

Spatial Data Bases as Tools for Land Use and Development

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Abstract. The definition of "Land Use and Development" (in German language: "Bodenordnung") and the objectives and procedures of land policy are presented in the first part of this paper, focused on the European and especially to the Austrian situation. Examples of the practical use of data bases for activities in the field of land use and development will be given. At last proposals for a possible breakthrough of spatial data bases in the wide-spread area of land use policy will be formulated.

1. Land Use and Development

1.1 Land Use and Development - an attempt of a definition

"Bodenordnung" is the German meaning for "Land Use and Development". Most of the people living in German language countries know the term "Bodenordnung", but everybody has another picture of it. Asking for a definition will achieve a wide-spread answer that depends on the personal experiences of the specific person: land reform, land consolidation, agrarian operations, spatial planning, cadastre, taxation of real estates and other items are given.

The term "Bodenordnung" is not content of German encyclopaedia, such as : Meyer's Lexikon (*Meyer's, 1995*), Bertelsmann Lexikon (*Bertelsmann, 1992*) and "Der große Brockhaus" (*Brockhaus, 1959*).

In Austria all national and provincial laws and regulations are available in a digital format ("Law Information System") and accessible for everyone via the Internet (<http://www.ris.bka.at>). The system also contains a search engine for keywords: "Bodenordnung" will only be found in 4 paragraphs.

There are some definitions of the term "Land Use and Development" in literature: A well put description of the "complex process of case specific peculiarity" (*Seele, 1993*) will be found by Seele (*cit. in Weiß, 1996*) and Hoisl (*Hoisl, 1993*). The words used in the definitions are different, but the kernel of the statement is the same: "Land Use and Development" implies "protection and preservation as well as organisation and designing of land".

1.2 Aims of Land Use and Development

Land Policy has to ensure an optimal use of land. This statement seems very simply, but in most of the states the competence of administering land use and development policy is not concentrated to one public authority. Additionally there is no one single law for land use and development. Regulations, decrees and guidelines

that concerns this field of policy are spread over a lot of laws (*Twaroch and Muggenhuber, 1999*): agricultural act, construction act, financial act, surveying act, regional planning act, environmental act, and others.

The above mentioned reasons and the pluralistic structure of our society complicate the "standardisation of land use and development", but they also, - and this is the benefit, - enable multi-layered designation of land.

In the European Union there is a fundamental consent about the aims of land use and development that are listed below in an abbreviated form:

- Avoiding of public interventions to private property (e.g. expropriation).
- Optimal use of land (land with good soils should belong to farmers).
- Minimisation of consumption of natural resources.
- Environmental protection of land.
- Scattering of property by allocation of land.
- Preservation of the social and economic structure.

1.3 Measures of Land Use and Development

In the activity of resource policy the importance of land use and development is increasing. It is a tool for balancing individual and common interests. The catalogue of measures for land use and development requires the experts of various fields of knowledge: ecologists, economists, lawyers, technicians and sociologists.

The different measures of land use and development may be classified in many ways, such as the competence of experts or variations in public costs. *Wytrzens (Wytrzens, 1998)* arranged the different methods by the intensity of the obstruction for the private owner:

- *Information Instruments*: Publication of specific information can change the awareness of people for using or owning land. The effect of these instruments is very slow and long-termed, but there is no public intervention to private interests.
- *Private-enterprising Instruments*: Public authorities operate with land in the same way as private persons (e.g. purchase and sale of parcels). But also the provision of subsidies can change the use of land. The effects are short-termed and the private owner does not have any disadvantages.
- *Fiscal Instruments*: Any change of the taxation of land has effects to owners of land. Increasing land taxes often stimulate the market of real estates. Fiscal measures do not change the rights on land, they only touch the duties of owners.
- *Compulsory Instruments*: If property can be interpreted as the sum of authorities of land, these instruments entail a reduction of these authorities - also against the intention of the owners of land. In general compulsory instruments only will be applied in cases of common interests on land (building of infrastructure, e.g. roads, railways).

2. Spatial Data Bases as decision making fundamentals for Land Use and Development in Austria - State of the art

Actual land use is closely linked with general planning and it is closely linked with other influences caused by regulations and even subsidies. The institutional effects depend on public as well as private structures as mentioned in *Chapter 1*.

Spatial data bases are tools and fundamentals for decision making in the field of land use and development.

The decision making process is on the one hand under the regulation of the public sector, but is also supported by the private sector (consulting engineers, and information providers like real estate agents and geo-marketing providers) as shown in *Figure 1*.

