

# NEW CHALLENGES TO EDUCATION IN GEODESY AND GEOINFORMATION

*A short presentation of the lecture, held at the Faculty of Civil and Geodetic Engineering of the University of Ljubljana on October 1, 2004, by FIG President Univ.-Prof. Dr.-Ing. Holger Magel, Co-Director of the Institute of Geodesy, GIS and Land Management at TU Munich and Program Director of Master's Program Land Management and Land Tenure.*

*Lecture materials kindly provided by  
Univ.-Prof. Dr.-Ing. Holger Magel*

*Summarized and edited by  
Joc Triglav*



During his visit to Slovenia, Univ.-Prof. Dr.-Ing. Holger Magel has been accompanied by some highly esteemed foreign professional colleagues, who joined the audience of his lecture. First, Prof. Magel was welcomed and shortly introduced to the audience by the faculty host Dr. Aleš Breznikar. At the beginning of the lecture Prof. Magel expressed his thanks for the invitation of Slovenian colleagues and explained that his lecture is also a very pleasant act of reciprocity for a very good lecture that Dr. Anton Prosen from the Faculty of Civil and Geodetic Engineering of the University of Ljubljana held during the recent celebration event at the TU Munich. The lecture continued with a presentation of the following new challenges to education in geodesy and geoinformation.

## 1 THE WEST EUROPEAN DISEASE: TOO FEW STUDENTS

There is a strong and decreasing trend of the number of students at the geodetic faculties in many West European countries. This situation is a serious threat to the geodetic community in these countries. For example, the geodetic faculty at the world known TU Delft in the Netherlands has closed a few years ago due to the lack of students. The same almost happened also in Berlin, Germany, but was – for now at least – fortunately avoided after Prof. Magel as the FIG President and some distinguished colleagues from our profession intervened at Berlin and federal political and university authorities. The situation at the TU Munich is not so critical yet, but in the last years the number of geodesy students is too low and counts only around 30 students per year. This is of course not good – neither for our profession nor for Bavaria or Germany.

Thus we have to ask ourselves, what we have to do and where to act for the prosperity of our profession. An even more important question is, how and what do we have to change to ensure that the society as a whole benefits most from our proper position and action in the society. The answers to these questions are not easy, but we have to find them by directing the development of our knowledge and implementation of our services in such directions that will enable us to exploit our full potentials and give our best in those professional and scientific fields that are needed most in the society.

## 2 SURVEYOR OR GEODESIST?

There is quite a big difference in understanding the role and functions of our profession on both sides of the Atlantic. To make things a little bit more clear let us take a look at the summary of FIG definition of the functions of the surveyor, which says that a surveyor is a professional person with the academic qualifications and technical expertise to conduct one, or more, of the following activities:

- to determine, measure, evaluate and represent land, three-dimensional objects, point-fields and trajectories,
- to assemble and interpret land, geographically and economically related information,
- to use that information for the planning and efficient administration and management of the land, the sea and any structures thereon,
- to carry out urban and rural development and land management, and
- to conduct research into and develop such practices.

The surveyor's professional tasks may involve one or more of the following activities which may occur either on, above or below the surface of the land or the sea and may be carried out in association with other experts:

- The determination of the size and shape of the earth and measurement of all data needed to define the size, position, shape, and contour of any part of the earth and monitoring any change therein.
- The positioning of objects in space and time as well as the positioning and monitoring of physical features, structures and engineering works on, above or below surface of the earth.

- The development, testing and calibration of sensors, instruments and systems for the above mentioned purposes and other surveying purposes.
- The acquisition and use of spatial information from close range, aerial and satellite imagery and the automation of these processes.
- The determination of the position of the boundaries of public and private land, including national and international boundaries, and the registration of those lands with the appropriate authorities.
- The design, establishment and administration of geographic information systems (GIS) and the collection, storage, analysis, management, display and dissemination of data.
- The analysis, interpretation and integration of spatial objects and phenomena in GIS, including the visualization and communication of such data in maps, models, and mobile digital devices.
- The study of the natural and social environment, the measurement of land and marine resources and the use of such data in the planning of development in urban, rural and regional areas.
- The planning, development and redevelopment of property, whether urban or rural and whether land or buildings.
- The assessment of value and the management of property, whether urban or rural and whether land or buildings or landed interests.
- The planning, measurement and management of construction works, including the estimation of costs.

