

CAPACITY BUILDING NETWORKS FOR EARTH OBSERVATION AND GEO-ICT A First Step towards a Virtual University

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ABSTRACT:

Geo-ICT plays an increasing role in the management of spatial processes at different levels ranging from local to global scale. A world wide scientific and professional community develops and implements tools and methods to deal with these issues. Furthermore new business and Geo-ICT environments are emerging which force GI-providers to develop new business strategies. They should anticipate the opportunities of new technology and new geo-data infrastructures. This means that Capacity Development (CD) should have a high priority for organizations which have to introduce new working methods and procedures which ultimately result in structural adjustments of their Geo-ICT architecture. CD programs should help these organizations to understand how technological, institutional and market developments lead to new geo-information products and services and how these services are increasingly embedded in globalizing economy. This all implies that international partnerships providing joint educational programs are of great importance for capacity development. Presently these develop into networks providing decentralised educational service supply chains, which form an interesting starting point for the development of a virtual university for *Geo-Information Science and Earth Observation*.

1. GLOBAL OUTLOOK OF GEO-MONITORING

Earth observation and geo-information are essential for monitoring of spatial processes affecting the sustainable development of our living environment. The management of these processes requires decision power at different administrative and political levels ranging from local to global scale. A world wide scientific and professional community develops and implements tools and methods to deal with these issues. They develop indicators at different resolution levels and their specifications based on profound knowledge of these processes and of the technology for earth observation and geo-information processing. This should really be a world wide community for several reasons. We will shortly mention three:

- The awareness that these processes are of a supra-national and even a global scale implies that world wide efforts are required to deal with these scientific problems, i.e. all nations should contribute.
- The globalization of the economy implies the development of global delivery chains for products and services (Friedman, 2005). Partners in these chains must have a common understanding of the specifications and conditions for products and service delivery. This should be developed through a global involvement in research and technology and service development.
- The fact that it is not possible for national economies to maintain sufficiently high investment levels over the full range of modern research sectors implies that national and regional priorities will be set for fields of interest. We will see an increasing regional or even (inter) continental spread of fields of expertise, first for research but consequently also for technology development and consequently for higher education.

2. PROBLEMS FACED BY GEO-INFORMATION PROVIDERS

Until twenty years ago production processes for geo-data, or maps, were quite stable and the development mapping technology and concepts allowed time horizons for investments in the order of 15 to 25 years. Presently the development of technology requires a time horizon for investments in hardware of 3 to 5 years and concepts for information products and services have to be adjusted every 5 to 8 years.

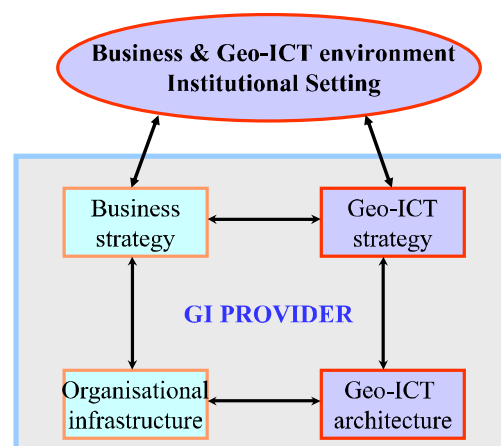


Figure 1. Strategic alignment model, after (Henderson et al, 1992)

Consequently GI-providers and users must adjust their Geo-ICT architectures continuously and this has technological,

organizational and institutional consequences (Figure 1) (Molenaar and Beerens, 2005):

- a) The technology aspect concerns the development and application of concepts for spatial data modelling, for the information extraction from (measuring and) image data and for the processing, analysis, dissemination, presentation and use of geo-spatial data.
- b) The organizational and institutional aspects concern the development and implementation concepts for the structuring, organization, management and institutional arrangements of processes for geo-spatial data production and the provision and use of geo-information services.

Within the modern evolving information society new business and Geo-ICT environments are emerging which force GI-providers to develop new business strategies. These require scenario studies anticipating the opportunities of new technology and new geo-data infrastructures (GDIs). Hence, permanent capacity development of entire organisations is required so that "lifelong learning" does not only apply to professionals, but also to their organizations.

