

Sustainable Mapping Provision in Developing Countries – Getting it together, the Geography Jigsaw

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Key words: Sustainable mapping, best practice guidelines, geospatial data maintenance.

SUMMARY

Many countries take for granted the fact that their neighbourhoods, towns and country are unambiguously described and maintained as geospatial datasets that are easily accessible. These datasets are regarded as one of the fundamental infrastructures that underpin modern economies and societies. There are many countries today where up-to-date geospatial data is inaccessible and their moves toward a National Spatial Data Infrastructures (NSDI) do not yet address the issue of how fragmented data sources can be brought together. Many areas of the world lack the fundamental map based infrastructure that the developed world takes for granted. Mapping based services are seen to be a crucial part of the delivery of the sustainability agenda being developed as part of the UN Habitat agenda. The UN and others are providing some support in this area, though they have not harnessed the appropriate level of funding required to address the basic issues. Solutions are not straight forward and any support provided has to address the ongoing sustainability of the mapping base.

This paper sets out to explore the issues that lie behind the need to undertake this research and examines in detail the findings that provide a variety of ways in which the situation can be improved. One important factor is the need for mapping and GI professionals to be able to understand their customers' needs and to deliver solutions which are cost effective and make sensible use of new technologies where relevant.

This paper relates closely to the work undertaken by FIG in the production of "FIG Publication 31 - Land Information Management for Sustainable Development of Cities" and provides an approach which, if adopted, will promote a valuable contribution toward the provision and maintenance of geospatial data in the developing countries.

RÉSUMÉ

Beaucoup de pays considèrent le fait que leurs quartiers, villes et pays soient décrit sans équivoque et maintenu comme les fichiers de données facilement accessibles comme allant de soi. Ces fichiers de données sont considérés comme une infrastructure fondamentale qui est à la base des sociétés et économies modernes. Aujourd'hui, beaucoup de pays ont leurs données géospatiales précises inaccessible et leur progrès vers une infrastructure des données spatiales nationales (IDSN) n'abordent pas encore la question du rassemblement des informations fragmentées. Plusieurs régions du monde manquent d'infrastructures fondamentales basées sur les cartes dont les pays développés considèrent comme allant de soi. Les services de cartographie jouent un rôle essentiel dans le programme sur la durabilité

et du programme pour l'habitat de l'ONU. L'ONU et autres fournissent aides et soutien dans ces secteurs, bien qu'ils n'aient pas le financement approprié pour aborder les questions rudimentaires. Les solutions ne sont pas simples et le soutien fourni doit aborder la question de la durabilité continue de la cartographie.

Ce rapport a pour but d'étudier les questions qui provoquent le besoin d'entreprendre cette recherche et il étudie en détail les conclusions qui fournissent des solutions avec lesquelles on peut améliorer la situation. Il est important que les professionnels dans ce secteur puissent comprendre les besoins de leurs clients et livrer des solutions rentables, en utilisant des technologies nouvelles judicieusement.

La RICS et la Fondation de la RICS ont financé cette recherche pour trouver des moyens d'améliorer notre compréhension des processus et des procédures pour le soutien de l'infrastructure de la cartographie dans les économies en développement et transitoire.' Les auteurs sont assistés au Sommet Mondial sur le Développement Durable à Johannesburg où il a été traité de questions proposées comme un résultat de recherche dans le contexte des programmes du Type 2. Les résolutions finales de la conférence ont beaucoup de mots excellents, avec quelques allusions directes à l'infrastructure de la cartographie. Ces mots doivent être consolidés par des mesures concrètes, auxquelles nous pouvons contribuer. Toutefois, il y a aussi un manque de la volonté politique et à moins qu'un soutien fort ne soit disponible, le résultat sera un développement fragmentaire des fichiers de données incompatibles avec soit des inefficacités cachées dans beaucoup d'organisations, soit un gaspillage considérable des ressources avec une duplication d'effort.

Ce rapport est étroitement lié au travail entrepris par la Fédération Internationale des Géomètres (FIG) dans la production de «FIG Publication 31 – Land Information Management for Sustainable Development of Cities». Si adopté, cette approche promouvra une contribution de valeur envers la mise à disposition et le maintien des données géospatiales dans les pays en développement.

