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COMPARATIVE ANALYSIS OF THAILAND'S SUCCESSFUL NATIONAL PROGRAM IN REMOTE SENSING: GOVERNMENT POLICY, APPLIED RESEARCH, COMMERCIALIZATION, AND OPERATIONALIZATION

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ABSTRACT: Satellite remote sensing has been used to varying degrees around the world for over three decades. Over that time the degree to which the technology has been applied has varied greatly from country to country – from being broadly embraced to being used hardly at all. At one time it was thought that this use was related to the economic situation within a country. While partially true, the analysis presented here suggests that data policy, approaches to commercialization, and the level of applied research and links to "real" users account for much of the variability within countries with similar economic conditions.

While this finding is especially important in less developed countries, it is also important in developed countries. Simply stated, where remotely sensed and related geospatial data are used in a limited fashion the full economic and social value of the data for resource evaluation, sustainable resource management, and environmental protection is not realized. Based on anecdotal evidence, interviews, review of the literature and observations, this paper examines the key factors that appear to be associated with varying use of the data and consequent derivation of benefits.

INTRODUCTION

Satellite remote sensing has been used to varying degrees around the world for over three decades. Over that time the degree to which the technology has been applied has varied greatly from country to country – from being broadly embraced to being used hardly at all. Simply stated, where remotely sensed data and related geospatial data are used in a limited fashion the full economic and social value of the data for resource evaluation, sustainable resource management, and environmental protection is not realized. This paper examines the key factors that appear to be associated with varying use of the data and consequent derivation of benefits.

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At one time it was thought that this use was related to the economic situation within a country or the quality of training and education. While these factors are of course important, this work isolates other factors as being equally if not more important. These factors include data policy, approaches to commercialization, the level of applied research and links to "real" users. This paper explores the importance of these other factors with special reference to data policy in Thailand and Canada.

BACKGROUND

In the examination of why some remote sensing programs in less developed countries were more successful than others Ryerson and Quiroga (2000) suggested that a number of factors come into play. In a review of over 200 projects around the world it was found that successful projects seem to share the operational characteristics outlined in Table 1.

• There was some previous experience with satellite or other remote sensing imagery; • There was a clear focus; • There was a combination of experienced researchers and bright innovative younger scientists involved in the project; • There was great attention to detail – technical and financial; • There was a basic understanding, either explicit or implicit, of the economics of the use of remote sensing for the specific application;	• There were close ties to real users with the interest, dedication, and ability to sustain the work; • There were close personal ties to scientists in the developed-country sponsor; • Training, personal ties, and the experience noted above resulted in the development of confidence and a lack of fear of failure on the part of the in-country project leaders; and • There was an entrepreneurial "can-do" spirit.

Table 1: Operational Characteristics of Successful Remote Sensing Projects

There were also structural prerequisites that varied by region. In Latin America, for example, research centers associated with universities or universities in arrangements with participating partners worked well. Other institutional models were more appropriate elsewhere. Experience has also shown that if tangible results are expected it is critical to involve the potential community of end users through self-sustaining institutions very early in the design stage.

While this work seemed to explain the level of success at the project level, and while it helped explain some of the level of success at the national level, there were situations at the national level that did not appear to be explainable solely on the basis of these factors. The remainder of this paper addresses these factors.

THE IMPORTANCE OF DATA POLICY

We have been involved in detailed studies of geospatial and remote sensing data policy in general and specifically in the USA, Europe, Australia, Canada and Thailand. In a land mark comparative study of data policy in Canada, the USA, and Australia, Sears (2001) found that cost recovery policies adversely affected the level of use of geospatial data. Furthermore, he found an inverse relationship between the levels of cost recovery fees charged and the growth of the geospatial industry. While this study has resulted in a reduction in cost recovery for base-

layers of geospatial map information in Canada (and in Australia), it has had limited or no impact on the high cost of remote sensing data in Canada where the study was done. Canada seems to have adopted a low-volume high-cost model for remote sensing data and by so doing has had an impact on several areas, including data use, development of value-added industry, and the derivation of benefits from widespread data use.

