547

International Cooperation in Remote Sensing: How can a project become a success?

Ferdinand J. Bonn
CARTEL, Université de Sherbrooke, Sherbooke, Québec, Canada

Gilles Cliche
IDRC/CRDI, Ottawa, Ontario, Canada

Abdelaziz Merzouk
Institut agronomique et vétérinaire Hassan II, Rabat, Maroc

Abstract

An evaluation of different remote sensing projects undertaken in developing countries shows that some projects do not bring the expected results in terms of technology transfer and scientific sustainability. The analysis shows that the projects that generate the best results are not necessarily those with a high budget but those which have been planned and supported on a long term basis combining governmental, industrial and university interventions in the scientific development process. This requires a training that goes in depth and is system independent.

Résumé

L'examen de plusieurs projets de télédétection dans divers pays du Tiers Monde montre que certains projets n'apportent pas les résultats qu'on en attendait en termes de transfert de technologie et d'autonomie du développement scientifique. L'analyse montre que les projets qui ont généré les meilleurs résultats ne sont pas ceux qui disposaient des budgets les plus élevés, mais plutôt ceux qui ont été planifiés et supportés avec une optique à long terme en combinant les interventions gouvernementales, industrielles et universitaires. Ceci requiert en particulier une formation approfondie et indépendante des systèmes utilisés.

Introduction

Remote sensing is involved in many international cooperation projects dealing with the management of natural resources in developing countries. Being a high technology applied to areas of the economy wich include the most traditional activities, such as agriculture, forestry, ranging or fisheries, it generates most of the time a technological shock even in developed countries. Different perceptions and behaviors can explain this shock, but most of them are a mix of fears: fear of loosing more traditional jobs in favor of high technology ones, fear of loosing a control on the information flow within the society, knowing that control of information is control of power. There is also a skepticism about the capability of remote sensing from satellites to provide reliable information at the desired scale and precision.

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In developing countries, the technical ability of remote sensing is less questioned because detailed information on resources is usually not available and because a large amount of the existing maps are inaccurate or outdated. Therefore, any information is better than none, and the problems lie more in the reliability of the systems, the cost of data and the training of manpower to operate the systems and interpret the images. However, the situation is more complicated in the administrative sense, because usually, implementation of remote sensing technologies in developing countries is done under some kind of international cooperation. This can potentially generate a risk of effort duplication due to the bilateral and multilateral structure of the funding.

However, most of these programs officially have an objective of sustainability of the development, with limited or decreasing support of the funding agency and of the technology providing country. Remote sensing projects usually require a group of components, such as equipment for data acquisition, processing and archiving, training at different levels and demonstration projects.

The key used in this paper to measure the success of these projects will be the level of sustainability achieved by the remote sensing program and its level of effective implementation in the resources management process in the user country. In this perspective, sustainability means the effective operation of the system as a whole on a continuous basis without the presence of foreign experts and the capability of the local group to improve the system with a limited support only. The next section will describe some program structures at various levels, and will be followed by examples of successes and failures of remote sensing technology transfer programs in different countries, and in the last section we will propose a project structure based on these experiences.

Different models of international cooperation in remote sensing

Remote sensing as such can be seen from different perspectives in the north-south programs where the funding comes mostly from the wealthiest country. Some people, especially at government, look at remote sensing as an information gathering tool only. In developing countries, where the natural resources are often scarcely known and difficult to manage, gathering that information is vital for the development of the political and economical system, in a resource based economy. The scientific aspects of remote sensing are often considered by them as a luxury for rich countries to play with, and only the really operational techniques are judged worthwhile for implementation. Others consider it as a science in itself and more suitable for university research than for operational implementation in a management decision making process.

The first model frequently practiced is what can be called the *"service purchase model"* . In this model, the government of a specific developing country buys the services of an organization (industry or public agency) of another country (usually an industrialized country) to provide the necessary thematic information, such as a forest cover map or a soils map. In this model, there is little or no national involvement except for the provision of the required specifications and of some ground truth data to validate the classifications as well as a very limited user training, turned towards the understanding of the finished product. However, the time between the purchase order and the delivery of the final product is usually short in this case if the supplier is efficient and the image data available.

