# GEOINFORMATION IN SUPPORT OF DECENTRALISATION AND COMMUNITY EMPOWERMENT

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## 1. Introduction

*At least 80% of public and private decision-making is based on some spatial or geographic aspects.* This remarkable observation, published in "The ISO Bulletin" in the year 2001, outlines in a very lucid way the need for spatial information by decision-makers.

The demand for spatial information in relation to decision-making can be considered from different perspectives. First and foremost, the process of making decisions requires information as an input. Decisions made in this manner are often referred to as informed decisions. The need for information in general and spatial information in particular can also be viewed from the point of view of impact. As is well known, decisions have a range of impacts. The impact of some decisions can be realised immediately. Other decisions may impact courses of action over medium to long time horizons. In all cases, the outcomes of decisions must be predicted, controlled and especially the long-term realisations the development process requires that the outcomes of decisions be monitored and evaluated. Once again, the support of spatial information is evident in monitoring and evaluating the impact of decisions or development processes. This is the reason why the increased need for spatial information is becoming a challenge for people who are involved in spatial data management.

Decision-making is done at different administrative or organisational levels. Various actors operating at global, national, regional or local level or organised as public or private units of an entity have to invariably take decisions. Nowadays, there is a global tendency to decentralize decision-making and delegate responsibility to regional or local actors or organizational units. As a result, the number of points where decisions are made has been increasing and this has, among other things, entailed the need to avail the attendant geoinformation to more decision makers or levels of decision-making than was the case some years ago.

Modern governance requires transparency and the involvement of communities and citizens in the decision making process. Decentralisation and community empowerment are strategies to achieve transparency and participatory democracy. They are also needed for community based land management processes in particular and development administration in general. By ushering in a process whereby governmental power can be shared, these also guarantee social cohesion and sense of belongingness. Modern spatial information management tools play the role of enabling technology by facilitating decentralisation, community empowerment, and citizen participation. This paper aims to highlight issues how this facilitation can be achieved.

Nonetheless, it doesn't and cannot cover all matters related the support geoinformation could provide to promote decentralisation and community empowerment. Accordingly, in the first part selected issues of spatial information management will be discussed, namely the users (customers) of geoinformation, the required data for (land related) decision processes, the new possibilities in the acquisition of geodata and the distribution of the same. In the second part several requirements and recommendations will be outlined to guarantee an essential support of geoinformation for decentralisation and community empowerment.

## 2. Definitions

Decentralisation, Community Empowerment and Geoinformation are terms with different meanings in the various fields of competence, even in different countries and in different cultures. To prevent uncertainties that may stem from such differences and facilitate proper communication, the author will clarify his understanding by using the following definitions.

### 2.1 Decentralisation

Decentralisation is the transfer of responsibility for planning, management and resource raising and allocation from the central (national) government and its agencies to field units of central ministries or agencies, subordinate units or levels of governments, semi autonomous public authorities or corporations, area wide, regional or functional authorities or non governmental, private or voluntary organisations [Cheema et al, 1983].

Decentralisation has several forms [Cheema et al, 1983]:

- *Devolution:* Transfer of responsibility for governing - the strengthening (financially or legally) of sub-national units of governments, whose activities are substantially outside the direct control of central government.
- *Delegation:* Assignment of specific decision-making authorities that can be done by the transfer of managerial responsibility for specific defined functions to public organisations outside the normal bureaucratic structure of central government.
- *Deconcentration:* Spatial relocation of decision-making – the transfer of some administrative responsibility or authority to lower levels within central government ministries or agencies.

### 2.2 Community Empowerment

Community empowerment is the activity to give official authority or legal power to the community that can be a local group, a citizen's action committee, a citizen's initiative, or a number of individuals with common interests [adapted to Merriam Webster Dictionary, 2003].

Another definition is given in the sourcebook of empowerment and poverty reduction [World Bank, 2002]: Empowerment is the expansion of assets and capabilities of communities to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives.

