

THE DEVELOPMENT OF REMOTE SENSING IN BRAZIL AND CANADA: COMPARATIVE CASE STUDIES

Tania Maria Sausen¹
Christine Nielsen²

¹Training Sector
INPE - Instituto Nacional de Pesquisas Espaciais
Av. dos Astronautas 1758, Cx. Postal 515
12201-900 S.J. Campos, SP, Brasil
Fax (0055)(123) 21 8743

²Visiting Professor
Faculty of Administration
University of Ottawa, Canada
136 Jean-Jacques Lussier
Ottawa, Ontario, Canada K1N 6N5
Fax: (001)(613) 564 6518

Abstract The remote sensing programs of Brazil and Canada originated in late 1960s through participation in NASA's LANDSAT program. National governments of both countries have supported the development of remote sensing activities. Both countries have shared common interests in developing this technology in terms of large geographic areas and strong interests in natural resources exploration and management. Despite these similarities, the situation in the two countries are quite different today. There are between 3000 and 5000 remote sensing users in Canada. The majority are in the private sector. While there are approximately 3000 remote sensing users in Brazil, 85% of the users are in the public sector. Just few private companies are involved with remote sensing technology in Brazil, of these just two companies are 100% involved. There are many sectors of the economy that could benefit from remote sensing information; however, this large market remains undeveloped. One may conclude that more needs to be done if remote sensing technology is to be transferred successfully from the public to the private sector in Brazil. The purpose of this research is to gain a better understanding of the evolution of remote sensing activities in Brazil and Canada over the past 25 years in order to further technology transfer/diffusion activities within the Brazilian context.

Introduction

The remote sensing programs of both Brazil and Canada originated in late 1960s through participation in NASA's LANDSAT program. National governments of both countries have supported the development of remote sensing activities and both countries have an antenna to track the satellites.

Both countries have shared common interests in developing this technology:- in terms of large

geographic areas (Brazil- 8.500.000 km; Canada 9.200.000 km) which are difficult to access from the ground;

- in terms of very strong interests in natural resources exploration and management;

- in terms of strong scientific human resource bases.

Differences in development:

Despite these similarities, the situation in the two countries today are quite different:

The Canadian situation:

There are between 3000 and 5000 remote sensing users in Canada. The majority of users are in the private sector (Ryerson, 1992). Estimates of remote sensing revenues are estimated at over 150 million Canadian dollars (Thompson and Inkster, 1990). Approximately 150-200 individuals are employed in remote sensing in the public sector, while the private sector accounts for 3500 - 4500 jobs. Company sizes range from one to two employees to giants in the industry. Examples are MacDonaldd Dettwiler Associates Limited (MDA) and Intera Technologies Limited (INTERA), which range between the two employees over 1000 people (Reyerson, 1990).

In 1971 the Canadian Centre for Remote Sensing (CCRS) was established within the Department of Energy, Mines and Resources. CCRS had general responsibility for research and development in areas such as development, airborne and satellite image production and processing and GIS technology, as well as in technology transfer and applications in the private sector. Also, CCRS has developed programs to demonstrate the benefits of remote sensing and to educate potential users regarding the value of this information source. From the inception of remote sensing activities in Canada, the government has pursued a strong cooperative relationship with private industry.

In 1972 the Canadian Advisory Committee on Remote Sensing (CACRS) was formed representing users, and remote sensing industry to advise the government on priorities for research, and to provide guidance on policy issues. This relationship has assured that research has been

focused toward commercially important application.

The development of a remote sensing industry in Canada can be seen as falling into three stages (Thompson and Inkster, 1990):

- 1) government investment (1970-1975)
- 2) industrial growth (1976-1988)
- 3) commercialization of remote sensing (1980-present)

Currently there are over 120 Canadian companies engaged in remote sensing activities, second only to the number of such companies in the U.S.A. The companies are distributed throughout the provinces as follows: British Columbia(19), the Prairies (30), Ontario (18), Atlantic Canada (14), Quebec (18), National Capital Region (24).

Activities include research and development, software development and software products, manufacturing of hardware, consulting and other services (External Affairs, 1987). Close to 40 of these companies are engaged in exporting to over 60 countries throughout the world (Reyerson, 1990); the largest markets are found in the U.S.A., Asia, the Middle East, Europe, the Indian subcontinent, South America, and Africa, listed in order of importance (Reyerson, 1989). Recognizing that some of the greatest benefits of the technology will be as a tool in development programs, the Canadian International Development Association (CIDA) has funded training and technological assistance for dozens of developing nations with significant resource information needs (External Affairs, 1987).

