



IMPACT OF TECHNOLOGICAL CHANGES IN LAND MANAGEMENT AND GEODESY ON LAND SURVEYING HIGHER EDUCATION IN UKRAINE

Prof. Dr. Andrii Martyn
Head of the Land-Use Planning Department National University
of Life and Environmental Sciences of Ukraine

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The pandemic forced us to take a new look at the content of surveying education

- the world is changing incredibly fast, the demand for skills and competence of employees is changing, and therefore the **knowledge and skills** that are now often considered relevant, **in 10 years may not be needed by anyone** (for example, in photogrammetry or technical-surveying)
- learning will not be based on memorization and personal contact, **online education and self-education will become the main competitors of universities**, which will lose the monopoly on qualification; the employer will assess specific skills and competencies, not the availability of a diploma
- the field of geodesy and land surveying is so **intensively technically re-equipped** that in the near future our students will most likely face completely different challenges and tasks
- "National borders" in the labor market, especially in the EU, will gradually disappear, **globalization is confidently "getting" to land surveying**

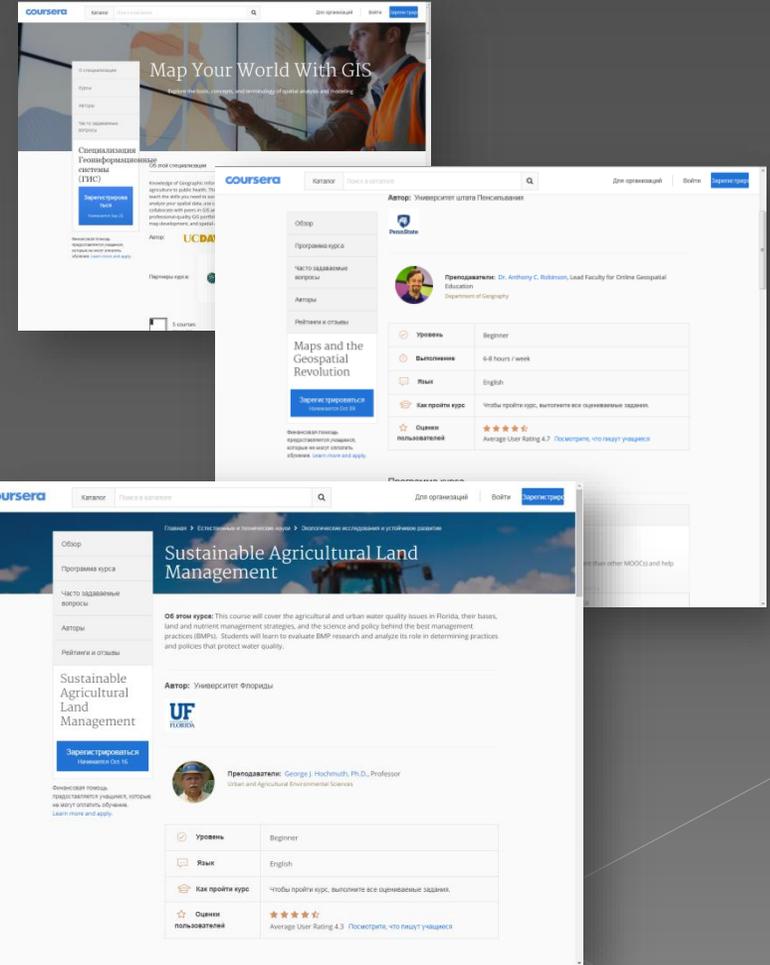


Problems of surveying education in Ukraine

Modern e-learning technologies makes university education accessible regardless of where a person is - in a remote village in Polissya or on the West Coast of the United States. Anyone can access an increasing number of online courses. It is clear that when a course of lectures is given to you by a Nobel laureate, it is steeper than a lecture by a sad associate professor from a provincial institute

Higher education in Ukraine, unfortunately, is characterized by a certain "inertia", and many universities, not having the technical and human capacity to offer training courses based on advanced technologies and technical means, continue to use openly outdated curricula

Further neglect by universities of the fact that the national and global market for engineering services are changing incredibly fast, and with it the demand for skills and competencies of employees, may have only one consequence - discrediting institutions such as higher education, because modern youth which have access to global information networks, can easily distinguish between the provision of truly relevant knowledge and dogmatic simulation of the educational process



"BAD NEWS" FOR LAND EDUCATION - ARE WE READY FOR THEM?