The involvement of communities in the decision process can be done in several stages. The spectrum of involvement is open from a very passive role to a very active impact of communities in decision-making. And community empowerment spreads from a powerless level up to a powerful one [Community Empowerment Working Group, 2003]:

- *Communication/Information:* The community is informed about what has been decided. In some cases the community also receives information during the process of decision-making.
- *Consultation:* The community is invited to respond to a proposal for action but without any commitment to acting on the responses.
- *Formal Involvement:* The community has a defined role in decision taking on its own behalf but as one interest amongst several.
- *Deciding Power:* The community has the right to decide for itself and has the means to implement its own decision.

### 2.3 Geoinformation

*Geodata* is a collective term for all kinds of data with a spatial reference. The spatial reference has to provide an unambiguous location for the specific data and has to allow the merging of data of different sources. The reference is realised as a point, a line, or an area in a defined (national or global) coordinate system. Also units of administration, addresses, or specific geographic names are used for referencing thematic data. In general the thematic data are describing physical characteristics, economic or ecological properties, legal aspects, social and cultural features of land.

*Geoinformation* is the result of combining geodata with expert knowledge. This can be expressed in the short formula "GI = GD + K" (Geoinformation = Geodata + Knowledge). Knowledge can be integrated as clearly defined procedures for data processing (fusion, merge, aggregation or filtering of data) or in form of mathematic or physical models describing dynamic processes.

## 3. Selected Issues of Geoinformation

Decentralisation as well as community empowerment can appear in several forms as shown above. But all stages of these features of modern governance are based on four key elements [World Bank, 2002]:

- Access to information
- Inclusion and participation
- Accountability and
- Local organizational capacity.

These are the basic concepts that should be defined to better understand issues raised in this paper. The following is a discourse on access to a specific type of information, the geoinformation, the technical possibilities in the capture of this information and the possibilities for the distribution of the same with a view to availing the same to decision makers that are located at many and different levels.

### 3.1 Required Data

It is now widely regarded that data are the most important component of the spatial data infrastructure (SDI) of a country. And the latter is gaining increasing significance and acceptance of late. A case for accessing geodata in this kind of set up can be illustrated with a typical scenario in land information management. Thus, relevant information about land, for example, can be obtained by the possibility to link different kinds of geodata together. The linkage of data is realised though a system of spatial reference. Said with other words the coordinate (reference) is often used as primary key in a (relational) geodata base linking the different components of a dataset and thereby playing the role of foundation data.

Decision-making for sustainable land use and land development is achieved through the geoinformation link and based on data sources as illustrated in *Figure 1*.

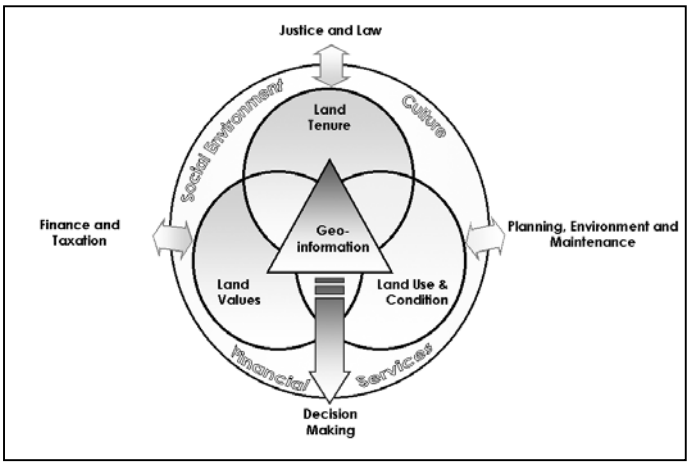


***Figure 1: Required Data for Decision Making***
Source: adapted from [Dale&McLaughlin, 1999] and [FIG, 2002]

Land tenure data define the rights to a specific piece of land (parcel) and they are recorded in land registers. Usually this kind of data is under the custody of Justice and Law authorities.

The use and the condition of land can be described by physical data. This group consists of topographic data of the land, information about the land cover, the geological situation, the quality of soils, as well as the shape and size of parcels. Often these data sets are collected and maintained by planning or environmental authorities.

The third data group that contributes to geoinformation characterizes the value of land and is assigned to the financial and taxation sector.