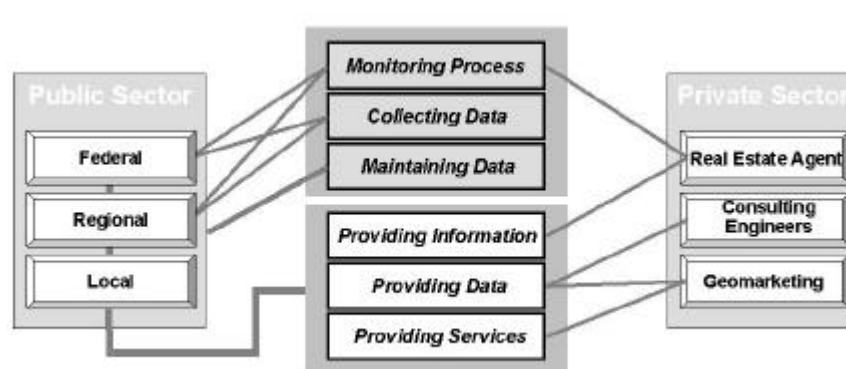


Figure 1: Data flow in decision making processes

Both parts - public and private sector - that are involved in a co-operation or partnership in the processing of spatial data must be aware of their strong points but they also have to acknowledge about weak points.

The strong point of the public sector in land use and development is their sustainability and reliability in the long run. On the other hand flexibility and customer-oriented behaviour are more likely to be provided by the private sector.

2.1 Public and legally-binding data as direct input for Land Use and Development

Different institutions within the public sector are maintaining information for monitoring, decision making and controlling procedures and long term developments, such as environmental monitoring, land use planning and urban developments. The basic data for these monitoring and control functions are collected by the public authorities, but they will also be collected by - registered - private companies, such as authorised surveyors. Land register, cadastre and graphical representations of the cadastre (Digital cadastral map in Austria) are assessor parts of this kind of data.

In recent years private companies with special focus on providing information are joining the geo-market. These companies buy existing legally-binding or public data from national or regional offices (Federal Office of Statistics, Federal Cadastre or others) and they add to this data by geo-coding, address-matching and/or other data processing techniques.

As a result of these improvements the companies can combine the data with their marketing knowledge and provide information and service for decision making. Other private structures like real estate agents benefit from that value added service.

2.2 Other spatial data for Land Use and Development

Data in a time sequence is needed for environmental monitoring. Existing data collected for other purposes can often be used as a basis for such time sequences. The risk of using data which are not originally dedicated for that kind of use are well known.

The Federal Office of Statistics has decided to use all available data as a basis for the next micro-census instead of asking again about the same data as somebody else had done before. In Austria the merge and linkage of data caused a discussion about privacy of personal data. From that legal point of view a lot of data are in a certain way related with individuals. Geographic information is often linked with a group of persons living in a block of apartments, or even linked to an individual apartment.

Using and linking data is on the one hand a question of cost and acceptability within population group. On the other hand it becomes more and more a legal problem, which causes a stronger limitation than any technical problem.

3. Spatial Data Bases & Land Use and Development: Future Aspects

Predicting the future is easy in an oral presentation. At the moment of presentation nobody is able to contradict the prediction. Predicting the future in a written paper could be more dangerous. So the authors are very careful in estimating the future of spatial data bases and land use and development.

There is certainly a need for spatial data bases in land use and development. The magnitude of the use of spatial data bases for fundamental decision making will depend on the quality of data and data access. Some improvements must be made. The authors found some irritations in present situation and will define five proposals, whose fulfilment could be the breakthrough of spatial data bases not only as an effective tool for land use and development but also as a complete land information system.

3.1 Proposal 1: Better Documentation of Legal Aspects

Surveyors are very skilled in the acquisition and documentation of technical data. They have sufficient knowledge about different co-ordinate systems, about the accuracy of data and with this the knowledge can establish the quality of data. But besides the technical data there is also a need for legal data. Experts on data bases, for example surveyors, have to develop special techniques for the processing of legal data. This means:

- suitable storage structures for maintaining the legal data,
- models suited for representation of laws and regulations in data bases, and
- suitable visualisation tools for a graphical representation of legal aspects.

3.2 Proposal 2: Documentation of Chronological Changes (Time Series)

Time (past and future) was and is an important aspect in land use and development. People can learn from the past. So a lot of development processes had been revised due to new scientific knowledge. For example some decades ago many riverbeds have been straightened to avoid flood disasters. New studies show that for the prevention of flood disaster within the whole catchment area the former course of the river is more effective and nowadays the repositioning of rivers is being done (*Bullard, 1999*). Old maps which document the former courses of rivers had become important planing fundamentals. So modern spatial data bases have to document historical data of objects, time series of ownership, changes of land use and finally the modifications of legal and financial aspects.

3.3 Proposal 3: Improvement of Information by "I + M = K"

In general the customers are able to improve the data stored in data bases. Knowledge is the result of the meaning about information. This can be expressed in the short formula "I + M = K" (Information plus Meaning = Knowledge).