In the application of the foregoing activities surveyors take into account the relevant legal, economic, environmental and social aspects affecting each project.

Changes in our profession are obviously unavoidable. As we can see from the descriptions given above, there is a difference between what we are doing and what we should be doing. Later on, the profile of surveyor/geodesist will be explained in some more details.

## CHANGE HAPPENS

### Therefore

- anticipate change
- monitor change
- adapt to change quickly
- enjoy change
- be ready to change quickly
- and enjoy it
- again and again.

Source: Discovered in hotel manager's office of Jamaica Pegasus in Kingston, Jamaica

### 3 STILL IN THE NICHE: LAND MANAGEMENT

In order to make changes happen the way we want and need them to happen, we have to play a very active role in the processes of change. But it is not enough to be a participant; we have to strive for leadership. We have to ensure that our knowledge, work and opinions are not only noticed somewhere in the background, we need them to be taken into account and implemented in practice for the benefit of society. Our huge contribution to the well being of the society is so often neglected, while we keep concentrated on the tedious work alone. Other professions, such as civil engineering and architecture as the closest professions to us, have learned very well how to stand in the first row, how to get noticed in the media and be well respected in the society. We have to learn this lesson, too! We have to be more present in the media and we have to cooperate closely on various levels with the politics and with the politicians personally. We have to combine our strategies, goals and efforts with politicians, economists and other professionals in various fields.

Over the last decade a strong move of the FIG in this direction was the strengthening of relationship between the FIG and the United Nations agencies. Through this cooperation we are able to promote the skills of our profession, achieve a better contribution to the betterment of society, raise the profile of surveying onto the world stage by showing that the profession is more than making maps but is about land and property management.

For example, there are many actual fields of cooperation between the UN authorities and FIG:

- land policy, land tenure
- cadastre, land administration, land market, valuation
- restitution of property, secure tenure, access to land
- governance principles, democracy, subsidiarity, devolution, civil society
- sustainable development, Agenda 21
- good urban governance, land use planning, urban land management
- rural development, land development, land consolidation
- spatial data information infrastructure/GIS
- geodetic engineering, remote sensing, photogrammetry, cartography
- capacity building, education, qualification, CPD professional development
- standards

FIG is deeply involved in global UN projects and campaigns in the field of sustainable development, where land management has a crucial role. For example, the UN Habitat Agenda represents an international commitment to facilitating "adequate shelter for all". The Global Campaign for Secure Tenure promotes the essential elements of sustainable shelter strategies. Legal access to land is a strategic prerequisite for the provision of adequate shelter for all and for the development of sustainable human settlement affecting both urban and rural areas. The failure to adopt, at all levels, appropriate rural and urban land policies and land management practices remains a primary cause of inequity and poverty. It is also the cause of increased living costs, the occupation of

hazard-prone land, environmental degradation and the increased vulnerability of urban and rural habitats, affecting all people, especially disadvantaged and vulnerable groups, people living in poverty and low income people. The divide between rich and poor people continues to widen. One in six people lives in disgraceful conditions in overcrowded urban slums. Thirty years from now, there could be twice as many. Therefore, UN-Habitat has identified good governance, land use planning, security of tenure, adequate housing, and reliable infrastructure and services as the key issues in making cities better and more sustainable places for the poor.

Also the EU, in cooperation with UN-Habitat, is conducting a research for sustainable urban development and land use and for “creating a world of sustainable cities”. Though many European cities are both wealthy and beautiful, they still have serious environmental and social problems.

However, in pursuing the goals of sustainable urban development we must never forget rural development. Therefore, as the FIG President, Prof. Magel acts on various international political levels to present the importance of proper land management in world’s rural areas. A major such event was the World Summit on Sustainable Development, which was held in Johannesburg in 2002. *Plan of Implementation* from this summit includes sections and paragraphs that confirm the importance of bringing land and agriculture into focus.