Decision-making is not only based on information about land. It also depends on the social environment, on the culture, and on the economic condition of a country, of a region, or of a local area. This information also must be integrated into the geoinformation system to guarantee optimal decisions.

As has been shown in the diagram above, spatial information offers a tool with which these disparate spatial datasets could be brought together and put to use through a common reference.

### 3.2 Users

Users of geoinformation are organisations, groups, or individuals and they can be involved in the production maintenance, and/or the processing of data. *Figure 2* gives a more detailed description of potential users. The diagram also specifies the demand on geoinformation in a three-step grading (low/medium/high) broken down to different levels of administration. Using this illustration, one can clearly see the increasing need for more geoinformation at a local level. This is not however always true and may only be valid in the context of decentralised administration where the communities and local government have more opportunities to make decisions.

The number of potential users is inversely proportional to the level of administration: The lower the level of administration the higher is the number of users.

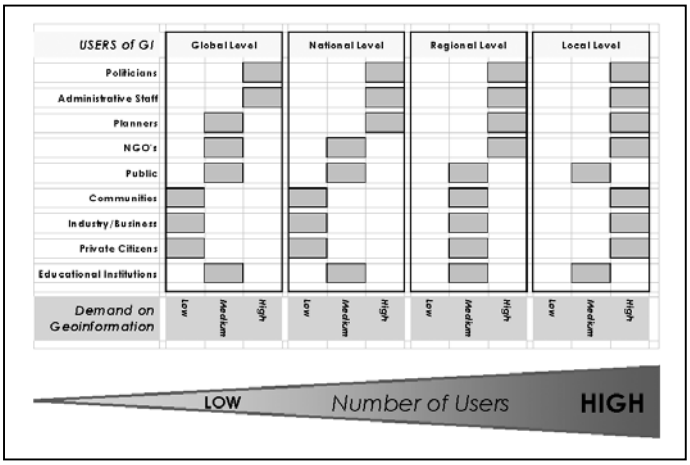


***Figure 2: Users of Geoinformation***

### 3.3 Data Acquisition

Within the last decade a lot of changes took place in the field of data collection and data processing. New technologies appeared, which - 20 years ago - were not known by most of the surveyors and other professionals involved in spatial data capture:

- Global Positioning Systems (GPS),
- Geographic Information Systems (GIS),
- Laser Scanning,
- High-resolution digital image data,
- Semiautomatic and Automatic Image Processing.

The use of new technologies leads on the one hand to an increasing effectiveness of data acquisition and on the other hand to an improvement of data quality. The details in relation to technical advances in the development of equipment and systems for geodata capture and management can be seen in [Mansberger & Muggenhuber, 2002]:

*Increased Data Acquisition Rates:* Innovations, like motorisation and automatic reflector (target) recognition of total stations, 3D-laser scanning or real time GPS, abbreviated the time for individual point measurements. Additionally new technologies result in the change of surveying methods: For the surveying of a façade the invention of reflectorless distance measurements enables the time saving method of 'radiation' (one station) instead of 'intersection' (two stations).

*'Higher Resolution' of Objects:* Since 1998 the ground resolution of satellite images decreased from ten meters (SPOT) to below one meter (IKONOS, QUICKBIRD).

*Time and Weather Invariant Acquisition Methods:* Modern remote sensing satellites are capable to take images for almost every place on planet earth within a repeat cycle of some days. High-resolution sensors are only equipped with detectors registering the visible spectrum or the near infrared spectrum and are not meant to take images during the night or images of cloudy regions. The use of radar sensors can easily help to overcome this shortcoming.

*Reductions of Staff for Data Acquisition:* Especially in industrialized countries manpower and with it the whole data acquisition is very expensive. So research activities of production companies are also focused to improve surveying equipment for a reduction of staff costs. GPS and one-person total stations are results for these efforts.

*Automatic Algorithms for Measuring Objects:* The need of huge sets of geodata only can be satisfied by automatic procedures for data acquisition. Object detection rises to one main research activities in the surveying industry. First results to recognise and classify objects out of digital images had been achieved in photogrammetry and remote sensing during the last years.

