



Surveying Education: Facing the Challenges of the Future

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Summary

In relation to surveying education there is one big question to be asked: Is the role of the surveyors changing? In a global perspective the answer will be "Yes". There is a big swing that could be entitled "From Measurement to Management". This does not imply that measurement is no longer a relevant discipline to surveying. But it does imply that the focus of the surveying profession is changing from being very much related to doing measurements to now being increasingly related to management of the measurement processes, the geospatial data, and the property and land-use regimes.

In surveying education there are a range of other challenges to be faced. These relate to the focus on learning to learn; the need for flexible curriculum to deal with constant change; the move towards introducing virtual academy; the demand for creating a quality culture; and the perspective of lifelong learning perspective.

This paper looks into the challenges in some details. It is stated that facing these challenges requires an innovative and adaptable approach to both curriculum design and course delivery within the framework of an overall quality culture. The success will eventually depend on an efficient interaction between education, research, and professional practice.

1. Global Drivers for Change

The global drivers for change in the spatial information world can be identified as technology development, micro-economic reform, globalisation, and sustainable development (adapted from Williamson and Ting, 1999). These global drivers of course affect the profile of the surveying profession and they challenge the whole educational basis of the profession.

Technology development is the major driving force in changing the face of the spatial infor-

mation world. The GPS/GNSS technologies for measuring have revolutionised the traditional surveying discipline and the high resolution satellite imagery along with new concepts such as Google Earth tends to revolutionise the mapping discipline. The database technologies for storage of large data sets and the GIS technologies for data management, analysis and manipulation arguably have had a huge impact on the spatial information environment.

Micro-economic reform in many countries has had a dramatic impact on the spatial information environment. The micro-economic reform initiatives represent the institutional and governmental side of the changes observed during the latest two decades. This includes initiatives such as privatisation, decentralisation, downsizing, cost recovery, performance contracts, quality assurance, public/private partnership, and other policies to ensure service delivery and cost effectiveness. These initiatives have changed the focus towards the more managerial components of building and maintaining national spatial data infrastructures and sustainable systems of land administration.

Globalisation is becoming a reality driven by communication technologies. A globalised world is one in which political, economic, cultural, and social events become more interconnected. The process includes that events in one part of the world increasingly have potential to impact on people and societies in other parts of the world. Globalisation widens the perspectives from the local to the global level. This should lead to a world movement towards improving the quality of lives of people by thinking and working together on common concerns. Globalisation has a social, economic, political, as well as an educational dimension.

Sustainable development will be a driving force in policies developed also through the decades ahead. Sustainable development means deve-

lopment that effectively incorporates economic, social and environmental concerns in decision making for development which thereby should “meet the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainable Land Governance also relates to addressing the big challenges of the 21st Century such as climate change, food shortage, energy scarcity, urban growth, environmental degradation, natural disasters and also the current global financial crisis. All these challenges relate to governance and management of land and spatial information.

2. The Educational Profile of the Future

Taking these global drivers into account, it is no surprise that changes are taking place in the definition and nature of the surveying education, as well as the surveying profession and professional practice. Changes in technology and institutional frameworks may provide new opportunities for the surveying profession, but they will also be the destroyers of some professional work. The challenges will be to integrate modern surveying technology into a broader process of problem solving and decision making within the land management regime.

This leads into the understanding that surveying education can no longer rely on measurements skills in relation to engineering and cadastral surveys. There is a need for changing the focus from an engineering discipline into a more managerial and interdisciplinary perspective. The strength of our profession lies in its multidisciplinary approach supported by skills for mediation and project management and in the combination of technical, legal, and managerial competence when dealing with development opportunities and property rights and restrictions.

The challenge of the future will to implement the new IT-paradigm and this new multidisciplinary approach into the traditional educational programmes in surveying and engineering. A future educational profile in this area should be composed by the areas of Measurement Science and Land Management 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 world wide. The profile is illustrated in Fig. 1.

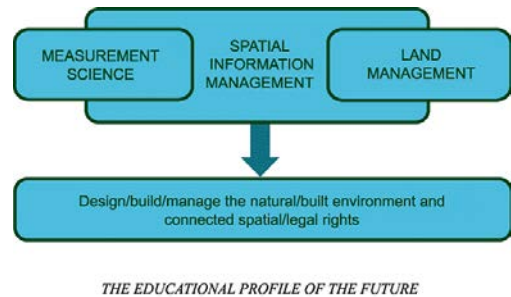


Fig. 1: The educational profile of the future (Enemark, 2001) [4]

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.

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.