For example, in one of the sections of the *Plan* on Poverty eradication a paragraph demands to improve access to land and property, to adequate shelter and to basic services for the urban and rural poor, with special attention to female heads of household. In another section of the plan on protecting and managing the natural resource base of economic and social development a paragraph emphasizes that agriculture plays a crucial role in addressing the needs of a growing global population, and is inextricably linked to poverty eradication, especially in developing countries. Enhancing the role of women at all levels and in all aspects of rural development, agriculture, nutrition and food security are imperative. Sustainable agriculture and rural development are essential to the implementation of an integrated approach to increasing food production and enhancing food security and food safety in an environmentally sustainable way.

From the *Plan* the following subparagraphs closely related to land management need to be highlighted and deserve our attention:

- Develop and implement integrated land management and water-use plans that are based on sustainable use of renewable resources and on integrated assessments of socioeconomic and environmental potentials, and strengthen the capacity of Governments, local authorities and communities to monitor and manage the quantity and quality of land and water resources;
- Enact, as appropriate, measures that protect indigenous resource management systems and support the contribution of all appropriate stakeholders, men and women alike, in rural planning and development;
- Adopt policies and implement laws that guarantee well-defined and enforceable land and water use rights, and promote legal security of tenure, recognizing the existence of different national laws and/or systems of land access and tenure, and provide technical and financial assistance to developing countries as well as countries with economies in transition that are

undertaking land tenure reform in order to enhance sustainable livelihoods; research results to the farming communities;

- Enhance access to existing markets and develop new markets for value-added agricultural products;
- Increase brown-field redevelopment in developed countries and countries with economies in transition, with appropriate technical assistance where contamination is a serious problem.

**“It is necessary, after a period of neglect to bring back rural development to the centre of the development agenda, noting that the world’s rural areas are where the needs are greatest and suffering most acute.”**

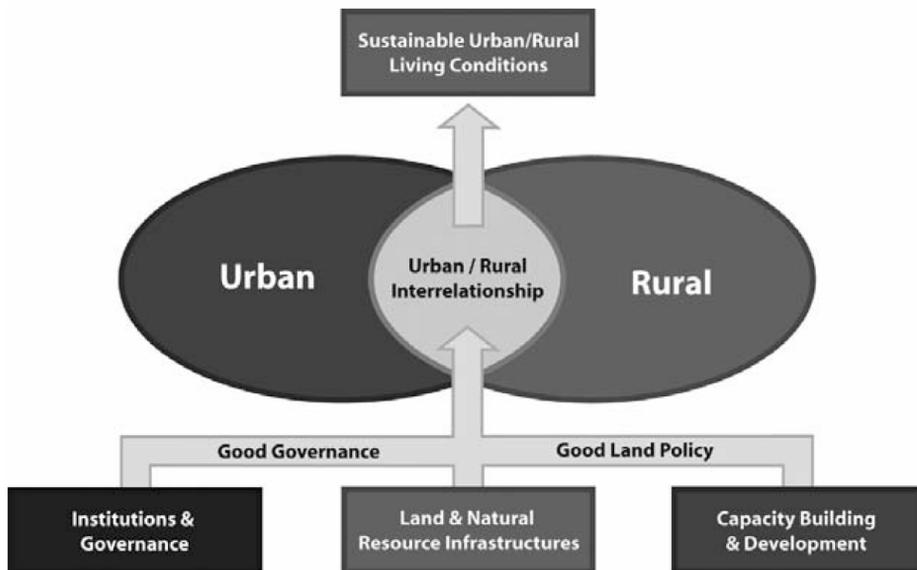
*Source: Secretary general of the UN ECOSOC session 2003 in Geneva*

In December of 2003 the 2<sup>nd</sup> FIG Regional Conference was organized in Marrakech, Morocco. The aim of the conference was to shed some light on selected issues of urban-rural interrelations and to raise awareness of this complex topic. It also tried to explain the close linkage of land policy and land administration. Based on the papers presented at the conference, Marrakech Declaration has been prepared by an expert group. This declaration is about Urban-Rural Interrelationship for Sustainable Development, which was also the title of Prof. Magel’s keynote presentation at this conference as the President of FIG. The launch of the Marrakech Declaration took place at an important recent event: the 2<sup>nd</sup> World Urban Forum in Barcelona, 13-17 September, 2004 and will also take place in these days at the Inter-regional Conference on Strategies for Enhancing Rural-urban Linkages Approach to Development and Promotion of Local Economic Development in Nairobi, 1-4 October 2004.