In the last decades the technical, economic and administrative environment for geoinformation management has changed dramatically. And the changes have also affected the activities of surveyors: some decades ago Surveyors enjoyed undisputed monopolistic position in geometric data acquisition largely because of the following facts:

- The calculation of measurements required broad knowledge in surveying or photogrammetry.
- Surveying equipment and analogue or analytic stereo plotters were very expensive.
- The thematic characterisation of acquired geodata was generalised (map data) and no special expert knowledge for the acquisition of semantic data was necessary.
- Other experts collected thematic data (e.g. landscape designers, regional planers etc)– mostly independently from geometry.

In the meantime point coordinates are computed automatically using the measured and registered data sets. Geodata are more detailed in their "thematic resolution" and so the required knowledge for geodata assessment shifted from geometric issues to thematic issues. Simultaneously with this shift the costs for surveying equipment and photogrammetric soft copy stations decreased resulting in a situation where thematic experts themselves began to master skills needed to acquire geodata [Mansberger et al., 2000]. With this, the role of the surveyors started to change from a specialist in data capture to a data manager.

### 3.4 Data Distribution

The access to geoinformation is an essential part in the process of decision-making. Information that is not accessible is as good as information that is unavailable. For information to be of any use, it must be accessible. Up-to-date datasets out of different data sources should be available in real time to all institutions and groups that are involved in the decision-making process.

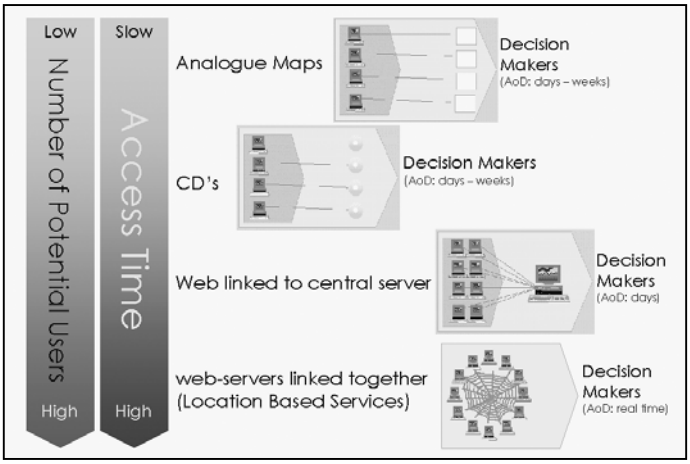


***Figure 3: Ways of Data Distribution***

*Figure 3* shows four possible ways to distribute data:

- *Data distribution by analogue maps* is the oldest and most conventional way. The maps are produced by specialists of several disciplines and are provided to the decision-makers. The actuality of maps is dependent on the production time and the delivery time. As customers and users of maps are independent of any technical equipment this method is still widespread all over the world. The limited possibility of multiplying and the analogue format are the obstacles of this geodata delivery medium.
- *Data distribution by compact disks* (CD) allows a transfer of data in a digital format. The CDs are often produced by specific experts and the end users have to bring the data from several service units to a common proper format. The data delivered on a CD are in general up-to-date, only the delivery time must be taken into account. The limited number of produced data CDs also downsizes the quantity of potential users.
- *Data distribution by access to a central web server* allows the access to data for a high number of users in real-time. Any limitation on the size of potential users is determined by skills and the technical equipment available in a country.
- *Data distribution by web access to linked web servers* includes all the benefits and lacks of the afore-mentioned method. Both ways of distribution provide geoinformation that is collected and maintained at several service units and stored on individual computers or servers. For the customers and end-users both methods differ in the actuality of the information: The web server linked solution allows for all users direct access to all of the servers and so the actuality of geodata is dependent on the updating rate of the individual service units. The actuality of data in the central server solution additionally is dependent on the maintenance rate of the central server.

All distribution methods are still in use. Of course there is a trend from analogue distributed data (maps) to digital data formats and from analogue transfer methods (postal way) to electronic data transfer methods. But especially web-based data distribution methods require a well-developed countrywide communication network with a high penetration of individual Internet access. Web-based distribution methods also demand clearly defined access permission for user groups to avoid misuse of data.