3. From Measurement to Management

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

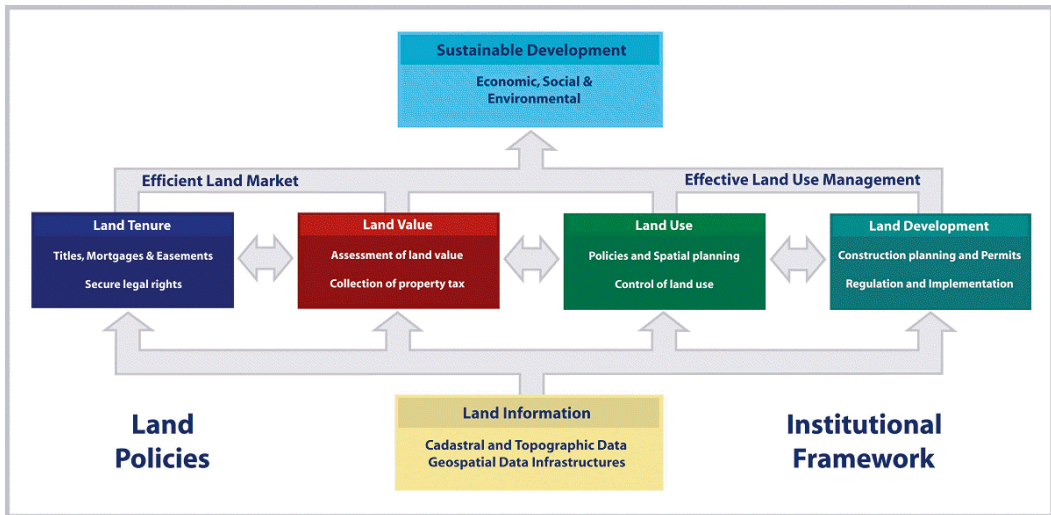


Fig. 2: A Global Land Management Perspective (Enemark, 2004) [2]

management in such a way as to meet the needs of customers, institutions and communities.

This does not imply that measurement is no longer a relevant discipline to surveying. Collection of data is now easier, but assessment, interpretation and management of data still require highly skilled professionals. But it does imply that the focus of the surveying profession is changing from being very much related to doing measurements to now being increasingly related to management of the measurement processes, the geospatial data, and the property and land-use regimes. This is the big swing that could be named “Form measurement to Management”, turning surveyors into “Land Professionals”.

The move from measurement to management also includes an increased focus on the social science issues of the surveying disciplines such as land tenure, land policies and land management. The surveyors play a key role in supporting an efficient land market and also effective land-use management. These functions underpin development and innovation for social justice, economic growth, and environmental sustainability. No development will take place without having a spatial dimension, and no development will happen without the footprint of surveyors – the land professionals - dealing with the areas of land management as indicated in Fig. 2.

4. Focus on Learning to Learn

An alternative to traditional subject-based education is found in the project organised model where traditional taught courses assisted by actual

practice are replaced by project work assisted by courses. The aim is broad understanding of interrelationships and the ability to deal with new and unknown problems. In general, the focus of university education should be more on “learning to learn”.

The traditional focus on acquisition of professional and technical skills (knowing how) often imply an “add-on” approach where for each new innovation one or more courses must be added to the curriculum to address a new technique. It is argued that this traditional subject-based approach should be modified by giving increased attention to entrepreneurial and managerial skills and to the process of problem-solving on a scientific basis (knowing why).

A number of research studies (e.g. Coleman, 1998) [1] 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