However, it should always be noted that the two-word key term, urban-rural, used to designate our spatial context, has been created deliberately to follow no specific pattern in terms of word order. This is considered important in order to do away with the mind-set that gives, in writing or speaking, precedence to either of them.



*Marrakech Declaration: Urban-Rural Interrelationship for Sustainable Development. Source: FIG Publication No. 33.*



A simplified view of the urban–rural interrelationship (Graphic: Stig Enemark).

Source: FIG Publication No. 33

**“If rural areas cannot breathe any more then the cities will suffocate.”**

Source: An everlasting truth contained in the words of the former French Prime Minister Edgar Faure.

What follows is a short description of the so called Three Pillar Model, developed by Prof. Magel’s highly esteemed colleague and his predecessor as the FIG President, Prof. Dr. Peter Dale. The three pillar model is about modeling the land market and about requirements that are necessary in order for a land market to work in an efficient and effective way. We know that the market operates through participants buying and selling goods and services. These transactions need to be supported properly by three sectors – land registration and the cadastre, valuation services, and financial services – which may be presented by three regulatory pillars, standing on the legal basis of land policy:

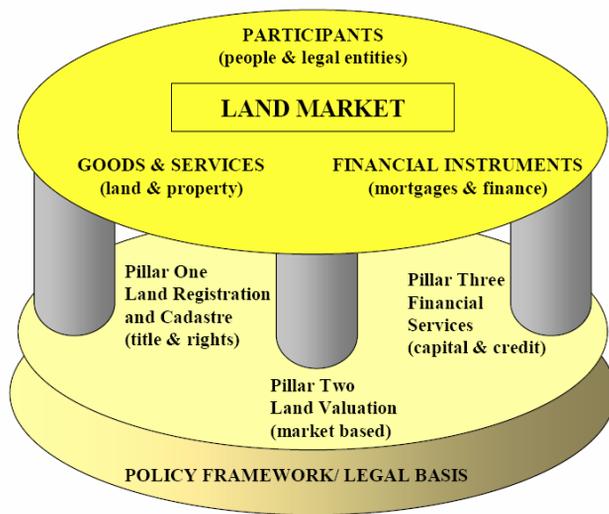
- Pillar 1 - Land Registration and the Cadastre
- Pillar 2 - Valuation
- Pillar 3 - Financial Services

Pillar 1 provides the connection between land and property on the one hand, and people and legal entities on the other. Pillar 2 provides the connection between land and property and finance mechanisms while Pillar 3 establishes the connection between finance mechanisms and people and other legal entities. Of course, the three regulatory pillars are dependent on the government land policy and are constructed on the base of the national legal framework. The

three pillars have to be properly established and supported by the government in order to provide a dynamic land market.



## The Three Pillar Model



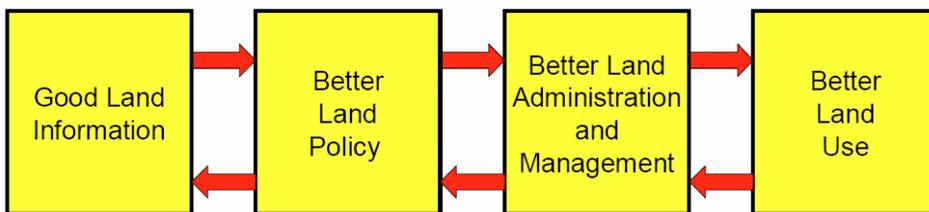
Source: Dale, Peter: *The Importance of Land Administration in the Development of Land Markets – A global perspective*, Proceedings of UDMS 2000, 11–15 September 2000, Delft, Netherlands

Almost all societies are currently undergoing rapid change brought about by a diverse range of factors that include e.g. growing population or public need pressures on the land. Insecure property rights inhibit use and investment in rural and urban land. Without effective access to property, economies are unable to progress and the goal of sustainable development cannot be realized. These issues are forcing the re-engineering of land administration systems to ensure that they support sustainable development and efficient land markets. Land administration frameworks will be forced to respond rapidly to these unprecedented changes.