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1. INTRODUCTION

In many countries we assume that we can accurately and unambiguously describe our neighbourhood, our towns and our country with maps or spatial data. We can use this to define who owns what and where our boundaries lie. It is almost impossible to imagine life without being able to do this. Spatial knowledge about location underpins almost every aspect of a modern economy and society. We do this using maps, and more and more digital spatial data that are both accurate and are kept up to date.

However, up to date mapping and accurate digital data is not something that can be taken for granted across the world. While huge amounts of aid are lavished on major development projects very little of this is directed at the provision of the fundamental infrastructures that underpin modern economies and societies – up to date spatial data.

RICS Geomatics Faculty and the RICS Foundation were concerned that little attention was being given to the mapping needs of developing countries and commissioned research to look at: *“improving our understanding of the processes and procedures available for the support of mapping infrastructure in developing and transitional economies”*.

The result of this research is a publication entitled “Getting it together – the geography jigsaw”. This is available in English and French in hard copy and is downloadable in pdf from the RICS web site (www.rics.org).



Figure 1: Getting it together - the geography jigsaw

The initial findings of the research, '*Getting it together - the geography jigsaw*', were made available at the World Summit for Sustainable Development (WSSD) in Johannesburg (2002) where the ideas proposed as a result of the research were discussed in the context of Type 2 agendas. The final Johannesburg conference resolutions addressed a wide range of important issues, including some directly alluding to mapping infrastructure. However, the words need to be followed up with well directed actions to which we can all contribute.

One could argue that there is a general lack of political will to do anything about the situation and unless high level backing is forthcoming the result will be a piecemeal development of unstructured and incompatible datasets with hidden inefficiencies in many organisations. There is, at many levels, a need for increased awareness and co-ordination in order to avoid considerable waste of resources and duplication.

2. SUSTAINABILITY

The United Nations defines a sustainability society as one which: “meets the needs of the present without sacrificing the ability of future generations to meet their own needs”, and Sustainable Development is: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland 1992,87). Sustainability is much more than signing up to a concept, it has essential financial and social connotations that can not be ignored if we are to provide a safe and secure world for future generations.

As Gerhard Muggenhuber, Chair of FIG Commission 3 wrote in the FIG Article of the month September 2003 - “Good decisions are based on good information. Good information is based on good data. The demand for spatial information for decision-making can be considered from different perspectives. First and foremost, the process of decision-making requires information as an input (informed decisions). Secondly spatial information is needed for impact analysis. As is well known, decisions have a range of immediate up to long term impacts. In all cases, the consequences of decisions must be predicted and controlled. Especially development processes require monitoring and evaluation of the decision’s outcome. This is the reason why the increased need for spatial information is becoming a challenge for people who are involved in decision making with spatial components.

Data collection and data analysis have contributed to an improved understanding of social and environmental impacts on planning and development actions. With new surveying, communication and information technologies decision-makers have more spatial information and thus accountability on the interrelationship of communities, impacts and effects of decisions. Finally the decision-makers have a powerful instrument for future developments.”

Following good practice and embracing the concepts of sustainability assume that the data is up to date and fit for purpose - what then should be made of the term ‘Sustainable Geomatics?’

3. SUSTAINABLE GEOMATICS

Sustainable Geomatics has only recently been conceptualised though it has existed in embryonic form for a number of years without being defined. Sustainable Geomatics is a concept that maximises the use of geospatial data in developing countries and reduces the costs of acquisition and collation.

RICS members in many parts of the world expressed a need to help with understanding the current environment in which ‘mapping’ needs to be provided to countries in development. This is very different from the situation of 20 years ago when large bi-lateral aid packages were churning out maps for the developing world albeit often prompted in both East and West by ‘cold war’ considerations. This concern prompted RICS to commission research to look at: *“improving our understanding of the processes and procedures available for the support of mapping infrastructure in developing and transitional economies”*.

3.1 Research

Today we have dramatic improvements in the quantity of raw data available from aerial and satellite remote sensing as well as much more sophisticated methods for handling this raw data and interpreting it for a wide variety of end users. But if you ask for an up to date map of a Caribbean island or of an African city you may get a tourist map (if it is a tourist area) and, if you know where to go, you may get an aerial photo mosaic or a satellite image. But ask for a map with settlement names, road numbers and a consistent interpretation of ground features for administration purposes and you will most likely get, at best, a 20 year old map with no updates and with a grid that is incompatible with modern GPS equipment.

