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The Impact of Global Change on the Future of National Mapping Agencies

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Abstract

The conditions prevailing when National Mapping Agencies (NMAs) were created and under which they have operated for over 100 years have changed significantly in the past decade. The rate of change is continuing to gather pace. New technologies are being introduced, competitors are entering the market, economies are different, and political landscapes are not the way they used to be. All of this means that NMAs must re-evaluate their missions and establish clear visions for their role and mode of operation in the 21st century. NMAs have to make the transition from government department to commercial business if they are to survive.

Introduction

The oldest National Mapping Agencies (NMAs) began their existence over 200 years ago and many were initiated well before World War I (Rhind 1997). The concept, rationale, mode of operation and economics of NMAs originated in an era substantially different to that of today. The early tasks of providing an inventory of national assets, maps for navigation, or a framework for conducting military operations, have largely been rendered redundant by recent political, economic and technical developments. In the words of Hadley (2003) “the discipline of military doctrine was hugely successful in the earlier years with strict processes and consistent controlled procedures creating products renowned for their detail and accuracy, the legacy of that approach has left organizations that are seen as inflexible, bureaucratic, and slow to respond, with a lack of clear focus on the evolving requirements of today’s customers. In short they are seen as difficult to do business with. Being in a monopoly position in the past may possibly have made them complacent, arrogant, and out of step with the customer’s changing needs.”

Today there is not one type of NMA, rather there is a complex collection of organizations focused on a mixture of activities spanning military/civilian applications, framework/cadastral data, public/private business models, regulated/de-regulated markets, developed/developing economies, and technically advanced/naïve users. In spite of this diversity the challenges and threats posed by global change are ubiquitous in their distribution, if not in their impact.

The challenge of transition from government department to private business, which all NMAs face, and many have already have embarked upon to a greater or lesser degree, means that we must think and talk about NMAs as businesses. The customers are no longer national government departments, but a mixture of departments, companies and citizens operating in both the public and private sectors. The lexicon of NMA Director Generals (now CEOs) now must include ROI (Return on Investment), cost-benefit analysis, risk, change, leadership, entrepreneurship, brand management, etc.

Beginning with an examination of organization change, the paper will examine the major global externalities that impact organizations and their implications for the very futures of NMAs.

Change, Innovation and Improvement

The history of human endeavor is a history of change, improvement, innovation and adaptation to new circumstances. Any individual or organization that is unable to see, understand and embrace changes in its environment will be rendered uncompetitive and will wither and ultimately die. In the 21st century all businesses – public and private – need to function in an environment of uncertainty, to adapt to change and to constantly re-engineer themselves; their very survival depends upon it (Balle 1995).

Anyone, of course, can be wise after the fact and it is simple and straightforward to look back over the past hundred years and identify and assess the origins and impacts of major changes on organizations: Frederick Taylor's 'principles of scientific management', Henry Ford's development of 'modern manufacturing lines and a car for everyone', Albert Sloan's application of Ford's ideas to management and the 'divisionalized corporation', Akio Moriata's global branding of Sony, and Tim Berners-Lee's World Wide Web that facilitated 'global information sharing' (Hammer and Champy 1993, Lansdell 2002). In the maelstrom of fast-paced, competitive business with many scales of change overlaid and interlaced, it is seldom possible for even the most astute leadership team to identify and determine the magnitude of impact events at their origins or any single point in time. That said, the leaders that wait until major trends are proven and major technologies are robust and reliable, and capable of showing a significant return on investment, will be left trailing in their competitors' wakes. Taking risks is an important and necessary part of being a leader.

Technological, Economic and Political Changes

Technology changes have always been a part of the NMA world. However, in the last few decades the rate of change has accelerated at an increasing and for some alarming rate. These changes impact traditional data collection, management and delivery activities, but also they require a re-think of long term assumptions about operations, markets and competitors.

The NMA world of separate independent departments responsible for field surveying using stand alone analog instruments, manual map compilation, and hard copy printing has been consigned to the history books. In its place is a new order of all-digital, integrated systems which execute transactions on an enterprise spatial database (Figure 1). Field data collector personnel now routinely use affordable, electronic total stations and GPS devices that can rapidly collect highly accurate data, and provide in-field validation (Longley *et al.* 2001). The manual map compilation process has been rendered obsolescent by COTS (Commercial-Off-The-Shelf) software copy photogrammetry and GIS-based WYSIWYG (What-You-See-Is-Way-You-Get) editor/map production workstation systems. The hard copy paper map has been replaced in the majority of cases by electronic delivery of digital data extracted from master databases, and increasingly, this is giving way to on-line direct access to databases over the Internet. Forward thinking NMAs are beginning to realize the benefits of reduced data collection, management and delivery costs, improvements in data coverage and quality, faster collection and revision cycles, and the consequent opening up of new markets.