Land administration institutions and infrastructures will have to evolve and adapt their often inadequate and narrow focus to meet a wide range of new needs and technology, and a continually changing institutional environment. They also need to adapt continually to complex emerging humankind–land relationships at the same time as changing relationships between people and governments. These conditions should lead to improved systems of governance.

From the well-known picture below it is obvious that human society needs sound land administration in order to be able to attain sustainable development. The pairs of four basic conditions are unavoidably mutually influenced and the important fact is that this influence of improvement goes constantly in both directions like a chain of positive influence.

Sustainable development is not attainable without sound Land administration



Source: *The Bathurst Declaration – FIG Publication No. 21*

#### 4 ABOUT SURVEYOR'S/GEODESIST'S PROFILE

The next subject of necessary change in our profession is the profile of the surveyor/geodesist. There is unfortunately still a firm and prevailing belief in the society and also in a large part of our profession that surveyors are only able to collect data and that GIS people are the ones who use data. Without any doubt surveyors have to move from pure data collectors to experts in information management and land development. We have to focus more on the use of data, to produce valuable information and to practice leadership. Therefore, to achieve this goal, we will have to learn more and to learn dynamically and continuously.

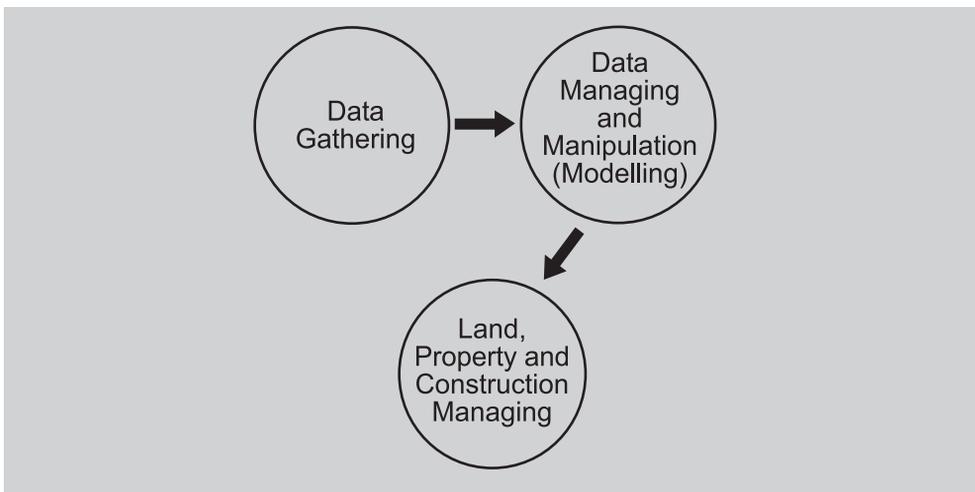


FIG Vision of Surveyor

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President of the International Federation of Surveyors (FIG)

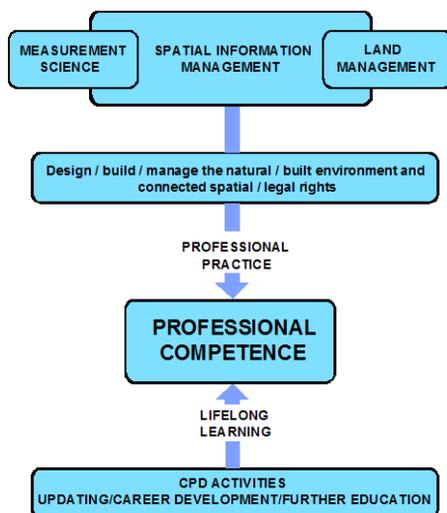
Changes are not only technology-driven, but more and more caused by improved business processes with a severe impact on our surveying business. However, responding to increased business pressure with organizational changes is often the wrong way. The most dynamic firms shift their business models without organizational changes. Instead of shifting organizational blocks we have to shift our mindsets!