With the findings of Sears and analysis of remote sensing data policies in the USA, Europe, Canada and elsewhere, a data policy framework was developed by Ryerson (2005). The essential elements of that policy believed to be relevant to data use are presented in Table 2. Other topics include confidentiality, archive, order desk and acquisition policy, copyright, and licensing. The data policy framework has been designed to allow for a mix of commercial and low-cost data.

Cost Recovery and Pricing Policy

1. Pricing policy must be stated. Options include: "Free" vs. cost of filling user request (COFUR), vs. cost recovery at some level for govt. subsidized systems.

Commercialization

1. With industrial development a goal of governments, the ideal approach is to balance public and private sector roles based on the level of commercial maturity in the specific jurisdiction.
2. The commercial model in RS will change to see suppliers providing information, not just satellite data. This issue tends to be contentious.

Reception, Bulk Purchase and One-Stop Access

1. Governments must commit to receive or otherwise obtain satellite remote sensing data.
2. Bulk purchasing has been a feature of successful satellite RS programs.
3. A central clearing house or single point of access for satellite remote sensing is suggested to reduce confusion, delays, and improve access to data.
4. One central government agency may acquire space-borne data from other national or commercial missions for non-commercial government and R&D use.

Data Sharing Among User Categories and Research Missions

1. Sharing data between users and researchers is encouraged within the commercial restrictions that may exist with respect to the data and derived proprietary information.

Reproduction and Dissemination for Public Good

1. Recognizing that public good is the major driver for national missions, reproduction and access for such applications is encouraged. One option would see data that are for the general good is freely available (on the Internet), with value-added products are available commercially.

Reproduction and Dissemination for International Aid

1. Subsidized access to data will be provided to help developing nations cope with resource and environmental management, disaster response and planning on a project-by-project basis.

Standards

1. The country will contribute to the development and setting of international RS data standards and national data will meet international standards for formats, metadata, etc. that are compatible with those used in the geospatial field.

Operational Data Use vs. Developmental Data Use

1. Data access policies in support of the development of new applications of remote sensing both commercial and for the public good are to be encouraged

Table 2: Data Policy Framework Elements Related to Data Use

The framework was subsequently applied and modified somewhat for Thailand in a September 2006 Workshop held in Bangkok hosted by the GeoInformatics and Space Technology Development Agency (Public Organization) (GISTDA) of Thailand and Kim Geomatics Corporation of Canada.

What is especially interesting in the Thai case is that Thailand has long had a low-cost/high volume remote sensing data policy as was recommended for geospatial data in Canada. Furthermore it has not had to significantly modify its policies either for international data or for THEOS data to conform to best practices related to increasing use in Thailand.

The Government of Thailand has maintained its data policy to subsidize the acquisition of remotely sensed data to ensure that the country could derive the full downstream public-good benefits that are associated with the data's use. Thailand, through GISTDA, has thus developed a special relationship with many data suppliers so that GISTDA could provide data to the Thai user community on a COFUR - Cost of Furnishing a User Request - basis. Part of the work leading up to the workshop was an analysis of the use of remotely sensed data in Thailand that has resulted from this policy.

LOW COST LEADS TO HIGH USE

Interviews were conducted with officials involved in the management and use of remote sensing data in a number of government agencies responsible for forestry, parks, land use, agricultural economics, fisheries, hydro-electric power generation and distribution, narcotics control, hydrology, defense, mineral resources, and municipal government.