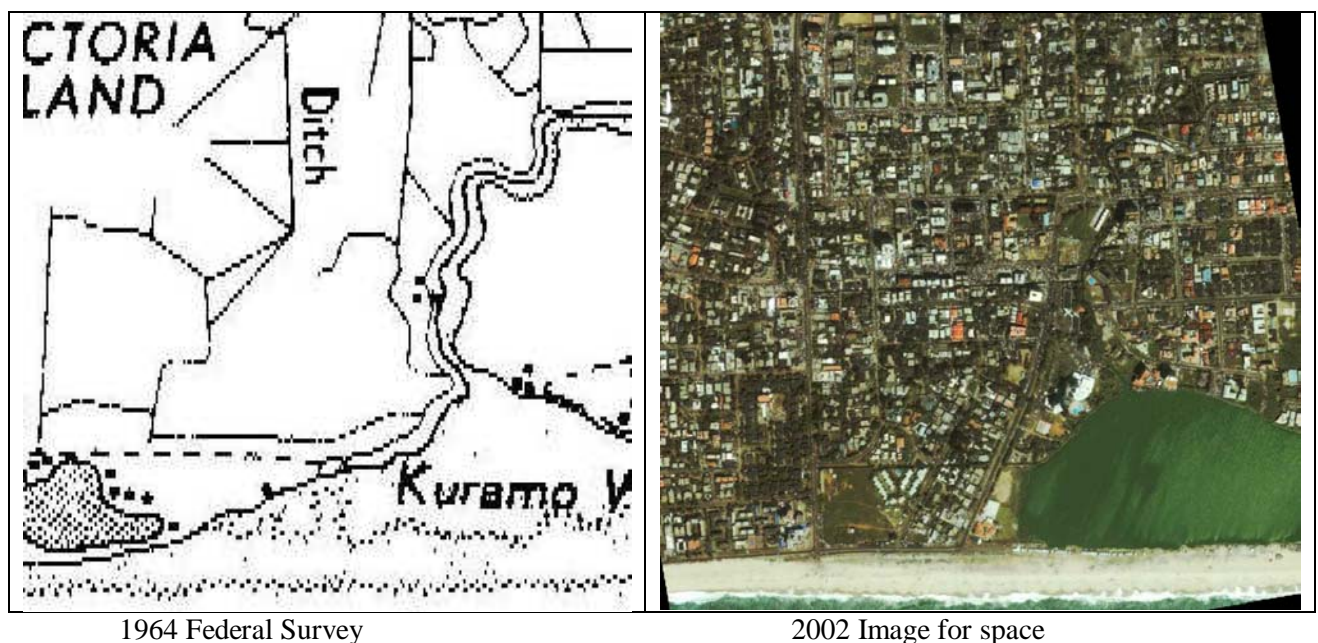


Figure 2: Illustration of the difference between conventional mapping and space imagery

There are many people and organisations that will buy the aerial and satellite imagery, analyse it for their own specific purposes and throw it away. This applies to exploration companies, aid agencies and the military. Around them will be a local civil administration that cannot afford the imagery, has no facility to interpret it but would probably love to have a hard copy of what others have put in the bin.

Was all that money spent on mapping in the post war years completely wasted? Or was it necessary at the time – before satellites – and is no longer required by anyone? Or are we now wasting a lot of money on duplicating the general interpretation of imagery in specialist organisations instead of having a general purpose map (or SDI) available for everyone at a reasonable cost? Expressed in those terms this research may be considered relevant to the developed world as well. We are constantly arguing about who should pay. What should the role of the private sector be? It could be argued, for example, that the developed world (or that part which has well maintained mapping) has merely delayed the advent of the same problem. With the benefit of hindsight it should be possible to bypass many of the pitfalls encountered by the developed world.

Right now we see that the agricultural programmes are beginning to move towards high resolution imagery as well as (or instead of?) large scale maps or vector data.