Some decades ago the strong position of surveyors with almost a monopoly in geometric data acquisition was mainly based on technology and people – technological innovation combined with highly skilled experts. In the meantime, technology became cheaper and easier in its use and thematic experts acquire geodata themselves. In addition, geodata became more detailed in their “thematic resolution”. The required knowledge for geodata assessment shifted from geometric issues to thematic issues with the consequence that thematic experts are more involved in data acquisition than surveying experts. The inter-professional communication and understanding are essential ingredients of success.

There is a strong need for spatial information in public and private decision-making. Good governance requires access to geodata and integrated solutions for an increasing number of users. Sustainable development requires information exchange among public and private institutions on all levels. Implementation of spatial data infrastructure requires cooperation between the private and the public sector and amongst all professions involved in land management.

At the same time there is a need for experts as well as for decision makers in land management. The latter need grows faster, thus the policy of our profession has to focus its activities on providing the knowledge, expertise and services in the broad field of geoinformation technology. The next picture shows that in order to achieve and maintain such professional competence professional practice must constantly be combined with lifelong learning.

## ...A Lifelong Learning Perspective



*THE PROFESSIONAL COMPETENCE MODEL*

Source: Prof. Stig Enemark,  
Head of School of Surveying and Planning, Aalborg University, Denmark, Intergeo, Hamburg, 12 September, 2003.

This brings us to the profile of surveyors/geodesists education at TU Munich.

## 5 THE MUNICH MODEL: FROM THE SINGLE PARCEL TO THE MARS

At the faculty you must define your educational, professional and social mission. You must set clear goals to yourself and, even more important, you must enable your mission and goals to become well-known in the media, in the public and among politicians. One word is crucial here: motto! You must have a motto! When some important people from the politics or economy come to visit your faculty, you must tell them your motto. This way they will get your message quickly and will better understand your achievements, plans and wishes. What is your motto here in Ljubljana? If you accidentally do not have a motto yet, you must invent one very quickly. Your motto is the clearest and the easiest way to define all actions inside the faculty walls and to present yourself to the outer world, beyond the walls of the faculty. Of course, every step that you take must comply with your motto otherwise the achievement of your goals and mission will be delayed at least, or even missed in the worst case.

### Profile of Surveyors/Geodesists Education at the Technical University of Munich (TUM)

- Preparation for activities in research and practice with the wide range “from the single parcel to the planet Mars”
- comprehensive scientific education in the fields of Geodesy, Geoinformation and Land Management
- The graduates finally should have become “well-grounded specialized generalists”, based on ethical values and commitment to the society.

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The motto of surveyors/geodesists at the TU Munich is simple and gives a clear message to everybody: “From the single parcel to the planet Mars”. This motto embraces the comprehensive scientific education in the fields of geodesy, geoinformation and land management. The motto also defines preparations for activities in research and practice using a wide range of surveyors’/geodesists’ knowledge and expertise. The graduates of the faculty with such a motto should finally have become “well-grounded specialized generalists”, based on ethical values and commitment to the society.

Our principal goal is to develop a professional model of “well-grounded specialized generalist” with competence in the future fields of land management and land development, based on and using the knowledge and professionalism in the fields of:

- Widening and deepening the professional knowledge in planning, valuation, land readjustment (Bodenordnung), law, management etc.
- Self-development towards a creative planning competence at normative, strategic and operational level
- Self-experience and self-confirmation in seminar work form and project work (developing