3. GOVERNANCE AND GEO-INFORMATION

The modern technology, the changing role of government and the globalization of the economy have a fundamental impact on the development of GDIs. Governments have a regulatory role with respect to information provision. They should facilitate the development of infrastructure through which geo-information is provided. But should they also be providers, or even producers? Clearly the development of GDIs is not only a responsibility of the public sector; GDIs will develop through public-private interactions. That implies that a strong private sector and thus a private industry is a prerequisite for sustainable GDIs.

Governments also have a direct interest in the use of geo-information which is indispensable the management of our living environment and resources. Governments have an important role here in the context of the international agendas and treaties for the sustainable development of our planet. Geo-information is a prerequisite for good governance at all aggregation levels, also at supra- or international levels. Because almost all human activities have a spatial footprint we can state that "Good Governance requires good geo-information".

4. CAPACITY DEVELOPMENT FOR THE EARTH OBSERVATION AND GEO-ICT SECTOR

All this implies that Capacity Development should have a high priority for organizations which have to introduce new working methods and procedures which ultimately result in structural adjustments of their Geo-ICT architecture (Figure 1).

Capacity Development (CD) comprises human resources development, organisational strengthening and institutional strengthening as implied in the following two definitions.

Capacity Development is to improve:

- the ability of people, organizations and society as a whole to manage their affairs successfully (OECD/DAC, 1997)
- the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner (UNDP, 2003)

The aim of CD is to strengthen organizations and institutions and through them civil society at large. For the international Earth Observation and Geo-ICT Sector this means that not only technology oriented professionals are required but also staffs that can formulate, design, manage and negotiate with other

organisations and government in order to address organisational and institutional issues (Georgiadou and Groot, 2002). Therefore three levels for capacity development have been recognized in Figure 2.

Capacity development

PURPOSE	FOCUS
HUMAN RESOURCES DEVELOPMENT	Supply of technical and professional personnel
ORGANISATIONAL STRENGTHENING	Strengthening the management capacity of organisations: embedding GITC (systems and processes) embedding strategic management principles
INSTITUTIONAL STRENGTHENING	Strengthening the capacity to develop and negotiate appropriate mandates and modus operandi as well as appropriate legal and regulatory frameworks

Figure 2. Three levels for capacity development

Human resources development aims at changing attitudes and behaviors, most frequently through training and education. It involves learning by doing, participation, ownership, and processes associated with increasing performance through changes in management, motivation, morale, and levels of accountability and responsibility.

Organizational strengthening focuses on overall performance and functioning capabilities, such as developing mandates, tools, guidelines and information management systems for the ability of the organization to adapt to change. It aims to develop its constituent individuals and groups, as well as its relationship to the outside.

Institutional strengthening is concerned with the creation of "enabling environments", i.e. the overall policy, economic, regulatory, and accountability frameworks within which institutions and individuals operate. Relationships and processes between institutions, both formal and informal, as well as their mandates, are important.

CD programs should help the international Earth Observation and Geo-ICT Sector to understand how technological, institutional and market developments lead to new geo-information products and services. They should be able to formulate Geo ICT strategies (see right hand column of Figure 1) to secure their institutional position and mandates in this field and to sustain their relevance. A profound knowledge of technological trends should therefore be complemented with a deep insight in the role that geo-information plays in the context of spatial policy and decision making. GI-providers and users formulating new strategies should anticipate on the fast development of GDIs. At the institutional level organizations should be aware of the new roles of government, the new economic and market conditions and thus their changing business environment.

5. PARTNERSHIPS, NETWORKS AND GLOBALIZATION OF SERVICE SUPPLY CHAINS

For reasons mentioned earlier international partnerships providing joint educational programs are of great importance for capacity development. Building these partnerships requires a substantial investment by the partners in staff time, material provisions and institutional arrangements; these investments are only worthwhile

when these partnerships are sustainable. Three types of sustainability are important here (Molenaar and Beerens, 2005):

- “Academic sustainability”: the partners should be able to continuously upgrade contents of their joint programs in correspondence with the related professional, scientific and market developments. This implies that joint education activities should be complemented joint research.
- “Institutional sustainability”: partnerships have a proper institutional or legal setting, i.e. the partners should have an official mandate and legal position embedded in existing frameworks of higher education. Therefore it is important to involve academic institutions and university departments in these activities rather than (the training branches of) professional organizations.
- “Financial sustainability”: each partner should arrange funding for their own activities from their own regular resources. The student-related expenses are jointly pursued from a variety of fellowship- and scholarship programs.

