Applying a Land Management Profile in Surveying Education

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Key words: Land Management, Land Administration, Surveying Education, Problem-based Learning.

SUMMARY

The role of surveyors in modern societies is changing. Surveyors increasingly play a key role in supporting efficient land markets and also effective land-use management. These functions underpin development and innovation for social justice, economic growth, and environmental sustainability. This new shift entails a conversion from land surveyors to land professionals.

Land management covers a wide range activities associated with the management of land and natural resources that are required to fulfil political objectives and achieve sustainable development. Land management is then simply the processes by which country´s resources are put into good effect. It is about land policies, land rights, land information, land economics, land use control and land development.

This paper presents an overall understanding of the land management paradigm and the benefits of good land governance to society. A Land Administration System (LAS) provides a country with the infrastructure to implement land-related policies and land management strategies. But land administration is not a new discipline. It has evolved out of the cadastre and land registration areas with their specific focus on security of land rights. Ten key principles are outlined for implementing the modern philosophy in land administration to develop and manage assets and resources within the land management paradigm to deliver sustainable development.

By applying this land management profile to surveying education, this paper suggests that there is a need to move away from an exclusive engineering focus toward adopting an interdisciplinary and problem-based approach to ensure that academic programmes can cope with the wide range of land administration functions and challenges.

An interdisciplinary approach to surveying education calls for the need to address issues and problems in a real-world context. The combination of different disciplines can be taught through a "learning-by-doing approach". Problem solving skills can be taught through a project-oriented approach to surveying education with a focus on developing skills for "learning to learn". The basic principles of this educational model are presented using the surveying programme at Aalborg University as an example.

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1. INTRODUCTION

Imagine a country without any basic administration of land – their key asset. Imagine that tenure to land and property cannot be secured, and that mortgage loans cannot be established as a basis for property improvement and business development. Imagine that the use and development of land is not controlled through overall planning policies and regulations. And imagine a slum area of 250 hectares with more than 1 million inhabitants lacking the most basic occupation rights and without basic water and sanitary services.

Land management is about addressing these problems by providing a basic infrastructure for implementing land related policies and land management strategies to ensure social equity, economic growth and environmental protection.

The recent book "Land Administration for Sustainable Development" (Williamson, Enemark, Wallace, Rajabifard, 2010) explores the capacity of the systems that administer the way people relate to land. A land administration system provides a country with the infrastructure to implement land policies and land management strategies. Until 2008 the developed world often took land administration for granted and paid little attention to it. But the global economic collapse has sharply focused world attention on mortgage policies and processes and their related complex commodities, and on the need for adequate and timely land information. Simply, information about land and land market processes that can be derived from effective land administration systems plays a critical role in all economies (Williamson, Enemark, Wallace, Rajabifard, 2010).

An overall theme in the book is about developing land administration capacity to manage change. For many countries, meeting the challenges of poverty alleviation, economic development, environmental sustainability, and management of rapidly growing cities, are immediate concerns. For more developed countries, immediate concerns involve updating and integrating agencies in relatively successful land administration systems, and putting land information to work for emergency management, environmental protection, economic decision making, and so on.

There is a need to apply such a land management profile in surveying education by adopting an interdisciplinary and problem-based approach to ensure that academic programmes can cope with the wide range of land administration functions and challenges.

2. LAND MANAGEMENT

All countries have to deal with the management of land. They have to deal with the four functions of land tenure, land value, land use, and land development in some way or another. Land management covers all activities associated with the management of land and natural resources that are required to fulfil political objectives and achieve sustainable development
A country's capacity may be advanced and combine all the activities in one conceptual framework supported by sophisticated ICT models; or the capacity may involve very fragmented and basically analogue approaches. Different countries will also put varying emphasis on each of the four functions, depending on their cultural basis and level of economic development.

Arguably sound land governance is the key to achieve sustainable development and to support the global agenda set by adoption of the Millennium Development Goals (MDGs). Land governance is about the policies, processes and institutions by which land, property and natural resources are managed. Land governance covers all activities associated with the management of land and natural resources that are required to fulfil political and social objectives and achieve sustainable development.

The cornerstone of modern land administration theory is the land management paradigm in which land tenure, value, use and development are considered holistically as essential and omnipresent functions performed by organised societies. The land management paradigm is illustrated in figure 1 below.