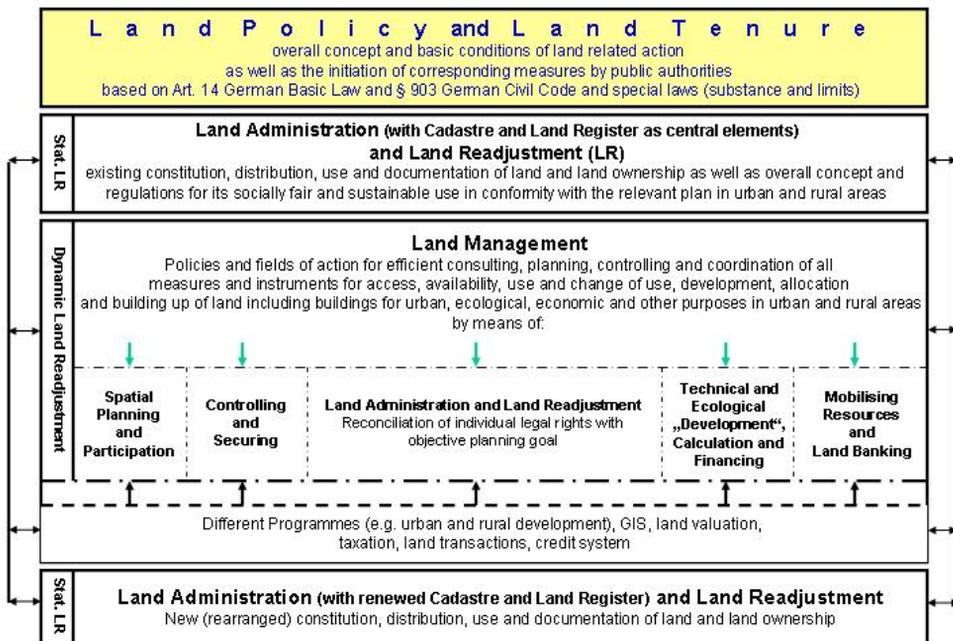
- team spirit, dispute management, dialogue planning and consensus searching)
- Strengthening of social competences and knowledge of methods (different forms and techniques of moderation, conflict mediation, rhetoric, presentation, negotiation techniques etc.)
- Developing competence for leadership (knowledge of human nature, communication capacity, analysis of group processes, conflict management)
- Teamwork and coordination with other professional disciplines (inter-disciplinary work)
- Information on European and global tendencies and professional work range
- Getting to know successful freelance professionals, entrepreneurs, professional association leaders etc.
- Applying for cooperation in research activities, professional events and expertise of the cathedra
- Maintaining foreign contact points (e.g. through FIG, UN, FAO, World Bank)
- Getting to know other studies and students (geography, land protection etc.)

Knowledge and expertise of such “well-grounded specialized generalists” fits very well into the needs of the society in the fields of land development, land policy, land tenure and land readjustment, etc. Following are some schemas showing the commitment of the surveyors/geodesists in Germany to these subjects and explaining their inter-relations and importance of the role of surveyors/geodesists in these processes and relations.



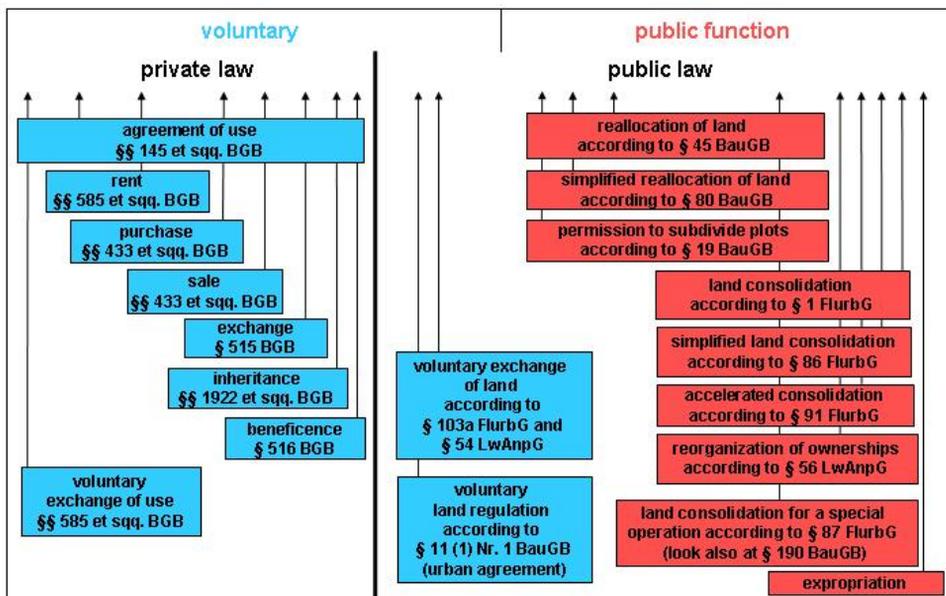
© Univ.-Prof. Dr.-Ing. Holger Magel, 2002, Institute of Geodesy, Geoinformation and Land management, TUM