- most of our graduates will not develop surveying documentation at all - the number of traditional jobs in the industry is quite limited and declining
- most of the "local" land surveying is often a mix of rather archaic rules, bureaucracy and meaningless traditions, which is generally uninteresting to a foreign student
- to learn how to perform measurements at the technical level the student now needs 2-3 weeks of GNSS practical training, but not 5 years at the university
- jobs of land surveyors and surveyors will be "stolen" by robotic and unmanned remote sensing systems, artificial intelligence software, computer-aided design systems that will become truly automated
- if the graduate will work abroad, then there is no land surveying in "local" understanding at all
- "specialty work" for our graduates is, at best, a wide range of projects related to the processing of geodata or services in the real estate market

WHAT SHOULD THE TRAINING CONTENT BE IN ORDER FOR OUR GRADUATES TO BECOME SUCCESSFUL, DEMANDED AND HIGHLY PAID PROFESSIONALS?

- 80% of training should be dedicated to what will be tomorrow, not what was yesterday, although this deprives most teachers of their "comfort zone"
- curricula must be ruthlessly cleared of obsolete and unnecessary material that loses its practical application
- the best we can give our students is the ability to think critically, not trust dogmas, be intellectually mobile
- while studying, the student must "touch" all the most advanced technologies that will determine the future of the surveying industry in the medium term to be ready for their practical application.
- practical training should be built so that the student without "additional training" could immediately work independently in the field of surveying

- Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!

Lewis Carroll, 1871



WHAT HAPPENS TO GEODESY?

- ◉ We have a kind of "revolution" in topographic and geodetic activities in recent decades has been caused by three technologies: global navigation satellite system (GNSS), laser 3D-scanning and operational mapping using UAVs. It is obvious that these technologies will continue to have a decisive impact on the development of the surveying industry in the near future.
- ◉ Thanks to GNSS, precise positioning has ceased to be an engineering art, but instead is increasingly used by professionals without engineering education and in everyday life. This leads to a significant reduction in jobs for surveyors. Accurate positioning in many areas in the coming years will be possible using smartphones without the use of special equipment and the hiring of land surveyors
- ◉ A few decades ago, we spent 70-80% of our working time in the field of obtaining primary geodata, and now the proportion is changing dramatically - obtaining primary data becomes fast and inexpensive.



WHAT HAPPENS TO CARTOGRAPHY?