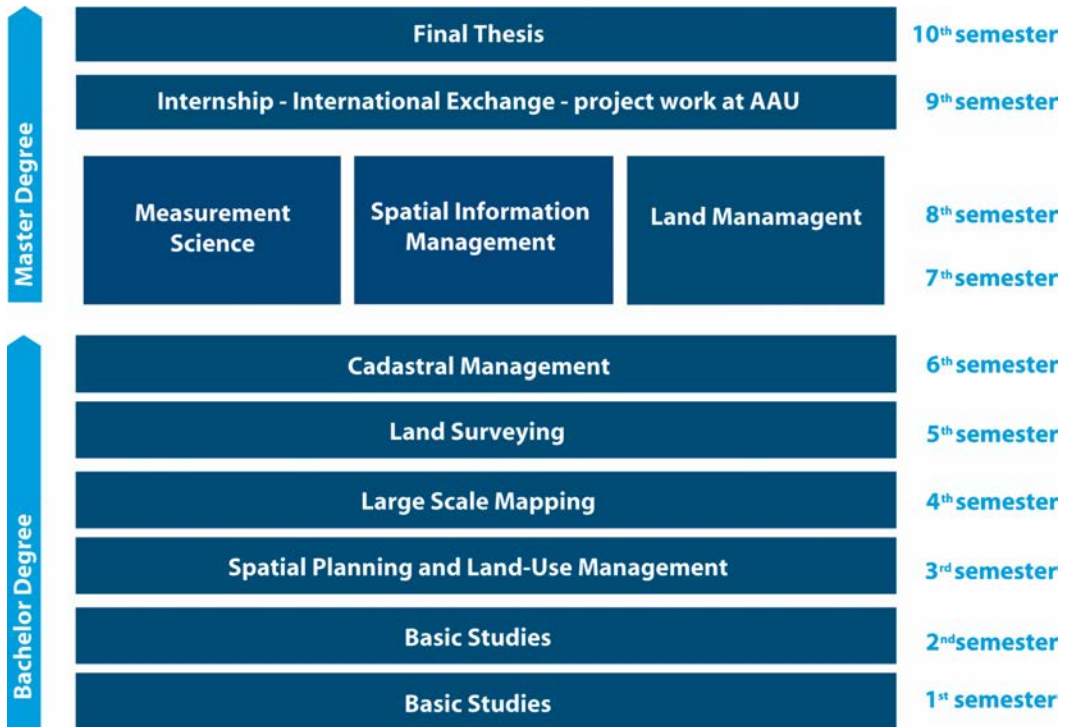


Fig. 3: The curriculum for educating Chartered Surveyors at Aalborg University, Denmark.

learning. Project work also fulfils an important pedagogical objective. The 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. The knowledge, insight, and experiences achieved by oneself will always be remembered. .

The PBL approach applied at Aalborg University, Denmark is both project-organised and problem-based. In order to provide for the use of project work as the basic educational methodology the curriculum is 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 curriculum as shown in k (Fig. 3) may be used as an example to illustrate the selection of themes as well as to explain the adaptability of the educational model.

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. Here the focus is on the ability of carrying out independent investigations on a scientific interdisciplinary basis. At the same time 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. The concept of problem-based and project-organised education is explained in details in (Enemark, 2007) [3].

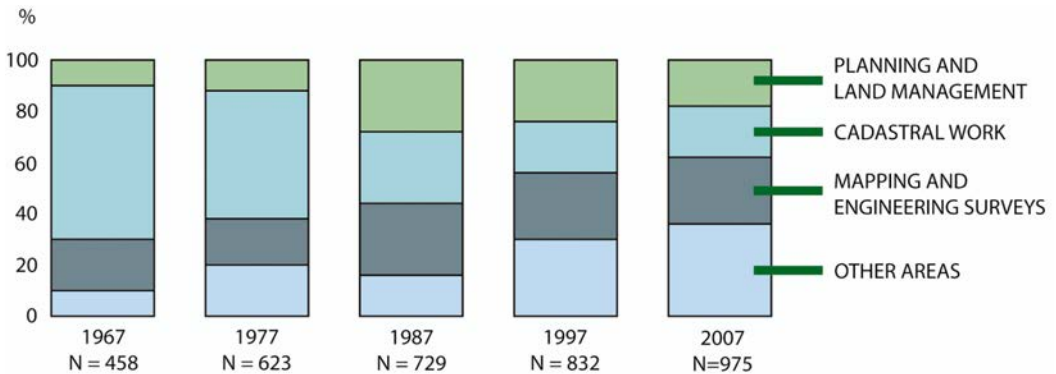


Fig. 4: The evolution of the professional profile of surveyors in Denmark over 40 years.

5. The only Constant is Change

One of the main challenges 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.

In Denmark, for example, the number of surveyors working in the private surveying firms accounted for about two thirds of the total profession about 40 years ago. Thirty years later around the year 2000 the situation is reversed. Two thirds of the profession was then employed outside the private surveying firms and this has increased further until today. During these 40 years the number of active surveyors has more than doubled from about 500 to about 1000. This means that the growth is located only within the surveyors employed in the public sector or other private business while the number of surveyors working in the private surveying firms has been more or less steady over during the last 40 years.

Over the same period, the general professional profile has changed completely. In 1967 the profile of the Danish surveyor was totally dominated by the cadastral area while in 1997 it accounts for only 20 percent of the total working hours. The evolution of the professional profile in Denmark is shown in the diagram below.

These constant changes have been coped with rather easily within the profession and also

with regard to the labour market. It is safe to assume that this is mainly due to the flexible and easily adaptable educational model that was introduced in 1974 when the surveying programme was moved from the Royal Veterinary and Agricultural Academy in Copenhagen to a new university established in Aalborg.

6. Towards Virtual Academy

There is no doubt that traditional classroom lecturing will be supported by or even replaced by virtual media in the future. This trend will challenge the traditional role of the universities. The traditional focus on the on-campus activities will change into a more open role of serving the profession and the society.

The computer cannot replace the teacher and the learning process cannot be automated. However, there is no doubt that the concept of virtual academy represents new opportunities especially for facilitating for process of learning and understanding and for widening the role of the universities. And the www techniques for course delivery on a distant learning basis represent a key engine especially in the area of lifelong learning programmes.