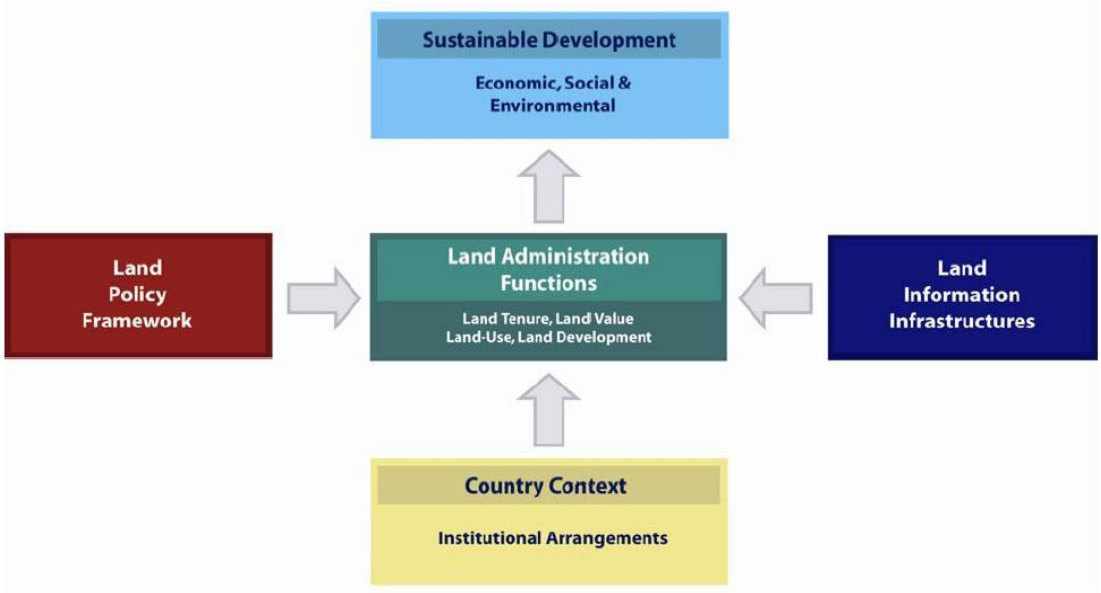

Figure 1. The land management paradigm (Enemark, 2004)

Within this paradigm, each country delivers its land policy goals by using a variety of techniques and tools to manage its land and resources. What is defined as land administration within these management techniques and tools is specific to each jurisdiction, but the core ingredients, cadastres or parcel maps and registration systems, remain foundational. These ingredients are the focus of modern land administration, but they are recognised as only part of a society's land management arrangements.

The Land management paradigm allows everyone to understand the role of the land administration functions (land tenure, land value, land use, and land development) and how land administration institutions relate to the historical circumstances of a country and its policy decisions. Importantly, the paradigm provides a framework to facilitate the processes of integrating new needs into traditionally organised systems without disturbing the fundamental security these systems provide. While sustainability goals are fairly loose, the paradigm insists that all the core land administration functions are considered holistically, and not as separate, stand-alone, exercises.

Land policy is simply the set of aims and objectives set by governments for dealing with land issues. Land policy is part of the national policy on promoting objectives such as economic development, social justice and equity, and political stability. Land policies vary, but in most countries they include poverty reduction, sustainable agriculture, sustainable settlement, economic development, and equity among various groups within the society.

Land management activities reflect drivers of globalization and technology. These stimulate the establishment of multifunctional information systems, incorporating diverse land rights, land use regulations, and other useful data. A third driver, sustainable development, stimulates demands for comprehensive information about environmental, social, economic, and governance conditions in combination with other land related data.

The operational component of the land management paradigm is the range of land administration functions (land tenure, value, use and development) that ensure proper management of rights, restrictions, responsibilities and risks in relation to property, land and natural resources. This is described in more details in section 3 below.

Sound land management requires operational processes to implement land policies in comprehensive and sustainable ways. Many countries, however, tend to separate land tenure rights from land use opportunities, undermining their capacity to link planning and land use controls with land values and the operation of the land market. These problems are often compounded by poor administrative and management procedures that fail to deliver required services. Investment in new technology will only go a small way towards solving a much deeper problem: the failure to treat land and its resources as a coherent whole.

3. LAND ADMINISTRATION SYSTEMS

A Land administration system (LAS) provides a country with the infrastructure to implement land-related policies and land management strategies. But land administration is not a new discipline. It has evolved out of the cadastre and land registration areas with their specific focus on security of land rights. Consolidation of land administration as a discipline in the 1990s reflected the introduction of computers and their capacity to reorganize land information. The UNECE viewed land administration as referring to "the processes of determining, recording and disseminating information about the ownership, value and use of land, when implementing land management policies"(UN-ECE, 1996).

For the first time, efforts to reform developing countries, to assist countries in economic transition from a command to a market-driven economy, and to help developed countries improve LAS could all be approached from a single disciplinary standpoint, at least in theory. That is, to manage land and resources "from a broad perspective rather than to deal with the tenure, value, and use of land in isolation" (Dale and McLaughlin 1999, preface).

The focus on information remains but the need to address land management issues systematically pushes the design of LAS toward an enabling infrastructure for implementing land policies and land management strategies in support of sustainable development. In simple terms, the information approach needs to be replaced by a model capable of assisting design of new or reorganized land administration systems to perform the broader and integrated functions now required. Such a global land administration perspective is presented in figure 2 below.