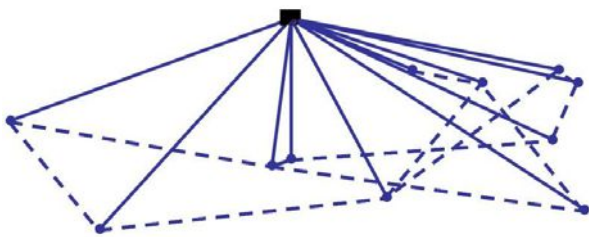


Figure 3: education networks for capacity development

Networks and decentralized supply chains for educational services
Partners generally participate in several partnerships which could in principle be up-scaled into multilateral regional or even global networks (Figure 3). Within these networks decentralized supply chains for education services (Friedman, 2005) can develop. Different partners in the network will have their own competences and fields of expertise; these can be combined into one educational

program or course. Students will visit these partners for the different educational modules when following the program. A more relaxed form is possible too where partnerships are based on agreements for the transfer of credit points. Then there is no joint program, but students follow educational modules elsewhere as part of a program at their home institute. These decentralized supply chains will make more and more use of distance learning approaches to reduce traveling costs of students.

6. THE ITC EXAMPLE

The *International Institute for Geo-Information Science and Earth Observation (ITC)* has been involved in capacity development through educational partnerships for many decades. The positive experience with these activities was good reason about seven years ago to enter into a next stage in which ITC has developed partnerships with universities and institutes on four different continents (Figure 4). These partnerships deliver joint educational programs and provide educational services in the countries or regions where many of the ITC course participants come from. The effectiveness, flexibility and productivity of the ITC educational system has been improved hereby substantially (Molenaar and Beerens, 2005).

These partnerships develop now into an educational network GI-NET which ultimately will serve as a base for decentralized supply chains for educational services. e-Learning tools are presently used for mutual support of the lecturers at the different nodes. But these tools are also used for offering short courses through distance learning and blended learning approaches and we expect to offer complete Degree courses in due time. The different nodes of the network will each take their share the development and support of such courses. Through the global spread of the network a 24/7 support will be possible. The nodes of the network can also give regional support to the course participants and alumni by arranging regional seminars and workshops

