This approach limits the types of geographies supported, e.g. topographic, address, roads, small area, tenure, and restricts the provision of alternative and competitive products in the market. Each stakeholder community has a different model of the world and requires appropriate geo-spatial datasets to support their model. This diversity of geo-spatial dataset products must be an aspiration of NSDIs.

NSDIs are also perceived to be repositories for 'formal' geo-spatial information either produced by the public sector or under contract by the private sector. However, the availability of commodity data capture technologies, e.g. satellite navigation systems, and new information publishing environments, e.g. mash-ups, provide individuals and organisations with the ability to capture and publish 'informal' geo-spatial information. This source of 'informal' geo-spatial information will increase in significance over the coming years and needs to be accommodated within NSDI strategies.

2.4 Business Case

Given the significant size of the investment required to create and maintain NSDIs, it is surprising that so few robust business cases exist to justify this investment. Business cases are essential to secure political support and funding and to monitor the benefits realisation. Rather than just focusing on efficiency gains for the public sector, it is essential that a more holistic approach is adopted that identifies benefits across economic, environmental and social domains. This requires a wide range of stakeholders to be engaged .

Rather than creating a NSDI strategy that is a neutral enabler and hoping that the NSDI will support current political initiatives, the NSDI strategy should be 'issues' based and directly support political initiatives that are a priority. This approach of supporting and complementing major political initiatives will lower the risk associated with obtaining direct funding and hit the right political buttons to engender ongoing political support.

2.5 Business Model

In many NSDI environments, the adopted business model excludes a major section of the stakeholder communities from significant commercial involvement.

One of the critical success factors for the implementation of NSDIs is the associated business model. If the business model is well designed then considerable economic value can be generated both for participants in the value chain and society at large. All stakeholders in the public and private sectors should have clear responsibilities and opportunities to participate in the value chain. Examples of these business models built on relationship development, strong

partnership building and cooperation can be found in Australia at the Public Sector Mapping Agencies (PMSA) [Paull, 2003] and Norway Direct [European Commission, 2005].

2.6 Communication Strategy

The Geomatics profession has normally been involved at instigating NSDIs and has been very good at selling the concept to themselves. Unfortunately, these Geomatics oriented visions and benefit statements use language that is often inappropriate for a wider range of stakeholders and normally turns them off rather than on. It is essential that NSDI related messages are tuned to the seniority level and professional perspective of the stakeholders, and provide practical examples of geo-spatial information in action within their professional domain. The communication strategy should be continually reviewed and updated to reflect the dynamic nature of political initiatives and the changing priorities.

2.7 Capacity Building and NSDI Exploitation

One of the potential bottle necks in implementing a NSDI is the lack of appropriate human resources available to effectively exploit geo-spatial information and associated services. The level of skills and expertise must be increased to build capacity to support and sustain the implementation and exploitation of the NSDI as the diffusion process takes place.

A programme of capacity building should be designed and implemented in the short and long term. This could include:

- Embedding geo-spatial skills into the primary and secondary education programmes;
- Working closely with the academic community to ensure that there are sufficient graduates with the appropriate skills (this should place emphasis on the exploitation of the NSDI);
- Enabling the provision of training courses for non-Geomatics professionals to ensure that they can become more self sufficient in managing and exploiting geo-spatial information. This is closely linked to the communication strategy; and
- Parachuting geo-spatial skilled personnel into new application areas to mentor and transfer skills.

2.8 Measuring Success

It is essential that a performance measurement framework is established for a NSDI. This framework will measure progress of implementing and exploiting the NSDI against an agreed set of targets and allow the various levels of governance to continually monitor progress and ensure that the strategic priorities and associated resources are targeted to the most appropriate areas.

3. CONCLUSIONS

The current paradigm supporting the current generation of NSDIs is not sustainable. It is essential that future NSDI initiatives are service oriented, engender diffusion and inclusion across a diverse set of stakeholders and ensure that the benefits are realised across all the social, economic and environmental domains. Although there is no single model for a successful NSDI, all are different and reflect the varying cultural, institutional and political contexts, the following critical success factors provide guidance on how to avoid these potential cul-de-sacs:

- Introduce a shared governance model amongst the stakeholders that will provide strong leadership, involvement and support. Without this, there will be a high risk that the objectives of the NSDI strategy will remain unfulfilled.
- Encourage effective partnerships among the public, private, voluntary and academic sectors. Be inclusive, wherever possible, and encourage shared services.
- Cooperate with the stakeholders governing and implementing the regional SDI strategies within the country and gain from their lessons learned.
- Sustain a strong communication strategy to ensure all stakeholder communities understand what is happening, why it is happening and how they can support the initiative.
- Create a robust business case that identifies a wide range of economic, social and environmental benefits, rather than just supporting a few stakeholder communities, and an associated performance measurement framework to monitor the benefits realisation.
- Design a NSDI that directly supports political initiatives and obtain joint funding wherever possible.
- Introduce a capacity building programme to ensure that sufficient and appropriate human resource capacity is available to create and exploit the NSDI.
- Clarify the proposed scope of the NSDI over time and obtain funding and resources to support the implementation plan.
- Provide clarity and transparency of the underlying business models to the stakeholders and simplify the licensing of geo-spatial information wherever possible.
- Intervene to change the underlying principles of the NSDI. Evolution does not always generate the desired outcomes in the NSDI arena.

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BIOGRAPHICAL NOTES

Robin McLaren is director of Know Edge Ltd a UK based, independent management consulting company formed in 1986 specialising in optimising the business benefits of geographic information and services. Robin has been at the forefront of the GIS revolution and is recognised as a world expert in Land Information Management and has worked extensively in Eastern Europe and world-wide to enable NSDI developments and to strengthen land tenure to support economic reforms. Know Edge Ltd recently won the tender to develop a UK Geographic Information Strategy and Robin heads the consortium delivering this strategic framework.

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