The researchers looked at the different parties involved with the production and use of ‘mapping infrastructure’ – national mapping agencies, funding agencies, contractors and consultants. The main conclusions reached will come as no surprise to those involved in the activities of FIG:

- The need to increase awareness of the cross-disciplinary benefits of mapping/SDI to governments and funding agencies
- The need to present mapping/SDI benefits effectively to other disciplines
- The need to identify gaps in support offerings – particularly with regard to the specification of useful cross disciplinary programmes and products
- The demand for ‘coaching’ (not just training) of local professionals and departments in cost effective methodologies and procurement processes
- The need to spread best practice – particularly from similar scenarios.

How do the conclusions from the research, which were originally reported by the authors at the earth Summit in Johannesburg 2002, correlate with the work undertaken by the FIG Commissions?

FIG has pursued the support of developing countries through a number of its activities, for example, FIG Agenda 21. In addition, through its Commissions, FIG has developed encouraged and fostered close relationships with UN Agencies and has published documents in co-operation with the United Nations and UN-HABITAT (FIG Publications 30 and 31).

More effective action, with the consequent improvement in Sustainable Geomatics, should be achievable if organisations working with the same aims and complimentary plans of action co-operate, and work together.

3.2 Correlation with FIG Agenda 21

In FIG Agenda 21, FIG plans among others, the following activities:

- to facilitate the optimum use of geographic information in decision making for sustainable development;
- to assist in keeping relevant UN Agencies and other international bodies informed about developments in the use of all aspects of Geographic Information (GI) for sustainable development;
- to promote the understanding that access to relevant geographic information is a democratic right; and
- to promote the sharing of geographic data and to help bring about integrated approaches to planning and management of land.

3.3 Correlation with Land Information Management for Sustainable Developments of Cities: FIG Publication No.30

This set of guidelines was developed through a partnership between FIG Commission 3 and UN-HABITAT and provides best practice in formulating, marketing and implementing City-wide LIM to support sustainable development in cities.

The document is aimed at senior managers within city organisations, aid agencies and consultants involved in managing or advising on land information. Although primarily targeted at cities in developing countries and countries with economies in transition, the lessons learned are applicable to all cities.

The publication states under Institutional Framework that: “The Land Information Management (LIM) of a city should fit into the corresponding spatial data infrastructure of the country In the ideal situation there is an Institutional Framework that provides an accepted and well communicated set of arrangements between all stakeholders in land information. This should guide how the data are collected, stored and maintained and exchanged, which set of standards are used, the financial arrangements, etc. Experience suggests that significant benefits and direct cost savings are possible through co-ordinated efforts by the stake-holders.”

Many of the issues addressed in this publication are analogous to sustainable Geomatics as they look at co-ordination, cooperation and capacity building all of which are required if appropriate spatial data are to be readily available to developing countries.

3.4 Correlation with The Nairobi Statement on Spatial Information for Sustainable Development: FIG Publication No.31

This publication states that: “Spatial Data and Information is an indispensable part of the basic infrastructure of an individual country, as are roads, hospitals and schools. Spatial Data and information is strategically important to decision makers at all levels.”

This supports the argument that countries in development have a need for up to date spatial information. Underlying the text of the Nairobi Statement is the need to promote sustainable development that will inevitably require interaction at a number of levels: Global; National; Regional; and local.

3.5 The Caribbean Example

Recently one of the authors has been working in the Caribbean where an island requires a revaluation of all of its land and property for taxation purposes. At present the Valuation List has developed property (buildings) shown as labeled symbols on 20 year old large scale paper maps. Properties constructed since the 1980's have been approximately located on the map by valuers unskilled in land surveying and not equipped with GPS or aerial photos. The net result is that we have found 15% to 20% of properties missing, and a significant proportion of the rest, tens of metres out of position. Some of the missing buildings are worth hundreds of thousands of dollars and many of the wrongly located buildings are small and very close together. It is therefore evident that the lack of up to date mapping or imagery available to the Valuation Department is not only a severe handicap but is devastating for staff morale and is preventing the government from fairly collecting a basic tax.

We also noted that all of the utilities and government departments are in the same position. Only the telecommunications company (privately owned and arguably on the basis of monopoly profits) had implemented a GIS – using scanned versions of the 20 year old maps but with new buildings entered and with pop up photos when a subscriber number is entered. The Lands & Surveys Department is under-staffed and under-resourced, it just keeps up with its primary function of conducting and checking land surveys for conveyancing. It has not been able to revise the basic 1:2500 topographic maps since they were made. The Planning Department has had a set of 1:10,000 photography for the last 3 years which were unknown or unavailable to any other departments. There are no street addresses on the island and there is no Land Register.