The role of the universities will have to be reengineered based on the new IT-paradigm. The key will be knowledge sharing. On-campus courses and distant learning courses should be integrated even if the delivery may be shaped in different ways. Existing lecture courses should always be available on the Web. Existing knowledge and research results should also be available, and tailored for use in different areas of professional practice. All graduates would then

have access to the newest knowledge throughout their professional life.

7. Creating a Quality Culture

Quality assurance refers to the means by which an institution satisfies itself that the standards and the quality of its educational provision can be maintained and enhanced. An important aspect is the cultural context in the organisation with its capacity to either facilitate or suppress local quality initiatives.

The capability and the quality of the programmes should be assessed continually within the educational system itself. Such a system of internal monitoring serves the purpose of quality management with regard to the relevance and quality of the lecture courses as well as the quality of the entire semester concerning supervising, organisation and resources. Ideally the system of quality management should be built into the educational model, and the processes should be described in the "Handbook of Quality Control". These processes should be carefully designed to underline the common responsibility for improving the quality of programmes as well as the quality of the total study environment. The development and implementation of such a system is basically about creating a quality culture. The students play a very key role in the process. The students at each semester should understand that only by fulfilling the duty of a serious evaluation of the past semester they can enjoy the benefits of commencing an improved up-coming semester themselves. Procedures for quality assurance are a must and, ideally, they should form an ongoing circle of quality improvement (see FIG publication no. 19, 1999) [6].

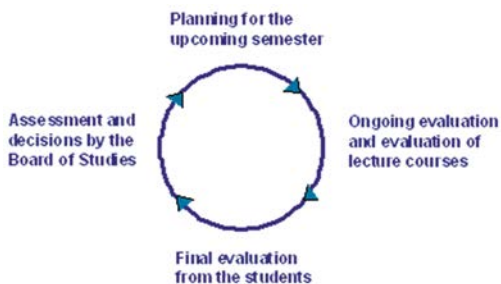


Fig. 5: The quality circle for ongoing improvement (Enemark, 2000)

Procedures for accreditation vary a lot throughout the world and also within regions of the world. Basically accreditation is about evaluating whether

a certain program meets some minimum standard criteria. Such systems of accreditation tend to become the norm at national as well as international level. Design of an adequate system of quality assurance is important in this regard. It is also important to establish adequate systems of monitoring the labour market both in terms of in terms of employment of the graduates and in terms of the whether the competences of the graduates meet the demands of the various employment areas. Such documentation is increasingly important as a tool of justification but also as a tool for strategic management and curriculum development. Assessment of such monitoring should be carried out in cooperation with representatives from the employment areas e.g. by establishing an "Advisory Board" with representatives from the key employment areas, representatives from the faculty staff, the students, as well the professional association. Such a forum may also discuss the balance between the different areas in the program, and thereby identify any needs for adjustments in relation to the demands of the various employment areas. The forum may also discuss the interaction between the university program and various activities of continuing professional development.

8. The Lifelong Learning Perspective

There was a time, when one qualified for life, once and for all. Today we must qualify constantly just to keep up. It is estimated that the knowledge gained in a vocational degree course has an average useful life span of about four years. The concept of lifelong learning or continuing professional development (CPD) with its emphasis on reviewing personal capabilities and developing a structured action plan to develop existing and new skills is becoming of increasing importance. In this regard, university graduation should be seen as only the first step in a lifelong educational process.

The term professional competence relates to a status as an expert. This status cannot be achieved only through university graduation and it cannot be achieved solely through professional practice. University graduation is no longer a ticket for a lifelong professional carrier. Today one must qualify constantly just to keep up. The idea of "learning for life" is replaced by the concept of lifelong learning. No longer can "keeping up to date" be optional, it is increasingly central to organisational and professional success.

The response of the surveying profession, and many other professions, to this challenge has been to promote the concept of continuing professional development (CPD) as a code of practice to be followed by the individual professionals on a mandatory or voluntary basis. Maintaining and developing professional competence is of course the responsibility of the individual practitioner. This duty should be executed by adopting a personal strategy which must be followed systematically. Implementation of such a plan, however, relies on a variety of training options to be offered by different course providers, including the universities (see FIG publication no. 15, 1996) [5].

9. Final Remarks

Even if the content of surveying curricula varies significantly between countries, some general trends can be identified. There is clearly a trend towards increased focus on managerial issues and the acquisition and application of interdisciplinary problem-solving skills. Regarding course delivery, there is a trend towards increased use of project-based education and web based learning tends to become an integrated tool. Curriculum must be flexible to cope with constant change and quality assurance procedures must be in place for ensuring constant improvement and innovation.

The paper discusses these major challenges in some details. It is stated that facing these challenges requires an innovative and adaptable approach to both curriculum design and course delivery within the framework of an overall quality culture. The success will eventually depend on an efficient interaction between education, research, and professional practice.

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Biographical Notes

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