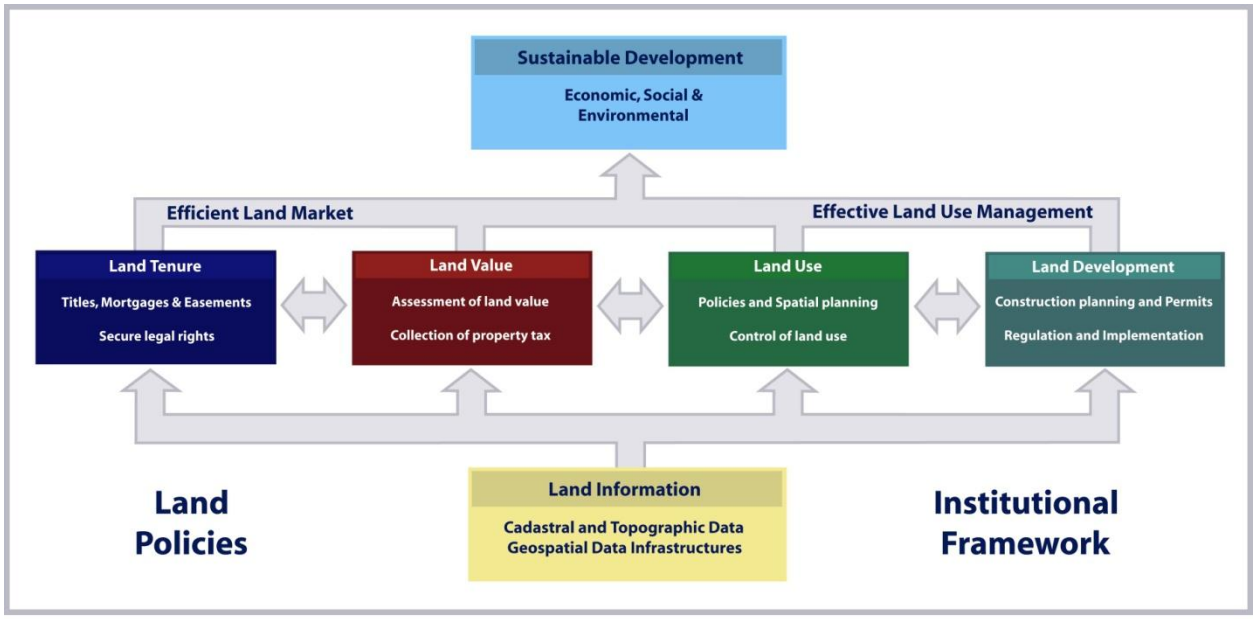

Figure 2. A Global land administration perspective (Enemark, 2004)

The four land administration functions (land tenure, land value, land use, and land development) are different in their professional focus. However, even if land administration is traditionally centred on cadastral activities in relation to land tenure and land information management, modern land administration systems designed as described in figure 1 deliver an essential infrastructure and encourage integration of the processes related to land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and, increasingly important, land development (implementing utilities, infrastructure and construction planning). Inevitably, all four functions are interrelated. The interrelations appear because the conceptual, economic, and physical uses of land and properties serve as an influence on land values. Land values are also influenced by the possible future use of land determined through zoning, land-use planning regulations, and permit-granting processes. And land-use planning and policies will, of course, determine and regulate future land development.

The four functions interact to deliver overall policy objectives, and they are facilitated by appropriate land information infrastructures that include cadastral and topographic datasets linking the built environment (including legal and social land rights) with the natural environment (including topographical, environmental, and natural resource issues). Land information should, in this way, be organized through Spatial Data Infrastructures (SDI) at the national, regional, federal, and local level, based on relevant policies for data sharing, cost recovery, access to data, data models, and standards.

Ultimately, the design of adequate systems of land tenure and land value should support efficient land markets capable of supporting trading in simple and complex commodities. The design of adequate systems to deliver land-use control and land development should lead to effective land-use management. The combination of efficient land markets and effective land-use management should support economic, social, and environmental sustainable development.

3.1 Ten land administration principles

Despite the uniqueness of local systems, the range of cognitive frameworks about land, and difficulties in transferring institutions, design of robust and successful LAS is possible. The ten land administration statements in figure 2 below set boundaries for designers, builders and managers of LAS to help them make decisions about their local system. Overall, the statements are written with the goal of making establishment and reform of LAS easier. The statements implement the modern philosophy in land administration to develop and manage assets and resources within the land management paradigm to deliver sustainable development. They are universally applicable. Countries at early stages of development will not be able to use the full array of technical options or specialist skills, but they can improve their land management through appropriately designed LAS.

The statements reflect a holistic approach for any LAS, and focus on sustainable development as the overriding policy for any national system, irrespective of whether a country implements property institutions, communal land arrangements, or socializes its land. They highlight the importance of information and participation of people. They set the framework in which the historical development of familiar ingredients, like cadastres and land registries, can be meshed with recent innovations, particularly incorporation of social tenures, new complex commodities appearing in highly organised land markets, and the technical potential of spatial information.

1.	**LAS**	**LAS provide the infrastructure for implementation of land polices and land management strategies in support of sustainable development.** The infrastructure includes institutional arrangements, legal frameworks, processes, standards, land information, management and dissemination systems, and technologies required to support allocation, land markets, valuation and control of use and development of interests in land.
2.	**Land management paradigm**	**The land management paradigm provides a conceptual framework for understanding and innovation in land administration systems.** The paradigm is the set of principles and practices that define land management as a discipline. The principles and practices relate to the four functions of LAS, namely land tenure, land value, land use and land development, and their interactions. These four functions underpin the operation of efficient land markets and effective land use management. "Land" encompasses natural and built environment including land and water resources.
3.	**People and institutions**	**LAS is all about engagement of people within the unique social and institutional fabric of each country.** This encompasses good governance, capacity building, institutional development, social interaction and a focus on users, not providers. LAS should be re-engineered to better serve the needs of users, such as citizens, governments and businesses. This requires building the necessary capacity in individuals, organisations and wider society to perform functions effectively, efficiently and sustainably.
4.	**Rights, restrictions, responsibilities**	**LAS are the basis for conceptualising rights, restrictions and responsibilities (RRR) related to policies, places and people.** Rights are normally concerned with ownership and tenure whereas restrictions usually control use and activities on land. Responsibilities relate more to a social, ethical commitment or attitude to environmental sustainability and good husbandry..
5.	**Cadastre**	**The cadastre is at the core of any LAS providing spatial integrity and unique identification of every land parcel.** Cadastres are large scale representations of how the community breaks up its land into useable pieces, usually called parcels. Most cadastres provide security of tenure by recording land rights in a land registry. The spatial integrity within the cadastre is usually provided by a cadastral map that is updated by cadastral surveys. The cadastre should ideally include all land in a jurisdiction: public, private, communal, and open space.