However it is believed that there is money available from at least one multilateral agency to fund mapping and SDI. However, there appears to be a lack of political will to do anything about the situation. Unless this high level backing is forthcoming the result will be piecemeal development of unstructured and incompatible datasets with either hidden inefficiencies in many organisations or considerable waste of resources with duplication of effort and material.

The need is paramount for mapping and GI professionals to be able to understand their customers' needs and to deliver solutions which are cost effective and make sensible use of

new technologies where relevant. Current imagery and field data collection tools are making it much easier to demonstrate the benefits of new technology in ways which have been difficult with the previous generation of digital mapping systems and expensive GPS equipment.

4. CONCLUSION

*'Experience is not what happens to a man it is what a man does with what happens to him',
Aldous Huxley*

We presented the preliminary results of this research to a multi-disciplinary audience at the Global Alliance for Building Sustainability in Johannesburg last year. That audience of planners, architects, engineers and other property professionals were able immediately to see some of the benefits of a co-ordinated SDI policy. The final Johannesburg conference resolutions contain many fine words, including some directly alluding to mapping infrastructure, however, they need to be followed up with well directed actions to which we can all contribute.

While huge amounts of aid are lavished on major development projects very little of this is directed at the provision of the fundamental infrastructures that underpin modern economies and societies – up to date spatial data

The apparent inability to conceptualise the ideas associated with Sustainable Geomatics may well have resulted in a lack of coordinated action in the past. The RICS research has on its own contributed to the global pool of knowledge – and it is this knowledge that needs to be built upon if results are to be seen. The results of this research should be used as the catalyst to encourage co-operation and co-ordination: indeed to focus the work of a number of organizations and agencies working in this area.

It is hoped that this paper will form the focus of on-going debate and actions designed to foster a greater level of awareness and activity in Sustainable Geomatics through the contacts that already exist between FIG and the UN Agencies.

Major projects do not always go to plan, but the most significant reason for projects failing to live up to expectations is more often due to human failing as opposed to poor or inappropriate technology - There is a need for increased awareness, co-ordination and action.

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BIOGRAPHICAL NOTES

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Director - Business Information Management

Rob Mahoney, is a Director of Business Information Management. Rob studied Land Surveying at the Polytechnic of the South Bank, is a Fellow of the Royal Institution of Chartered Surveyors, Immediate past Chairman of the Geomatics Faculty, a Fellow of the British Cartographic Society and an active member of FIG Commission 3.

Rob has extensive experience in the management of land information, and land registration, together with the associated technologies and business processes. He has been engaged upon a wide variety of successful national and international projects including: the feasibility Study for the National Land Information Service (NLIS); its Scottish equivalent ScotLIS; and has been an advisor to the Hungarian, and Isle of Mann Governments on the computerisation of the land registration systems. His clients also include many local authorities and utilities. Rob is a regular contributor at international GIS conferences and guest lecturer at many masters courses in GIS.

Robin Waters

Director - RSW Geomatics Ltd

Robin graduated from Cambridge with a degree in Engineering and Geography and joined the Directorate of Overseas Surveys as a survey project leader in Africa and the Caribbean carrying out surveys for mapping and for land reform. In the late 70s he was involved in digital mapping development at Ordnance Survey, gained an MSc in Computer Science and ran the Overseas Surveys computing section. During the 80s he worked for Laser-Scan in Cambridge as project manager and in sales with clients in five continents requiring digital mapping systems for many purposes. Since 1990 Robin has consulted with governments, international agencies including the World Bank and commercial organisations. He also published CD-ROMs of European statistical information and managed the Experian Goad retail information systems (and the Goad Plans) for three years. He has recently worked with Hutchison3G (now '3') on the development of location based services and with the Registers of Scotland on the modernisation of the land registers and cadastral mapping in Croatia. Robin is the (part time) News Editor for GEO:connexion magazine. He has been an active Chartered Surveyor and was Hon Secretary and later President of the Land & Hydrographic Surveyors Division. He is now on the council of the (British) Association of Geographic Information.

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