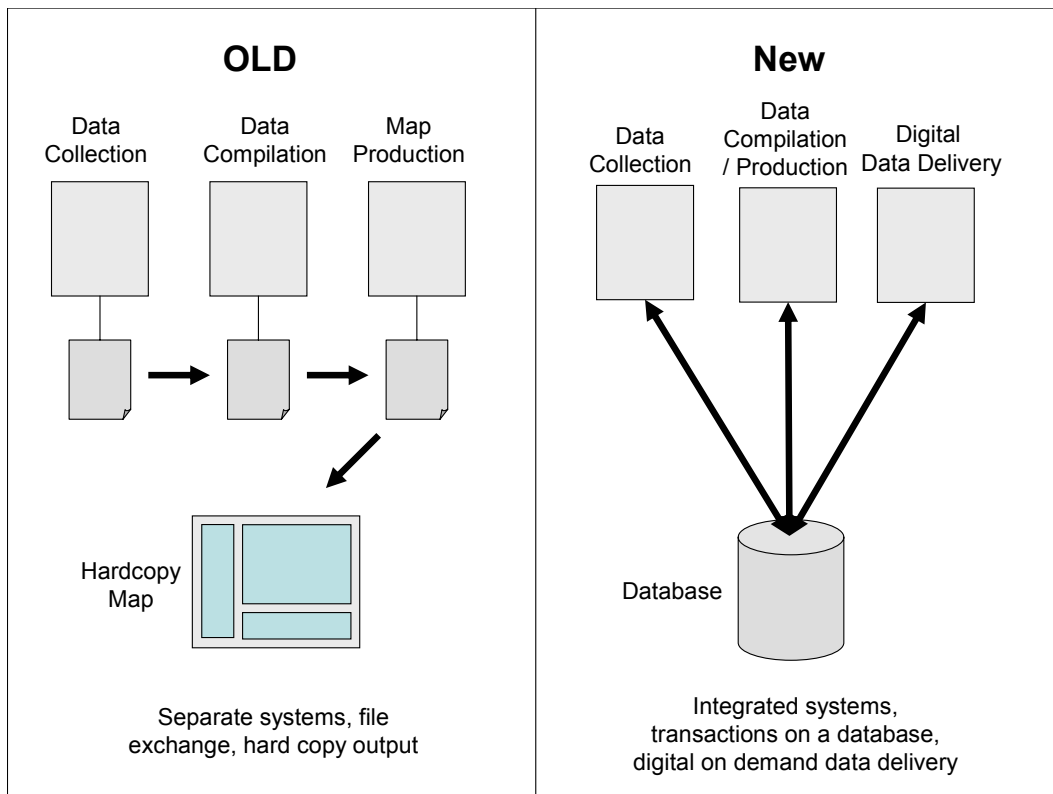


Figure 1: NMA data collection, management and delivery: Old and New.

Changing technologies have also had an impact on NMAs through their effect on the democratization of Geographic Information (GI) collection, management and delivery. Twenty years ago NMAs were able to sustain a monopoly on GI in their market (usually a country) simply because the cost of entry to the market was so great¹. The advent of comparatively low cost high resolution satellite imagery and aerial photography, as well as the availability of vector and raster databases collected for military and car navigation purposes has substantially reduced the cost of data collection. The introduction of commercial off the shelf, standards-based, easy to use GIS software has made the complex task of data management much simpler, and advancements in network bandwidth, connectivity and access has revolutionized the delivery of data. In short it is now technically and financially possible to create, maintain and sell on-line access to a medium to large scale (1:100,000 to 1:5,000) national map database that effectively competes with, at least part of the work of NMAs. This is happening, for example, in France, India, the US and the UK.