6.	**LAS are dynamic**	**LAS are dynamic.** Dynamism has four dimensions. The first involves changes to reflect the continual evolution of people to land relationships. This evolution can be caused by economic, social and environmental drivers. The second is caused by evolving ICT and globalisation, and their effects on the design and operation of LAS. The third dimension is caused by the dynamic nature of the information within LAS, such as changes in ownership, valuation, land use and the land parcel through subdivision. The fourth dimension involves changes in the use of land information.
7.	**Processes**	**LAS include a set of processes that manage change.** The key processes concern land transfer, mutation, creation and distribution of interests, valuation and land development. The processes, including their actors and their obligations, explain how LAS operate, as a basis for comparison and improvement. While individual institutions, laws, technologies or separate activities within LAS, such as property in land, a land registry, a specific piece of legislation or a technology for cadastral surveying are important in their own right, the processes are central to overall understanding of how LAS operate.
8.	**Technology**	**Technology offers opportunities for improved efficiency of LAS and spatial enablement of land issues.** The potential of technology is far ahead of the capacity of institutions to respond. Technology offers improvements in the collection, storage, management and dissemination of land information. At the same time developments in information and communications technology (ICT) offer the potential for the spatial enablement of land issues by using location or place as the key organiser for human activity.
9.	**Spatial data infrastructure**	**Efficient and effective land administration systems that support sustainable development require a spatial data infrastructure to operate.** The spatial data infrastructure (SDI) is the enabling platform that links people to information. It supports the integration of natural (primarily topographic) and built (primarily land parcel or cadastral) environmental data as a pre-requisite for sustainable development. The SDI also permits the aggregation of land information from local to national levels.
10.	**Measure for success**	**Successful LAS are measured by their ability to manage and administer land efficiently, effectively and at low cost.** The success of LAS is not determined by complexity of legal frameworks or sophisticated technological solutions. Success lies in adopting appropriate laws, institutions, processes and technologies designed for the specific needs of the country or jurisdiction.

Figure 3. Ten land administration principles
(Williamson, Enemark, Wallace, Rajabifard, 2010)

3.2 Benefits to society

From this global perspective, land administration systems act within adopted land policies that define the legal regulatory pattern for dealing with land issues. They also act within an institutional framework that imposes mandates and responsibilities on the various agencies and organisations. They should service the needs of individuals, businesses, and the community at large. Benefits arise through the land administration systems guarantee of

ownership, security of tenure and credit; facilitating efficient land transfers and land markets; supporting management of assets; and providing basic information and efficient administrative processes in valuation, land use planning, land development and environmental protection. LAS designed in this way forms a backbone for society and is essential for good governance because it delivers detailed information and reliable administration of land from the basic foundational level of individual land parcels to the national level of policy implementation.

Support for the rule of law	The formalization of processes used for land management engage the public and business, leading to their support for the institutions of government.
Alleviation of poverty	A primary means of alleviating poverty lies in recognizing the homes and workplaces of the poor, and their agricultural land as assets worthy of protection.
Security of tenure	Ensuring security throughout the range of tenures used in a country helps provide social stability and incentives for reasonable land use.
Supporting formal land markets	Security in land arrangements are essential for successful, organized land markets. LAS manage the processes that assist land exchange and build capital out of land.
Security for credit	International financing norms and banking practice require secure ownership of land and robust credit tenures that can only exist in formal LAS.
Support for land and property taxation	Land taxation takes many forms. However, all taxation systems, including personal and company taxation, benefit from a national LAS.
Protection of state lands	The coherence of a national LAS is dependent on its coverage of all land. Thus management of public land is assisted by LAS.
Management of land disputes	Stability in access to land requires defined boundaries, titles and interests. A LAS with simple, effective processes for boundary determination reduce land disputes.
Improvement of land planning	Impacts of rural and urban land uses affect adjoining land and beyond. These impacts need to be understood and managed by effective land planning assisted by LAS.
Development of infrastructure	New infrastructure projects require LAS to balance private rights with these large scale infrastructure projects, whether provided by public or private agencies.
Management natural resources	Land and resource titles require complicated and mutually compatible administrative and legal structures to ensure sustainability in short and long terms.
Information and statistical data	Each agency needs to appreciate the importance of information generated through its processes for the public, business and government generally. More importantly, everyone needs to understand the fundamental importance of integrated land information for sustainable development.

Figure 4**.** Traditional benefits of Land Administration Systems
(Williamson, Enemark, Wallace, Rajabifard, 2010)

4. A LAND MANAGEMENT APPROACH TO SURVEYING EDUCATION

The changes in the surveying profession and practice and especially the development of new push button technologies has voiced the need for including the core discipline of management as a basic element in today's surveying education. Traditional specialist skills are no longer sufficient or adequate to serve the client base. Surveyors need to have the skill to plan and manage diverse projects, including not only technical skills, but those of other professions as well. The modern surveyor has to be capable not only of managing within change but managing the change itself.