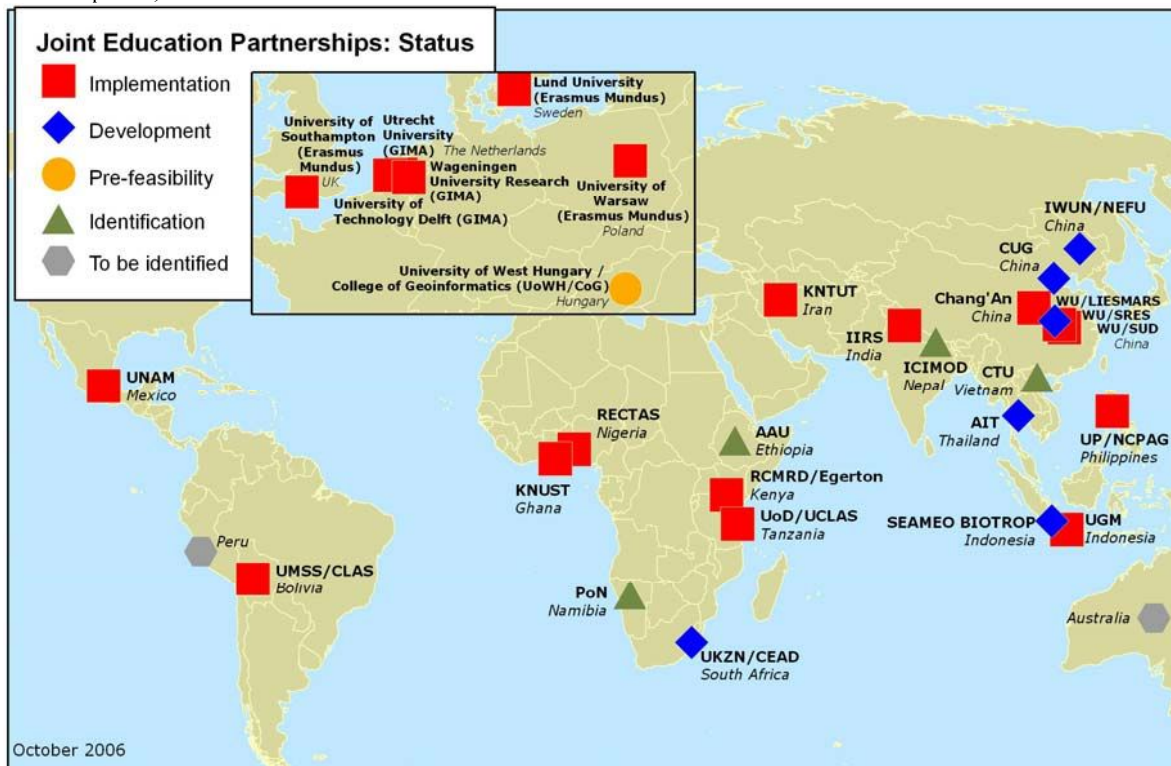


Figure 4: GI-NET, ITC’s international network of partnerships for joint education.

ITC acts as a driving node in this network and guarantees its academic sustainability through continuous impulses for academic and professional upgrading and innovations of the educational services (Ginkel, 2005). Furthermore it also stimulates mutual exchange and support between the other nodes of the network.

The educational programmes at ITC's home base provide the experience. In this role, they serve as a vehicle for permanent educational innovation which respect to content, educational methods and tools and quality assurance. The rapid developments in technology, as well as in the demand for information, imply the need for continuous upgrading of professionals through lifelong learning. According to (InterAcademy Council, 2004): "...all nations, particularly the developing ones, require an increased level of S(cience) & T(echnology) capacity to enhance their ability to adopt new technologies and adapt them to local needs...". Institutes for higher education must be up to date with these developments and a strong interaction between education and research is therefore needed. Therefore ITC is presently developing partnerships for research purposes with organizations in less developed countries, which often have no sufficient resources to develop their own research activities. This research network creates opportunities for the colleagues of those partner organizations to participate in the research programme of ITC and of other strong research partners.

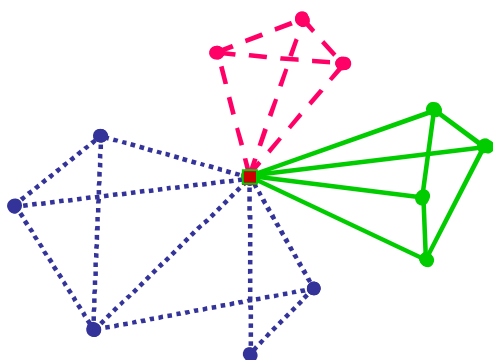


Figure 5. Linked networks

ITC is active in several other networks besides GI-NET, such as the GIMA program with three Dutch universities, an Erasmus Mundus program with several European universities and the United Nations University (UNU) network. These networks are connected because of they have ITC as a common node, as in Figure 5. Through this position ITC can transfer experience and knowledge between networks and also be the gateway for staff and students to move between networks

7. TOWARDS A VIRTUAL UNIVERSITY FOR GEO-INFORMATION SCIENCE & EARTH OBSERVATION

These networks with their decentralised educational service supply chains, with the different types of educational partnerships and with different concepts for joint courses and joint degree programs form an interesting starting position for the development of a virtual university for *Geo-Information Science and Earth Observation*.

The present partnerships are bilateral. The first stage is always a Memorandum of Understanding stating that both parties have the intention to enter into a partnership, which then will be based on an agreement which defines the set up of the joint educational

program including the duties, contributions and responsibilities of both parties and the financial arrangements. The network structure required for the development of a virtual university is quite different from a standard joint education program. This is a multilateral arrangement where most likely not all partners will enter at the same time. A network will be dynamic so that partners come and go over time. In that case a multi lateral agreement might not be the proper institutional base. One should rather think of a charter drawn up by the founding partners, so that parties joining the network at a later stage can sign up to it later.

This charter should specify the domain in which this virtual university will provide educational services (e.g. *Geo-Information Science and Earth Observation*) and the type and content of the programs and courses it will deliver and how to evaluate their market relevance. It should specify the building blocks of these courses (course elements) and units applied in its credit transfer system (e.g. ECTS). Quality standards have to be specified and procedures for quality assurance and control (e.g. internal - in the network - and external peer reviews) and choices should be made for accrediting organizations. The financial arrangements should be formulated such as course fees and financial compensation for marketing activities, course contributions and administrative support.

The road to a virtual university for *Earth Observation and Geo-Information Science* is certainly a long one to go. But there are good examples in other domains and the present GEOSS process provides an unique opportunity for such an initiative.

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