The Brazilian Situation:

Today there are approximately 3000

remote sensing users in Brazil. Eighty five percent of the users are in the public sector. Approximately ten private companies are involved with remote sensing technology, from this number just two companies are 100% involved (Imagem Sensoriamento Remoto and FUNCATE).

The National Institute of Space Research (INPE) is the Brazilian institution responsible for basic research and development of remote sensing technology in Brazil. There are 1400 employees at INPE and among these 215 are currently working in remote sensing area.

In October 1985 INPE created the Coordination of Technological Orientation office under the Remote sensing Area, responsible for transfer of technology to end users in Brazil. This office has increased remote sensing training activities in Brazil, and has created the Remote Sensing Regional Laboratories Program.

Under this program, four main Regional Labs have been created in the North region (Pará state), the Northeast region (Paraíba state), and in the South region (Rio Grande do Sul and Santa Catarina states). The objective of these laboratories is to disseminate remote sensing technology and to provide advice on remote sensing activities in these regions. Today there are 15 Remote Sensing Labs spreaded in the five Brazilian regions.

In 1990 this office was integrated into the Remote Sensing and Space Meteorology Division. Technological transfer activities continue under this Division. Despite these INPE technology transfer programs in different regions of the country, the dominance of the Southeast (64% of users) and South (11% of users) regions is evident. There is a lack of remote sensing users in the North

(users) and Central West (users) regions that could benefit most from indigenous remote sensing capability, as these are the least developed regions in the country and represents 65% of the country area (Sausen, 1992).

The Brazilian antenna covers 80% of South America, and INPE sells LANDSAT images to Brazilian institutions and to all countries in South America.

One may conclude that more needs to be done if the transfer of technology within Brazil is to be successful:

- there are many potential sectors of the economy that could benefit from remote sensing information, however, this large market remains undeveloped. This is of crucial importance given the increasing concern in Brazil regarding monitoring and management of the country rich resource base.

- the development of a remote sensing industry offers a large, untapped resource for commercial activity. This is particularly important given the current Brazilian concern for privatization.

In order to aggregate basic information about the Brazilian Remote Sensing Community which is dispersed among many institutions and individuals; to analyse this information in order to provide a foundation upon which long-term planning for remote sensing can take place; in order to extend the remote sensing community to all Brazilian regions; in order to motivate private companies to be more involved on remote sensing; in order to motivate the creation and/or the enlargement of the Brazilian Remote Sensing industry a project about the Market for Remote Sensing in Brazil was proposed.

There are three stages in this

project:

Stage 1 - The development of remote sensing in Brazil and Canada: Comparative case studies.

a) Current : users and potential market

b) Providers: data and value-added

c) Time frame: 18 months

d) Results: Remote sensing technology transfer model for Brazil: a market development

Stage 2 - pilot study - Application of remote sensing technology transfer model in one region in Brazil

a) Time frame: 3 years + feedback

b) Results: Analysis of market in number and variety of users

Stage 3 - Development of national remote sensing technology transfer program

a) Time frame: 5 years

b) Results: The transfer of remote sensing technology in Brazil: a market approach

Main activities areas for which this information will be useful are outlined below:

a) transfer of technology activities such as training courses, graduate programs and conferences;

b) joint projects and cooperative program such as, between INPE and other national and international institutions; between INPE and private companies; between private companies and national or international institutions; between national and international institutions; and so on.

c) establishment of national and regional research and applications programs;

d) data sales;

e) introduction of new sensors systems;

f) remote sensing orientation program for decision makers, project and program managers;

g) further development of the remote sensing regional laboratories.

This paper presents the Stage 1 proposal and its actual development.

Objective of Stage 1:

The purpose of this stage is to gain a better understanding of the evolution of remote sensing activities in Brazil and Canada over the past 25 years, including the impacts of socio-economic, political and technological factors.

Secondary objectives:

- to evaluate INPE and CCRS influence in national and regional remote sensing environmental programs;

- to gain better understanding of the market for remote sensing information in Brazil (current and potential users);

- to increase understanding about private sector companies in Brazil which are currently working with this technology;

Methodology:

1) Data collect:

1.1- Remote Sensing History in Brazil and Canada: data collect through interviews; COBAE, CNAE and INPE reports; original researchers to

NASA; remote sensing books writers; former Brazilian and Canadian committee; former and current directors;

1.2- Sample Selection : description of the institutions, in Brazil and Canada, from Brazilian and Canadian data base, questionnaire for additional information about Brazilian and Canadian institutions.