Technological developments take the skill out of measurement and the processing of data. Almost any individual can press buttons to create survey information and process this information in automated systems. In the same way, technological developments make GIS a tool available to almost any individual. The skill of the future lies in the interpretation of the data and in their management in such a way as to meet the needs of customers, institutions and communities. Therefore, management skills will be a key demand in the future surveying world.

Taking a land management approach to surveying education, there is a need to change the focus from being seen very much as an engineering discipline. There is a need for a more managerial and interdisciplinary focus as a basis for developing and running adequate systems of land administration.

Surveying and mapping are clearly technical disciplines (within natural and technical science) while cadastre, land management and spatial planning are judicial or managerial disciplines (within social science). The identity of the surveying profession and its educational base therefore should be in the management of spatial data, with links to the technical as well as social sciences.

The systems of land administration have moved away from being ”provider” driven to now being “user” driven. They are interdisciplinary by nature and they will require skills for management and problem-solving in order to serve their clients. The ability to access, to interact with and to contribute to a wide range of public and private databases at a distance will become the norm in many areas of surveying. Again, this will change the skill-base of the surveying workforce, the structure of the organisation and, especially, the tasks of those surveyors holding managerial responsibilities.

There is no doubt that the main challenge of the future will be that the only constant is change. To deal with this constant change the educational base must be flexible. The graduates must possess skills to adapt to a rapidly changing labour market and they must possess skills to deal even with the unknown problems of the future. The point is, that professional and technical skills can be acquired and updated at a later stage in ones career while skills for theoretical problem-solving and skills for learning to learn can only be achieved through the process of academic training at the universities.

5. EDUCATION, RESEARCH AND PROFESSIONAL PROCTICE

A successful educational system depends on a comprehensive interaction between education, research and professional practice. This dynamic interaction is shown in figure 5 below (Kjaersdam and Enemark, 1994).

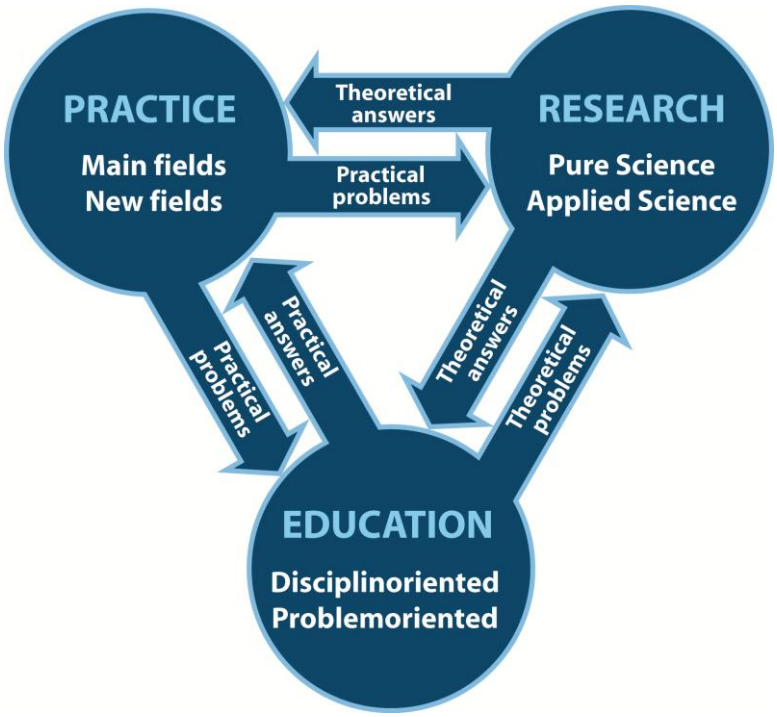

Figure 5. The interaction between education, research and professional practice

Practice may be defined as specific fields or tasks within society that conform professional functions which are carried out by academically trained persons, e.g. surveyors or civil engineers. In a society of increased complexity one has to continually face new problems and new challenges in practice. The traditional way to deal with these challenges is through in-service training, professional seminars, publication of articles, etc. However, this method of development is a rather slow process. The answers, or even the problems themselves, may no longer be of current relevance when the solutions are found. And, at the same time, society is still developing new problems which require new solutions. The answers to the challenges are no longer to be found only within the profession itself.

Therefore, in order to make improvement research and education should be involved in the development process in order to establish a dynamic interaction as shown in fig.1. Research is needed to produce theoretical answers, and interplay with education is needed to produce graduates who are capable of producing practical answers by applying new knowledge and skills when dealing with the new and unknown problems of the future.

5.1 Educational innovation

Traditional higher education has been focused on rule-based disciplines with independent identities in their own contexts. In the discipline-oriented education, the special disciplines and theories, which are considered necessary/relevant for the specific subjects, are normally taught by means of set textbooks and lectures. The students become experienced in the use of these disciplines and theories through the exercises and case work that support these theories. The aim is specific knowledge in certain fields and standard solutions to standard problems. This system functions reasonably well in a stable society where the individual functions and tasks are reasonably standardized.