¹ In practice there were also legal barriers preventing competitive entry in many cases. For example, in the UK the Ordnance Survey has a copyright on the National Grid (the national spatial reference framework)

The biggest and most significant external global impact on NMAs in the past decade has been the development and widespread acceptance of the Internet. At one level the Internet has revolutionized communication (email) and marketing (web sites), at another it has changed forever information searching (search engines and metadata portals (e.g. the US government Geospatial One Stop portal www.geodata.gov, the privately funded Geography Network www.geographynetwork.com, and the UK Ask Giraffe GI Gateway www.askgiraffe.co.uk)). At the same time it has ushered in the era of e-business. Today we live in an economy where the tyranny of distance can be overcome electronically (users do not know and do not care whether a web site is in their town or is several thousand miles away, and buyers do not need to leave their desk to make and receive purchases), where the cost of building an electronic store front is a fraction of the cost of a 'bricks and mortar' store, and where purchasers can easily garner and compare product information. The disintermediation (removal of the middleman) effect of the Internet has both reduced costs (which can be passed on the purchaser) and speeded up the delivery of purchases. In this digital democracy highly focused, fast moving organizations, with low overheads can easily and effectively compete with general purpose, slow to react organizations with high cost structures.

Globalization

The idea of market globalization – the homogenization of national and continental markets – was introduced over 20 years ago (Levitt 1982). In this view, old style multinational corporations are replaced by large companies that view the world as a single global market, producing and selling the same product everywhere. This establishes *de facto* standards and, through economies of scale, reduced prices and accelerated innovation.

The experience of the last decade, however, has taught us that there is really no such thing as a truly global organization operating in a homogenous market. All markets are different to some extent and organizations need to accommodate variations in cross cultural understanding, international relationships, work force diversity, ethics, multi-cultural communication, and technology and business standards, to name but a few important topics. This is especially true of the GIS industry which, at least at the data sector, is by definition focused on characterizing the specific characteristics of local phenomenon. Each country has its own market dynamics, its specific applications and standards.

At the same time, the reduced costs of market entry described earlier mean that new players can pick off the most lucrative areas of business and compete against static general purpose organizations. To illustrate how things have changed in the last 25 years consider the case of global mapping.

In 1990 when the only global maps were small scale paper charts, the US military mapping agency (National Imagery and Mapping Agency (NIMA) – then called DMA) commissioned production of a 'digital chart of the world' at 1:1m scale. This was produced by vectorizing paper maps. The 4 GB database was made freely available with viewing software and in GIS software compatible formats. In 2003 ESRI will effectively provide for free a global image map at 150m pixel resolution. The single continuous global image was created from commercial satellite imagery and can be used to create regional maps at approximately 1:250,000. This global data set will be accompanied by 15m resolution true color image databases for the continental US and Europe which can be used for mapping at scales up to 1:65,000. The US data set is 175 GB uncompressed/10 GB compressed. Its is possible to foresee integrated databases containing global street centerlines and addresses in the near future.

Discussion and the Future

It is clear that NMAs now live in rapidly changing and uncertain times. It should also be evident that NMAs must regard themselves as businesses, irrespective of their formal status as public, public/private, or private organizations. There are competitors at the local, national and global levels who can compete effectively in selected market areas. Currently the most competitive areas are those based on address, highway/street centerlines databases, and small and medium scale vector and image basemaps of urban areas. Competition is also increasing in the provision of land parcels, digital terrain models and cadastral/land information.

The new NMA economy requires a new 'Just in Time Geography' approach. An approach in which the most up to date data, for the requisite area of interest can be obtained and paid for on demand. The means to provide electronic access, delivery and charging are certainly available today, and demand is increasing as the proportion of computer-literate people in the market place continues to rise.

There are several ways in which NMAs can respond to these challenges:

- Ignore the threat and concentrate on the national interest mapping tasks of completing pre-agreed mapping programs (for example, complete creation of national map series).
- Protect their markets using legislation (for example India and China still prohibit the sale of high resolution commercial imagery in their countries).
- Compete by adopting new technologies, on-line delivery and sales mechanisms, by becoming aware of program profitability and slashing costs, and by focusing on market led activities.
- Develop new markets by raising awareness of the value of GI, creating new closely targeted products that mine existing databases (e.g. tourist maps derived from medium scale map series, on-line travel web sites developed from large scale map databases).
- Form alliances with other commercial organizations to create joint ventures that leverage NMA strengths of existing databases, high quality production flow lines, brand awareness, etc.

Just as understanding the impacts of global change are difficult to assess, so too are the strategies for changing the way organizations respond to the new world order. Tough it may be, but the alternative is even worse. After assessing all the technical and economic hype and doomsday prognostications, it is useful to remember that customers still want value for money, and that in the expanding GIS industry there will continue to be a market for good GI products, that are well engineered and clearly presented. NMAs must compete by offering valued added maps and digital data products that are well documented and in a direct use format that avoids the need for lengthy and difficult translation into target software systems.

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