The second model currently observed is what can be called the *"government/industry/government"* model. In this model, there is an establishment or a development of a local technical facility. Government officials are usually interested in turn-key solutions, achievable in short term, and which have the advantage of generating quick results and of giving a high-tech look to departments used to a more traditional down-to-earth approach. The same kind of interest exists within the so called *"donor "* country, where the industry is interested in quick sales and short training essentially, and where some overseas projects are considered as being a showcase for their technology. Governments of donor countries generally support their industries, and plan also within a short term only. The usual time frame used in these programs is 2 or 3 years, enough to install an image receiving and processing facility and to give basic training to a certain number of government officers who will have to operate the system.

Even if sustainability is officially mentioned in the official policy documents produced by the national funding agencies (CIDA, 1987), these agencies must show results and achievements to their respective governements and parliaments within a time frame shorter than the usual 4 year election cycle, to be able to justify the taxpayers money they spend. They also have the unwritten mandate to promote their national industry, and as such they may provide equipment which is not necessary the best the recipient country. Sophisticated computer systems have been installed in areas where the power supply or dust control was unstable and no technical repair facility was locally available. Unsurprisingly, if the system breaks down it cannot be repaired by the local technicians. International multilateral funding agencies may have more flexibilities for long term funding, but they are more complicated to put into action for small specific projects.

The third model is what can be called the *"institutional development model"* which directs efforts towards the improvement of the teaching and research capabilities of local universities and/or higher education institutions. It has usually lower budgets than the projects of the second model and generates a slow but continuous improvement of the technical knowhow in the country. However, universities, even public ones, are usually not linked to the government decision making process and in many countries they are even considered as suspect, potentially subversive or at least politically troublesome. It is therefore difficult to establish a linkage between the two in areas of military interests such as detailed topographic mapping or socially sensitive land-use planning decisions.

Impact of these models on the sustainability of remote sensing development

It is obvious that the first model has only a limited impact on remote sensing technology development in the recipient country, besides increasing the national awareness for the technology. Local scientists can feel frustrated by this model if they are not associated with its implementation or development. Unfortunately, they are often used only as field guides and ground truth suppliers, and are not part of the planning process (Belabbes, 1989).

The impact of the second model varies from case to case. In some countries, the model has proved to be quite successful. However, importing technologies developed in other countries without a serious adaptation to local contitions can often be desastrous, creating a neo-colonial type of dependence, not compatible with sustainable development. Duplication of efforts due to competition and overlap between donor agencies and complete collapse of some facilities after departure of the foreign experts have been seen too many times. This creates very embarrassing situations such as unused expensive equipment slowly covered with dust because of lack of maintenance or minor breakdowns.

The remote sensing methods require adaptation and modification by the local scientists, and to achieve that technological independence, the training associated with the different programs should be as much as possible system independent and done with a certain level of depth. A short term approach generates a stronger dependence than a long term partnership, which allows joint development and improvement of the methods. A long term approach, if well done, changes a tradesman/customer relation into a real cooperation project, where both partners work jointly towards the development of better tools and methods adapted to the local environment.

In the area of remote sensing, where hardware and software systems become obsolete after only a few years, the training should provide the user with an access to tools and basic principles to allow an understanding of all new developments. Too many operational and semi-operational environmental remote sensing programs in government agencies work on wrong scientific principles, due to a superficial training of the operators. A typical case is the widespread use of vegetation indexes calculated from raw digital numbers instead of atmospherically corrected reflectance values. The results, if they are used in a desertification trend analysis, can be partially wrong and completely misleading. This is due to a common training mistake where the physics of remote sensing are treated somewhat superficially by lack of time in the training program. An in-depth training is then needed for at least some members of the application group to supervise the analysis operations. It requires a systems approach which is more easily realized if the local learning and research institutions are part

of the process.

Therefore the third model based on institutional development could be more beneficial for the country if it is coupled to applications development in government departments and in industry. The typical problem that arizes when institutional development is not integrated with national development ·orts is the loss of high level trained people to foreign countries where they can apply their knowledge ... a working environment and at a salary corresponding to their level of education. On the other hand, lack of people trained at the M.Sc. or Ph.D. level in some regions leaves a vacuum for scientific cooperation.