Problem-oriented education, however, is based on working with relevant, current and unsolved problems from society/industry/real life. By analysing the problems in depth the students learn and use the disciplines and theories which are considered necessary and relevant to solve the problems posed, i.e. the problems defines the subjects and not the reverse. Organizing problem-oriented education through project work allows groups of students to choose problems and to try to analyse and solve them. Through the project work the students should acquire the necessary basic knowledge by means of literature and lecture courses and, at the same time, develop the ability to formulate, analyse and solve relevant problems. In principle, it can thus be ensured that the graduates are capable of handling also the unknown problems of the future.

Educational innovation can then be achieved by being aware of the necessary dialectics between discipline and problem oriented education. The disciplines and their related theories are necessary for the graduates´ fundamental academic and professional basis. On the other hand, the problem oriented project work is necessary in order to understand the interdisciplinary character of the problems in real industry/society/real life, and to enable the graduates to deal with the new and unknown problems of the future. The aim is broad insight into and understanding of the connections between different fields and skills in order to be able to function in an ever-changing and increasingly more complicated society.

5.2 Learning to learn

A main challenge of the future will be to accept that the only constant is change. To deal with this constant change the educational base must be flexible. Graduates must possess skills to adapt to a rapidly changing labour market and they must possess skills to deal even with the unknown problems of the future. Professional and technical skills can be acquired and updated at a later stage in one's career while skills for theoretical problem-solving and skills for "learning to learn" can only be achieved through academic training at the universities.

A number of research studies (e.g. Coleman, 1998) have confirmed that students retain only 10 per cent of what they read and only 20 per cent of what they hear. However, if a problem is simulated, then up to 90 per cent of the lessons learned may be retained. This finding is behind the shift in the pedagogical doctrine toward project work and problem-based learning. It emphasizes learning instead of teaching. Learning is not like pouring water into a glass.

Learning is an active process of investigation and creation based on the learners` interest, curiosity and experience and should result in expanded insights, knowledge and skills.

A consequence of this shift from teaching to learning is that *the task of the teacher is altered from the transferring of knowledge into facilitating learning.* Project work also fulfils an important pedagogical objective. Student must be able to explain the results of their studies and investigations to other students in the group. This skill appears to be vital to professional and theoretical cognition: *Knowledge is only established for real when one is able to explain this knowledge to others.* In traditional education the students restore knowledge presented by the teacher. When the project organized model is used, the knowledge is established through investigations and through discussion between the student members of the project group, and mainly without the presence of the teacher.

6. PROJECT-ORGANIZED AND PROBLEM BASED LEARNING

The PBL approach applied at Aalborg University is both project-organised and problem- based. In order to provide for the use of project work as the basic educational methodology the curriculum has to be organised into general subjects or "themes" normally covering a semester. The themes chosen in a programme must be generalised in such a way, that the themes in total will constitute the general aim or professional profile of the curriculum. The themes must provide for studying the core elements of the subjects included (through the lecture courses given) as well as exploring (through the project work) the application of the subjects in professional practice. The principles of project-organised and problem-based learning are shown in figure 6 below (Kjaersdam and Enemark, 1994).

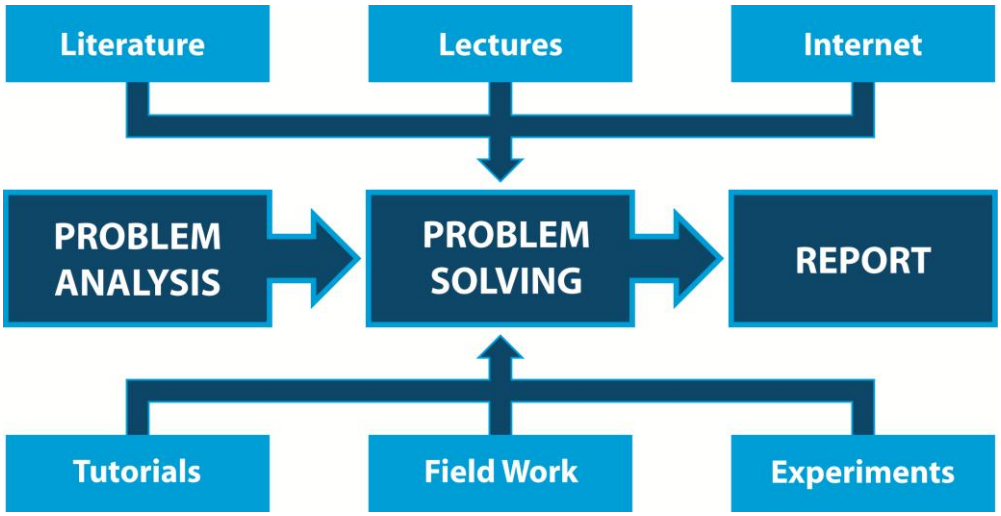

Fig 6. Principles of project-organised and problem-based learning

Real life problems are not defined in surveying/engineering terms. Therefore Problems analysis and formulation of the problem in surveying/engineering terms is important before staring the problem solving problems. Through this process the students also develop skills for communications and documentation of the results – as is the case in real life.

Project-organized means that traditional taught courses and labs is replaced by project work assisted by lecture courses. The project-organized concept moves the perspective from description and analysing into synthesizing and assessment. The concept is based on a dialectic interaction between the subjects taught in the lecture courses and the problems dealt with in the project work. Each term has a basic structure containing, in principle, equal distribution of lecture courses and project work. But the study-time is dominated by lecture courses at the beginning of the term and by project work at the end. The project work is carried out by groups of four to six students having a teacher appointed as their supervisor.