In connection with this, it should be noted that, perhaps with the exception of the first method, all of these might not be presently feasible in the context decentralization and community empowerment in poor countries. This could mean that decision will be made without adequate and quality geoinformation unless ways and means are found to overcome the problem. Important steps towards solving this problem are the analyses of specific cases where felt needs are to be addressed and the direct involvement of stakeholders (communities and local government entities) who may wish and should specify their needs and capabilities.

## 4. Requirements for and Recommendations related to Geoinformation Support for Decentralisation and Community Empowerment

*There is a strong need on geographical information for public and private decision-making.*

Decision-making in land management is highly related to spatial information. Especially the basics of geoinformation (land ownership, land rights and land use) should be maintained countrywide to enable and guarantee an unobstructed function of common and personal welfare.

*Geoinformation is part of the infrastructure in a country.*

The acquisition and maintenance of geoinformation itself never will become a cost-covering activity in a country. But the availability of geoinformation has positive impacts to public as well as to private business and welfare and as a consequence to the national economy of a country. The countrywide supply with infrastructure must be is a primary objective at all levels of administration.

*Implementation of spatial data infrastructure requires cooperation between the private and the public sector and amongst all professions involved in land management.*

Land registers and land cadastres as a basis of spatial data infrastructure are mostly the responsibility of public authorities. But decision-making processes demand additional thematic information about land (as sketched in Section 3.1) that are collected and maintained by various public or private institutions or by professionals trained in a particular trade. Partnership and cooperation between and among all groups is necessary for successful geoinformation management.

*Decentralisation and Community Empowerment require countrywide and detailed geodata.*

New developments of hard- and software meet these requirements: New Technologies opens unlimited opportunities to acquire more and detailed data in a shorter time. Within the last years powerful tools for the storing and processing of geodata appeared on the market. Due to the high costs of modern data acquisition and data processing equipment the new systems are not accessible to local governments and communities in poor countries. Policies and strategies are necessary to make new technology also accessible to poor people. Research work on technical innovations must be continued and has to focus on the development of cheap and easily usable technology.

*Decentralisation and Community Empowerment require data access for an increasing number of users.*

Modern information technology enables real time access to geoinformation for an approximately unlimited number of users. The penetration of modern communication technology in less industrialized countries is very low and prohibits a frictionless access to geoinformation. Using wireless communication system can accelerate the progress of implementing a countrywide communication networks.

*Decentralisation and Community Empowerment require experts of geoinformation at a local level.*

The use of available geoinformation resources requires at a local level knowledge about data acquisition, data processing, and the visualisation of data. The degree of geoinformation expertise is varying and depending on the responsibility of a specific person or user group. Decision-makers need different education and training programs in information technology as people involved in the implementation or maintenance of IT systems or specialists for data capture. Policy has to focus its activities on capacity building in the broad field of geoinformation technology.

*Decentralisation and Community Empowerment require a specific geodata policy.*

As shown above various private or public users in different levels of administration require spatial information for decision-making. Very often these people need the same geodata. The number of units involved with geodata management is increasing with the degree of decentralisation. To avoid redundancies and inconsistencies in the collection of geodata, in the storage of data, in the maintenance of data, in the processing and improvement of geodata, and/or in the distribution of geoinformation, policy has to provide the legal and the administrative framework as well as the business environment to clarify the responsibilities various actors involved in geodata management. The regulations have to include detailed specifications in terms of the tasks

for the units, in terms of the topics of data, and the defined working areas. Geodata policy also has to coordinate strategies and procedures for the internal and the external access of data.

*Decentralisation and Community Empowerment require data exchange between different levels of public and private institutions.*

Only the use of clearly defined standards and norms can facilitate the sharing and exchange of geoinformation without any problems amongst various user groups. But the increasing number of collected and available geodata also requires a detailed description of the data, the so-called metadata. The use of metadata can facilitate access to and improved use of geodata. Metadata in the context of SDI can also prevent duplications that may arise from limited knowledge of available data residing at different locations in a country.

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