SURVEYING is an essential tool for the sustainable development of countries, the increase of their quality of life and the enlargement of their horizons in the XXIst century.

Scope of the professional activities

Surveying, Engineering Surveying... 40%
Photogrametry, Remote Sensing... 5%
Cartography, GIS, Information Management... 30%
Land Administration, Land Management... 20%
Geodesy... 5%

Professional fields for the Surveyor

Surveyor
Measurement
Property
Cadaster
Valuation
Land use control

Traditional fields

Measurement
Science
Land Management

Global drivers

Technological Development
The main driver here
GPS
Satellite images
GIS
Internet

Micro - Economic Reform:
Technology → Administration
Globalization: Dimension
- Social
- Economic
- Politics
- Educative

Sustainable Development: The engine of the future policy

Changes in the definition and nature of the profession

Changes in the University Education

International trends in Surveying

Generalization & Management versus Specialization

Management = Core of education
To manage *in* the change and manage *the* change

Data manag. = future

Manag. capacity = outstanding factor

New Technologies make "easier" the data capture; so, the new Surveyor should become a DATA MANAGER

Future profile

Surveying, Geodesy, Cartography, GIS,... have an engineering character

Cadaster, Land Adminis., Planning, Valuation,... have a juridical-administrative character

The identity of profession and its educational base should be in the Spatial Data Management, although strongly linked with Technology and Social Sciences

Educational Profile of the Future

Measurement science
Spatial Data Management
Land Management
Foreseeable trends in the technological sciences

**GEODESY:** Increasing of the reference frames.
- New Cartography in the new systems, such as:
  - ETRS’89 (European Terrestrial Reference System’89)
  - SIRGAS (South American reference System)
  - NAD’83 (North American Datum’83)
  - AFREF (African Reference Frame)
- all of them compatible with the new navigation systems (GNSS’s)
- Definition by GPS of the common vertical datums being included the definition of the geodetic model.

**SURVEYING:**
- LAND SURVEYING: Generalized use of GPS; new Total Stations; powerful software;....
- ENGINEERING SURVEYING: Use of GPS for setting out; the challenge of new infrastructures; extremely powerful software for designing; etc.
- INDUSTRIAL SURVEYING: Where very few microns are the tolerance allowed to most of the works....

**ENGINEERING SURVEYING**
- GPS for setting out
- Making up topographic tools for the management of coordinates in the work.
- Setting out of infrastructure works.
- Software for setting out.
- CAD in the equipments.
- Models of geoid.
- Integration of Total Staions – GPS receivers.
- Shortening the post-process and improving the efficiency of the GPS systems.

**PHOTOGRAMMETRY:**
- DIGITAL PHOTOGRAMMETRY, NEW AND MORE ACCURATE SCANNERS, NEW DIGITAL CAMERAS, GPS AIRBONE;....

**CARTOGRAPHY:**
- DIGITAL CARTOGRAPHY: Visualization of the result of analysis and modelization of enviromental,socio-economic,logistic,... problems
- CARTOGRAPHY IN INTERNET: Easy accessibility
  - Interactive Maps
  - Dynamic presentations in multimedia
  - Easy updating

**MULTIMEDIA:**
- Presentation of 3D land models
  - Static and dynamic visualization
  - Possibility of measuring in 3D

**INTEGRATION:**
- From GENERAL to DETAIL (for instance: Navigating in a 3D map 1:25000 to a city, to a house (e.g. a museum,f.i.), to a picture,to a detail in the picture,...)

**METADATA:**
- Every country must have its SDI (Spatial Data Infrastructure);so USA has FGDC, Europe, recently, adopted ISO TC211/Geomatics.
- The next step: Servers for maps

**Geographic Information Systems:**
- Standards based in the concept of “interoperability” (norms of the OpenGIS consortium).
- Every supplier is able to exhibit his data in the form of the so called “well known types” independently of data structure of his own.
- Increasing importance of “Metadata”.
- Spreading of RDBMS (Relational Data Base Management System) based on environments,including O2 (Object Oriented) Extensions, according to SQL3 version of the standards.
- Enhancement of spatial analysis capabilities,being the main goal the evolution towards full spatial decision systems.
Land Administration is defined as the processes of determination, recording and disseminating information about:

- **Land Tenure**
  - Adjudication, cadastral surveys
  - Security, and transfer of property rights
- **Land Value**
  - Assessment of value
  - Land taxation
- **Land Use**
  - Planning Control
  - Implementation

Land Information Management

- **Spatial data Infrastructures**
  - Provides mechanisms for sharing geo-referenced Information
    - Conceptual mechanisms
      - design of organizational concepts for data sharing and custodianship
    - Political mechanisms
      - provision of an effective institutional framework and the distribution of power between the governmental levels.
      - policies for access to data
    - Economic mechanisms
      - cost recovery policies
      - strategies for distribution and maintenance

The concept of a global LAND MANAGEMENT approach raises some challenges to be met by the Surveying Community on the threshold of the third millennium.

These challenges can be divided into three different groups:

- **The Educational Challenges**
  - The identity of the Surveying profession and its educational base should be in the management of spatial data, with links to the technical as well as social sciences.
- **The Professional Challenges**
- **The Institutional Challenges**

Design, build, manage the natural/built environment and connected spatial/legal rights.
"Lifelong learning" instead of "Learning for a life"

**Need of capacity building in the area of interdisciplinary land administration**, especially in developing and transition countries, for building sustainable infrastructures.

The capacity building should ensure that the focus be more on education and building sustainable institutional infrastructures rather than building just high level IT infrastructures.

**The Professional Challenges**

Professions such as Surveying are being re-engineered and re-invented to accommodate the spatial information revolution, while endeavouring to maintain traditional services.

The modern Surveyor has to be capable not only of managing within change but managing the change itself.

The skill of the future: Interpretation of data and their management.

**The Institutional Challenges**

Adopting appropriate institutional and organizational infrastructures is a crucial key to achieving sustainability in any society.

Property right is an institution in society. Cadaster plays the most important role to make the institution of real property right work.

"Sustainable development" is "The development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Comm. 1987).

An efficient and effective land administration system is important for many different and essential aspects of development.

A fundamental institutional challenge is related to understanding the value of developing appropriate institutional, legal and technical processes to integrate land administration and topographic mapping programmes within the context of a viable national strategy for spatial data infrastructure.

The only constant is CHANGE

Flexible education

Professional adaptation

Capacity for solving new problems
New curriculum in Aalborg (Denmark) University

**Basic Year Programme**
- Large Scale Mapping
- Spatial Planning & Land Use Management
- Control Surveys
- Land Surveying & Cadastre Management

1. - 2. sem.
3. - 4. sem.
5. - 6. sem.
7. sem.
8. sem.
9. sem.
10. sem.

**Measurement Science**
- Land Management
- Spatial Information Management

**The Curriculum - New Structure**

**Continuous Professional Development**
All these circumstances suggest that:
- Continuous education instead of temporary education
- University education is the first step in a long life learning process

**Professional Competence**
- Measurement science
- Spatial Data Management
- Land Management
- Professional competence

**University Education**
- University is the place to acquire all needed capacities
- Which University?:
  - Campus Education
  - Virtual

**Which kind of education?**
- Subject Education?
- Project organised?

As previously, there are advantages, disadvantages, supporters, detractors and, mainly, the possibilities of setting up one or another.
Adaptability of subjects
Adaptability of curriculum
Adaptability of the graduates

Graduates must have the skills and competences needed to solve the new and unknown problems of the future. Skills for “learning to learn.”

This new Professional will need a deep knowledge, an excellent background, on basics: Math., Physics, Adjustment, etc.

All software, all advances in technology, all facilities given by the new instrumentation, could carry out us to prepare not professionals but... according to Prof. Czarnecki.

Conclusions

New times
New subjects
Changes and/or enlargements: at what price...?

Future necessities:
Development of profession
Development in other countries
Exchanges of experiences
University - Profession

PROPERTY IS ESSENTIAL FOR HUMANS
INFRASTRUCTURES ARE ESSENTIAL FOR PROPERTY
TECHNOLOGY AND PROPERTY MUST GO TOGETHER

According to their social-political-economic situation, every country will adopt the most suitable university and professional solutions.