Among all the papers published about remote sensing in the Sahel in Africa, it is astonishing to see how few are co-authored by local scientists, giving the impression that some areas of the world, especially when they are indicators of global phenomena, are just laboratories or playgrounds for the wealthier countries. 85% of ongoing research on the African continent is done by scientists of the wealthier countries of the north and African scientists must often emigrate to get access to adequate working tools (Porto-Novo report, 1989). Lack of strong links with local scientists and traditions of some institutions inherited from the old colonial days can probably explain this situation, but it is not enough. Could we imagine a publication on detection of soil salinization in California without any American co-author or a publication on forest fire detection in Provence without any French co-author? .is attitude may be unconscious for many of the people involved but it reveals a neo-colonial attitude not easily accepted by the scientists of developing countries (Pérez, 1990).

Therefore, long term university twinning programs, even low budget ones, can generate more benefits for both partners than short term spectacular turn-key systems, wich may be obsolete in a few years, and out of reach for local improvements. This kind of approach is usually used for cooperation and scientific exchange programs between developed countries, and is often successful in generating new ideas and high quality internationally co-authored publications. However, a link with existing government priorities is essential even if it stays at the local county level, ensuring at least that the university scientists keep their enthusiasm and preoccupations tied to practical development ɔlems.

A typical success story of this approach is the program between the Université de Sherbrooke and the Institut Agronomique et Vétérinaire Hassan II in Rabat, Morocco. This low budget program funded by IDRC has allowed the establishment of a remote sensing laboratory at the Institut and its use for a soils mapping project (Merzouk *et al*, 1989). Also provided were training and support capabilities for ongoing government projects. Typically, a research institution can handle problems which are too damental or not operational enough for government or industry implementation. It can also handle local training and applications, and in the above mentioned case it started even work for other countries in the area, thus opening the door to south-south cooperation projects and technical support for local industry.

However, the success of this program is due to a great extent to another, pre-existing long term program involving the University of Minnesota over a 10 year period (Lowenthal *et al*, 1988). This program was carried out with sustainability in mind; the implementation of the remote sensing laboratory was made in a department and within a group holding a certain number of high level scientists with Ph.D. degrees in soil science and related environmental sciences. This group has good relations with governmental agencies especially at the Department of Agriculture because many of the civil servants are former students or colleagues of the Institut, thus allowing a good concertation and feed-back between research activities and government priorities.

Conclusion

Too many remote sensing technology transfer projects have ended up in failure in the past, but these failures were usually related to inadequate choices of technology, insufficient or inappropriate training and to support on a too short term only. On the other hand, university and education projects

based on a long term approach have not been sufficiently connected with resources management priorities within the government, resulting in a waste of skilled and trained manpower who cannot apply their knowledge in real life problems. Therefore, funding agencies such as IDRC have a tendency to try to support research projects that fit into national development efforts (Camara,1989).

An effective coupling of both approaches (the government model and the university model) can be done by automatically reserving a significant percentage of the overall budget to long term education and research programs at local institutions generating a multiplying effect on the effectiveness and sustainability of technology transfer programs and ensuring that the research activities stay focused on priority development needs.

References

Belabbes, Kamal (1989). *Note sur l'état d'avancement du projet: Télédétection spatiale appliquée à la gestion de périmètres irrigués.* Rapport interne, I.A.V. Hassan II, Rabat.

Pérez, Jesús (1990). *La technologie spatiale et le développement du tiers monde: l'exemple de la télédétection.* Station internationale de recherche contre la faim. Toulouse.

.wenthal, J.B., S.O. Berg, R. Dunlop, A. Morton (1988). *Supporting Moroccan Agriculture in the 1990's: the sustainability of the Hassan II Agronomic and Veterinary Institute.* Final interim evaluation, USAID project 608-0160.

CIDA (1987). *Sharing our future: Canadian international development assistance.* Policy paper, Ottawa, 95 pp.

Camara, A. et G. Cliche (1989). *L'approche du CRDI dans la lutte contre la désertification en Afrique et l'apport de son programme de cartographie et télédétection.* 2èmes journées du Réseau Thématique lédétection de l'UREF, Thiès, Sénégal.

OUA (1989). *Rencontres Afrique - Europe de Porto - Novo (Bénin).* Rapport du Conseil de l'Europe.

Merzouk, A., M. Badraoui, D. Fassi, H. Akeskouss, F. Bonn, M. Hinse, H. Gwyn (1989).*Essai méthodologique de classement des terres en vue de la conservation des sols en zones semi-arides: apport de la télédétection.* 2èmes journées du Réseau Thématique Télédétection de l'UREF, Thiès, Sénégal.