Problem-based means that traditional textbook-knowledge is replaced by the knowledge necessary to solve theoretical problems. The problem-based concept moves the perspective from understanding of common knowledge into ability to develop new knowledge. The aim of the project work is "learning by doing" or "action learning". The project work may be organized by using a "know-how" approach for training professional functions, or it may be organized by using a "know-why" approach for training methodological skills of problem-analysis and application. The former is normally applied in first half of the curriculum where the necessary disciplines are taught in the lecture courses. The latter is applied in the second half of the curriculum and is supported by lecture courses presenting the necessary theories within the specific professional areas.

The difference between traditional subject-oriented education and this project-oriented educational model may be expressed in short by an old Chinese proverb:

"Tell me and I will forget
Show me and I will remember
Involve me and I will understand
Step back and I will act"

6.1 Curriculum design

In order to provide for the use of project work as a basic educational element the curriculum has to be organised into general subjects or "themes" normally covering a semester. The themes chosen in a programme must be generalised in such a way, that the themes in total will constitute the general aim or professional profile of the curriculum. The themes should provide for studying the core elements of the subjects included (through the lecture courses given) as well as exploring (through the project work) the application of the subjects in professional practice. The curriculum for educating chartered surveyors (Figure 7) may be used as an example to illustrate the selection of themes as well as to explain the adaptability of the educational model.

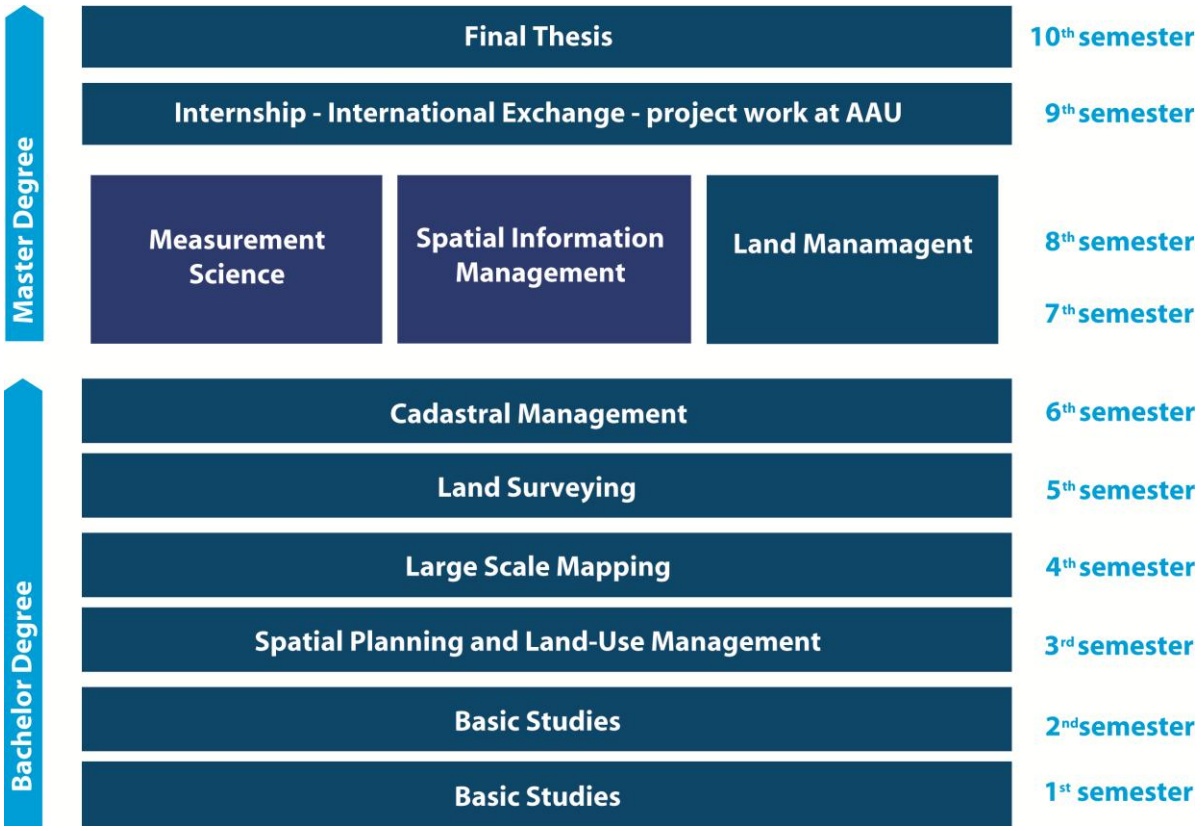

Figure 7. The curriculum for educating chartered surveyors at Aalborg University, Denmark

Each semester has a basic structure containing, in principle, an equal distribution of lecture courses and project-work. But the study-time is dominated by courses at the beginning of the semester and term and by project-work at the end.

There are two types of lecture courses: curriculum related courses and project related courses. The aim of the curriculum related courses is to establish the necessary fundamental and general scientific knowledge in relation to the curriculum. The aim of the project related courses is to deal with the theoretical and professional contents of the theme. The professional and discipline oriented approach dominate the lecture courses given in the undergraduate studies, while the theoretical and scientific approach dominate lecture courses given at the graduate level. In the entire curriculum 50% of the study time is spend on project, 25% on lecture courses related to the project work, and 25% on lecture curses related to the curriculum.