• Forest inventory • Forest change detection • Forest fire • Human impacts • Mapping and monitoring fishing activities (freshwater, coastal, marine) • Aquaculture monitoring • Coastal shrimp • Vessel detection and monitoring • Environmental feasibility studies • Security • Municipal/local area tax mapping • Mineral resource mapping • Field work planning	• Land use at various scales • Crop type mapping (12 major crops) • Crop area & crop statistics • Statistical sampling frame development • Land cover • Flood zone mapping • Landslide mapping • Disaster and risk management and reduction • Soil mapping • Route selection and corridor planning and terrain suitability studies • Base mapping (topographic) • Water management

Table 3: Operational Satellite Remote Sensing Applications in Thailand

Satellite data are currently being used for all of these applications on an operational and on-going basis. Many of these applications can be directly linked to important government policies in Thailand and elsewhere – including the Millennium Goals. Equally important, if the agencies involved had to pay the so-called "commercial rate" for data, our interviews determined that few if any of these public good applications would be carried out and the country would thus have poorer information for resource management planning. While beyond the scope of our study, we

believe it accurate to say that a few million dollars invested in the data has led to many millions of dollars in terms of improved information and better decision-making for the sustainable management of Thailand's natural and environmental resources.

To put the data use within Thailand into a more international context, consider that over 4000 images are provided annually by GISTDA. Given the size of Thailand and the size of Canada, this rate of use would be the same as Canada's governments (federal and provincial) using 77,600 images. Even counting the use of Radarsat imagery for ice monitoring, our information is that Canada comes nowhere near this level of data use. While the use of alternate sources of data collection (such as statistical surveys) plays a role in this disparity, we believe that one reason is data policy – or put more bluntly: high remote sensing data costs.

Of those interviewed in the key Thai user agencies all had an on-going need for the sort of information obtainable from the satellite data. Most had some level of in-house research or applications development capacity – often tied to university researchers, and in a few cases (such as fisheries) with international development assistance. Technology transfer from these applications development efforts was also an on-going activity. In some agencies as many as 70-100 people were users of the data, while in others it was fewer than twenty. In virtually all of the agencies interviewed the operational requirements to achieve success noted above were met.

In some cases such as forestry, the monitoring has been on-going for as long as thirty years. In others data use on an on-going and operational basis was a new activity that came as a direct result of the lowering of data costs. As one senior Thai resource management official said "the lower price motivates the government user where cost - and not profit - is the controlling factor." This sort of comment was repeated again and again. In fact, low data cost was cited as a primary reason to use the data to the extent that they now do for each and every agency.

The approval of THEOS by the Government of Thailand is a strong endorsement and statement on the value of remote sensing data to the country.

GENERAL APPLICATION OF THE PRICE MODEL

While this finding is especially important in less developed countries, it is also important and can be transferred for application to developed countries.

The United States has examined several models for data delivery – and seems to have settled on a combination of commercial for high resolution data and COFUR for satellite data for the derivation of public good information. Europe seems to have opted for a similar blend, although the emphasis within the European Space Agency as well as within some national space agencies seemed to be geared more towards the widespread distribution of lower cost data to ensure that the public good benefits are derived. India has also worked hard to get data into users' hands to derive these same benefits. (Radhakrishnan, 1999.) It is worth noting that a number of authors have stated that one of those benefits is the creation of a robust industry to interpret the large volumes of data that are consumed under the low-price/high-volume model.

France and Canada seem to be among the few advocating the commercial sale of data at commercial rates by commercial entities from what began as (and in some cases still are) nationally subsidized systems. It is worth noting that at a meeting on Radarsat-2 Canadian Space Agency staff suggested that the follow-on radar constellation will not be distributed commercially, but rather will be provided by government – which we assume means at a lower price. With each shift in data policy and/or level of competition one can observe a shift in the

development of industry, as well as in the application of the data as several previous studies cited in the references below have shown.

CONCLUSION

This paper suggests that data cost has been a limiting factor in achieving the full benefits of remote sensing in both developed and developing countries. The approach developed by Thailand to data cost and other elements of data policy, research, and the emphasis on technology transfer have together resulted in a vibrant user community in government using far more data for far more applications on a comparative basis than many other countries in the world – including so-called developed countries.

Thailand's extensive use and derivation of benefits of remote sensing across government provides a clear demonstration of both the impact and importance of both an informed data policy and the use of "home grown" applied research. The approval and launch of THEOS will now provide Thailand with an on and off ramp to the information highway as well as a sign post on that highway that states that Thailand is further developing its operational use of advanced remote sensing technology to strengthen the capability and competitiveness of Thailand.

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