1.3- Image Generation in Brazil and Canada: Landsat/MSS, Landsat/TM and Spot from 1973 to 1992

1.4- Data sales in Brazil and Canada: Landsat/MSS, Landsat/TM and SPOT from 1973 to 1992

1.5- Remote Sensing Master Course: INPE students, external students.

About seventy questionnaires have been sent to the students who have received their master degrees in INPE (from 1972 to 1992), in order to know if they are still working on remote sensing, what kind of research on remote sensing they are developing, which kind of institution (government or private) they are working for, which region of the country they are located. Up to now we have received around twenty seven responses.

1.6 Remote Sensing on Undergraduate Courses:

One hundred and fifty questionnaires have been sent to Brazilian universities that have undergraduate course on natural resources and engineering in order to know if they have the discipline Remote Sensing in their regular curricula. Up to now we have been received around forty responses.

1.7- Remote Sensing Regional Laboratories Program: North region, Northeast region, South region, Central West and Southeast regions.

1.8- Remote sensing symposiums:

Some data about the Brazilian symposiums has been collected and a report has been written. The data collected is about papers subjects, author's origin (city and state), author's institution, number of papers presented/symposiums. Besides this information analysed the history of these symposiums has been analysed.

2) Historical phases in the remote sensing evolution in Brazil and Canada:

2.1- INPE and CCRS role in the remote sensing evolution in Brazil and Canada

- Establishment of the Brazilian and Canadian remote sensing program - 1969 to 1973

- Landsat/MSS data reception: 1973 to 1984

- Landsat/TM data reception: 1984 to 1992

- Spot data reception : 1986 to 1992

- ERS-1 , RADASAT, CBERS, MECB reception data: as of 1992

2.2- Characterization of remote sensing community in Brazil and Canada in terms of private and public institutions

2.3- Profile of remote sensing institutions in Brazil and Canada

2.4- The characterization of remote sensing customer

2.5- To analyse the data generation and sales in terms of economical fluctuations and new sensors

2.6- To analyse the obstacles to remote sensing in Brazil and Canada To analyse the influence of Regional

Laboratories Program in the remote sensing market in Brazil

2.7- To analyse the influence of Master program in the Brazilian remote sensing market

2.8- To analyse the influence of training activities in the remote sensing market in Brazil and Canada

2.9- To analyse the influence of national remote sensing symposiums in Brazil and Canada

3) Results:

- main current research and application areas in remote sensing in Brazil and Canada;

-potential research and application areas to be exploited in Brazil and Canada

- market reaction to each remote sensing phase in Brazil and Canada;

- current market location in Brazil and Canada;

- potential markets in Brazil and Canada;

- to increase the number of private sector companies that are providers of remotely-sensed, and products and services.

- Characterization of remote sensing market profile in Brazil and Canada

- Why the Brazilian remote sensing market is basically made of public institutions and in Canada is basically made of private companies?

- Strategies to be adopted to motivate the private sector in Brazil to use remote sensing data;

- To motivate the Brazilian private sector to be involved with remote

sensing, would this be, like in Canada, a viable way of transferring technology in Brazil too?

- To propose a Remote Sensing Technology Transfer Model for Brazil: a market development

4) Personnel:

Dr. Tania Maria Sausen, INPE/Setor de Treinamento

Dr. Christine Nielsen, Ottawa University

Roseli de Souza Monteiro Carvalho, Bsc., Inpe-Setor de Treinamento

References

External Affairs Canada, Advanced Technology marketing Division. 1987. **Remote Sensing Products and Services for World Markets**. Ottawa External Affairs Canada

Ryerson, R.A. 1987. Introduction to "Remote Sensing in Canada" special issue. *Geocarto International* 2(3): 3-4. Ryerson, R.A. 1989. The remote sensing industry in Canada: A profile. Paper presented at the 12th Canadian Symposium on Remote Sensing, Vancouver, July.

Ryerson, R.A. 1990. Interview in Ottawa, 10 December.

Sausen, T.M. 1992. Brazilian Remote Sensing Community: Historical, Geographical and Economic Aspects, INPE-5421-PRE/1763

Thompson, M.D. and D.R. Inkster. 1990. The commercialization of remote sensing in Canada, 1972-1990. Paper presented at the 23rd International Symposium on Remote Sensing of Environment, Bangkok, Thailand, 18-25 April.