Knowledge also can be obtained in a computerised way by extending data bases to Information Systems (IS) that contains different methods to acquire new knowledge out of consisting data, for example:

- Analysis of data.
- Aggregation of data.
- Data modelling (Image of the real world).
- Simulation of processes (Image of processes within the real world).

The digital way to acquire knowledge includes the risk of obtaining the wrong results caused by inadequately conceived models and caused by incompetent interpretation of data.

3.4 Proposal 4: Interdisciplinary Co-operation by Establishing Data Bases

Land use and development policy needs experts in different fields of sciences: This cognition, documented in *Chapter 1*, is transferable to the acquisition of data and transferable to the interpreting of digitally derived knowledge: Both tasks must be done by authorised experts in interdisciplinary co-operation (*Stolitzka and Mansberger, 1999*). Of course these specialists who have knowledge about the quality of specific data have to bear the responsibility: Surveyors for the geometric data, lawyers for legal data, economists for financial data, and others.

The risk of obtaining false results as mentioned in *Proposal 3* also can be minimised in this way.

3.5 Proposal 5: Customer-friendly Data Access

In the past the customer who needed various data for tasks in land use planning lost most of the time by visiting different public authorities (e.g. cadastre office, land register, spatial planning office, finance authorities). The progress must be improved. Land use and development requires an easy and fast access to data bases or to (knowledge-based) information systems: The "one-stop shopping"-philosophy for getting data must be realised as soon as possible.

4. Conclusion and Outlook

Land Use and Development is an imperative part of the exercise to administer land. The aims of land regulation are dependent on the spirit of age of the society and of course they are dependent on the political views of governments. Methods of land use and development have often changed in the past and they will be modified in the future. The need of data for this task will always continue.

In the field of land use and development the present part of the surveyor is involved in data acquisition, data processing and the visualisation of data. The impact of surveyors in land regulations could be improved by the achievement of the proposals as formulated in *Chapter 3*.

The achievement of the proposals is more than a **task**: It is a **challenge** for scientific research and a **chance** for the surveyors to become established in the wide-spread area of land use and development policy.

References

Bertelsmann, 1992. "Bertelsmann Universallexikon in 20 Bänden". Verlagsgruppe Bertelsmann GmbH. Gütersloh. 1992.

Brockhaus, 1959. "Der große Brockhaus". F.A. Brockhaus, Wiesbaden 1959.

Bullard, R., 1999. "Reclamation of abandoned land leading to sustainable development". In "**Land Reform and Sustainable Development**". Edited by Robert W. Dixon-Gough. International Land Management Series. Chapter 24. pp.287-300. Ashgate. Aldershot. 1999.

Hoisl, R. 1993. "Einführung: Bodenordnung - eine geodätische Disziplin". **Zeitschrift für Vermessungswesen**. 118.Jahrgang. Heft 6, pp.258-263. Verlag Konrad Wittwer GmbH. Stuttgart. 1993.

Meyer's Lexikon, 1995. "LexiROM ©". 1995 Microsoft Corporation und Bibliographisches Institut & F.A. Brockhaus AG. Meyers Lexikon in drei Bänden © Bibliographisches Institut & F.A. Brockhaus AG, Mannheim 1995;

<http://www.ris.bka.gv.at>. 1999. Österreichisches Rechtsinformationssystem des Bundeskanzleramtes im WorldWideWeb. Wien. 1999.

<http://www.bev.gv.at>. 1999. Homepage of the Austrian Federal Office of Metrology and Surveying. WorldWideWeb. Wien. 1999.

Seele, W., 1993. "Wissenschaftlichkeit in der Bodenordnung - Folgerungen für die Ausbildung in Ost und West". **Zeitschrift für Vermessungswesen**. 118.Jahrgang. Heft 6, pp.294-297. Verlag Konrad Wittwer GmbH. Stuttgart. 1993.

Stolitzka, G., Mansberger, R., 1999. "Public and legally-binding data bases for the protection of natural resources". In "**Land Reform and Sustainable Development**". Edited by Robert W. Dixon-Gough. International Land Management Series. Chapter 7. pp.69-76. Ashgate. Aldershot.1999.

Twaroch, Chr.; Muggenhuber, G., 1999. "Grund und Boden als ökonomische Größe". Proceedings der "Internationalen Geodätischen Woche in Obergurgl". Herausgeber: Institut für Geodäsie. Universität Innsbruck. 1999.

Weiß, E., 1996. "Rechtsgeschichtliche Grundlagen und Wirkungen ländlicher Bodenordnungsverfahren für städtebauliche Entwicklungen". **Vermessungswesen und Raumordnung**. 58.Jahrgang. Heft 3 und 4, pp.129-153. Ferdinand Dümmler's Verlag. Köln. 1996.

Wytrzenz, H.K., 1998: Bodenordnung und Grundverkehr in Mitteleuropa. Vortrag "Ukraine - Österreich: Landwirtschaft - Wissenschaft und Praxis". Wien, 1998.