The aim of the project-work is "learning by doing" or "action learning". The professional skills are established during the discipline-based project-work, which is dominating at 3-6 semester. The professional cognition and the methodical skills are established during the problem-based project-work at 7-10 semesters where the ability of carrying out independent investigations on a scientific interdisciplinary basis is trained. Also the ability of presenting independent conclusions and the ability of finishing the project in time is trained. In fact the process of the project-work at this stage is very similar to the problem-solving process in practice.

7. THE EDUCATIONLA PROFILE OF THE FUTURE

The developments as discussed above have a significant educational impact. There is a need to change the focus from being seen very much as an engineering discipline. There is a need for a more managerial and interdisciplinary focus. The strength of our profession lies in its multidisciplinary approach.

Surveying and mapping are clearly technical disciplines (within natural and technical science) while cadastre, land management and spatial planning are judicial or managerial disciplines (within social science). The identity of the surveying profession and its educational base therefore should be in the management of spatial data, with links to the technical as well as social sciences.

The future educational profile in this area should be composed by the areas of Measurement Science and Land Administration and supported by and embedding in a broad multidisciplinary paradigm of Spatial Information Management. Such a profile was promoted at the FIG/CLGE seminar on Enhancing Professional Competence of the Surveyor in Europe, held in Delft, November 2000, and increasingly it seems to become generally accepted worldwide. The profile is illustrated in figure 8 below (Enemark and Prendergast, 2001).

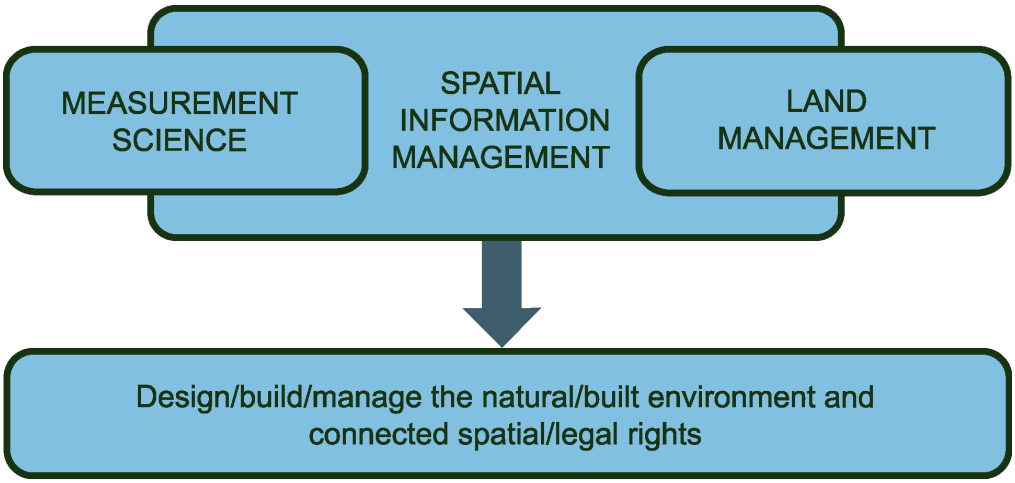

Figure 8. The educational profile of the future

The universities should act as the main facilitator within the process of forming and promoting the future identity of the surveying profession. Here, the area of GIS and, especially, the area managing geographical and spatial information should be the core component of the identity. This responsibility or duty of the universities, then, should be carried out in close co-operation with the industry and the professional institutions.

Both in Europe and in US there are examples of surveying programs being closed down due to the fact that they have insisted on maintaining the traditional technical focus and have not changed to comply with a more interdisciplinary approach. On the opposite, programs that have changed to comply with a broader and more interdisciplinary approach seem to flourish.

The affiliation with engineering science has served the surveying discipline well. However, the future will possibly rather point at an alliance with Geography based on Spatial Information Management and focusing on Land Management. There will still be a need for teaching the basic skills within measurement and mapping, and it should still be possible to specialize within these areas. We must, however, be aware that the GPS technology makes these disciplines available also for many other professions and for non-professionals as well.

8. FINAL REMARKS

Land administration systems, in principle, reflect the social relationship between people and land recognized by any particular jurisdiction or state. Land administration activities are not just about technical or administrative processes. The activities are basically political and reflect the accepted social concepts concerning people, rights, and land objects with regard to land tenure, land markets, land taxation, land-use control, land development, and environmental management. However, land administration systems are not an end in itself but facilitate the implementation of the land policies within the context of a wider national land management framework.

Sustainable land administration systems provide clear identification of the individual land parcels and land rights attached to these parcels. This information on the people to land relationship is crucial and plays a key role in adaptation to climate change, management of natural disasters, alleviation of poverty, and management of rapid urban growth,

By applying this land management profile to surveying education, this paper suggests that there is a need to move away from an exclusive engineering focus toward adopting an interdisciplinary and problem-based approach to ensure that academic programmes can cope with the wide range of land administration functions and challenges.

It should be recognised that the only constant in the future is change. To deal with such significant change the educational base must be flexible. The graduates must process skills to adapt to a rapidly changing labour market and they must process skills to deal even with the unknown problems of the future. Therefore, skills for learning to learn have become increasingly essential.

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BIOGRAPHICAL NOTES

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