## Relationships between Land Policy, Land Tenure and Land Management in Germany



Source: H. Magel, based on model by Professor Theo Kötter, Hanover University at the 3<sup>rd</sup> Munich Congress of Land Readjustment and Land Development 2001

## Land readjustment in Germany



© Univ.-Prof. Dr.-Ing. Holger Magel, 2004, Chair of land readjustment and land development, TU München

### Two-fold concept of Bodenordnung

On the one hand this refers to the more **static concept** of Bodenordnung in the sense of land tenure. It comprises the contemporary concept of ownership of land, including its use and taxation as well as the overall concept of development aims for the future (new) land administration.

On the other hand the experts speak of the **dynamic components** of Bodenordnung. In this sense of land readjustment it comprises all measures which serve the reconciliation of the (subjective) ownership, tenure and use of land relationships with the (objective) aims of spatial planning and the resolution of conflicts between public and private interests. I will accordingly speak of land tenure and land readjustment as appropriate.

Source: Seele (1979): Bodenpolitik für Stadt und Land

## 6 MUNICH'S UNIQUE OFFER TO THE WORLD

The Chair of Land Readjustment and Land Development at the Faculty of Civil Engineering and Geodesy of TU Munich has been offering for the fourth consecutive year the Master of Science Program in Land Management and Land Tenure, which provides the necessary theoretical and practical background for future experts in this field.

The program was started to serve the growing worldwide need for better skills and knowledge in Land Management and Land Tenure. In the meantime some outstanding international events and many regional and national developments have confirmed the confidence in this decision and are inspiring the chair to continually intensify the efforts and to broaden as well as deepen the master program.

The philosophy of the program is to demonstrate and illustrate the important role of land rights and land policy, land management and land administration for a sustainable urban and rural development in the broader context of good governance and to teach adequate approaches and tools for their implementation.

The list of courses includes topics on the following basic elements:

- global framework for land management and land tenure,
- rural and urban development,
- land rights and land tenure systems,
- land policy,
- land economics (land valuation, land markets, land taxation),
- land management,
- land administration and cadastre,
- natural resource management,
- land management and land tenure in Germany.

During the master program studies the participating students learn how to use the methods and tools for:

- participatory planning
- land conflict management and reconciliation of land conflicts,
- land use planning,
- photogrammetry and remote sensing,
- visualization of geodata and (web-)cartography,
- geographical Information Systems (GIS), global positioning systems (GPS),
- project planning and impact monitoring.

In addition, courses on project management, presentation, mediation, intercultural communication are offered. Mid-career students from all over the world are taking part in the program. After completion of the master program the graduates are qualified to work with local and national governments, with their administrations, and with private sector or non-governmental organizations. Some of the best graduates will take the leading national positions in land management, for example two of the excellent graduates from China will soon take the leading posts at the newly established Chinese land development agency, which plans to employ 40 000 (forty thousand!) graduate surveyors in the next 10 years.

From this short description of the program it is obvious that the master program has manifold dimensions and that it is really more than only a scientific-technical program. It includes highly important political, institutional and social-humanitarian aspects! Prof. Magel, who is the master program director, has invited the audience to take a closer look at this program on the website [www.landmanagement-master.de](http://www.landmanagement-master.de) and encouraged the audience to spread the word about it among colleagues.

At the end of the lecture Prof. Magel expressed his hope that his presentation has given the audience a very clear picture: It is time for more experts in Land Management, Land Tenure, Surveying, GIS and Risk Management skills. Instead of fractioning on different professional levels it is time to step together and combine our knowledge and strengths, to strive for leadership and to make every effort to serve our society in the best professional and ethical manner!

**Univ.-Prof. Dr.-Ing. Holger Magel, FIG President 2003–2006**

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