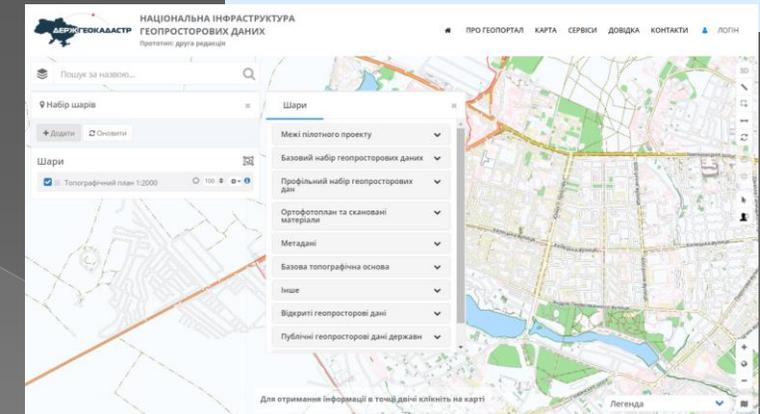
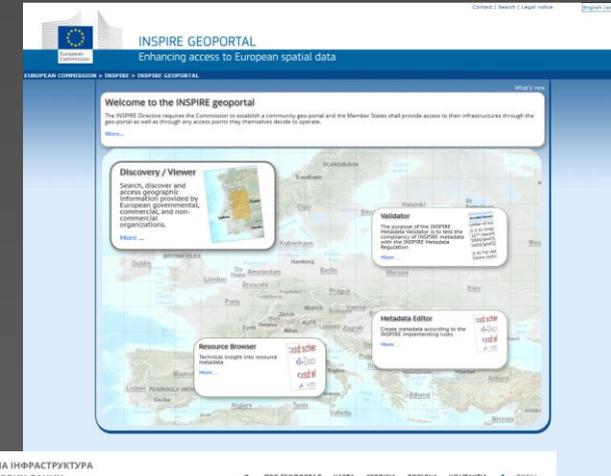
- Paper maps are being intensively replaced by multimedia devices that display dynamic cartographic content adapted to a specific consumer. Artificial intelligence and crowdsourcing are increasingly being used to create cartographic content.
- Future of cartography will be determined by the following trends: real-time cartography; everyday use; media adequacy; personalization; excellent visualization
- The global infrastructure of mass web cartography is developing rapidly and has a decentralized, multi-layered architecture, which combines both global (Google Maps, Open Street Map, Bing Maps) and local services.
- The most promising technologies in the industry: web cartography, 3D maps, map personalization, integration with social services, augmented reality.



Artificial intelligence replaces humans by 50-60% when decoding topographic objects (example of the city of Kharkov and two adjacent communities)

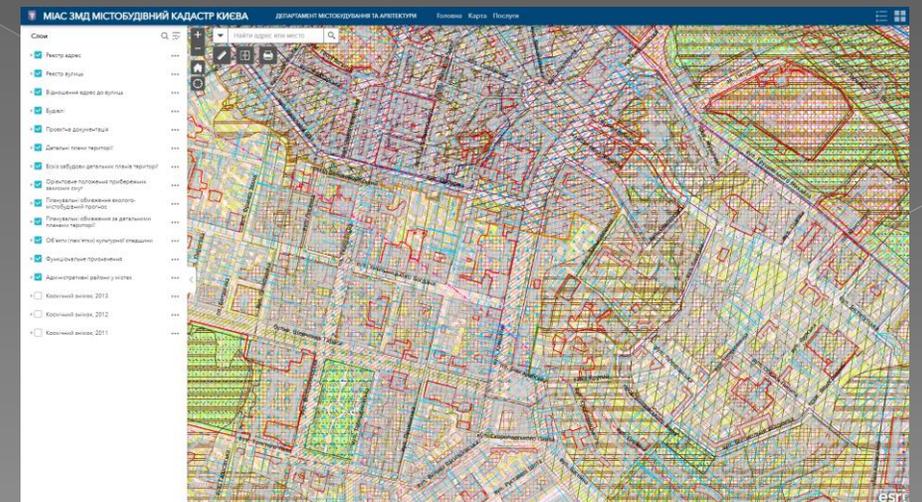
WHAT HAPPENS TO GIS?

- Thanks to GNSS, RFID and modern GIS, the time has come when everyone can find out where any object is. This will allow a revolution in entire industries, when the location of each vehicle, each farm animal, each commercial flight, each mobile phone, each bank card, etc.
- GIS is confidently becoming a real-time system. Previously, the process of creating a map was quite long, and therefore, traditionally, it was applied to the most permanent features of the earth's surface: roads, rivers, mountains, streets. However, over the past two decades, the widespread use of GNSS and mapping software has changed this rule. Neogeography has become a new trend: the ability to create personal maps, personal reflections that may be of interest only to a particular consumer and only for a short time. For example, thanks to a smartphone with a GNSS-navigator, a modern driver sees "traffic jams" and the optimal route in real time.
- "Expansion" of GIS into new areas will provide our graduates with work in the medium term (agriculture, logistics, trade, geomarketing, social networks, etc.)



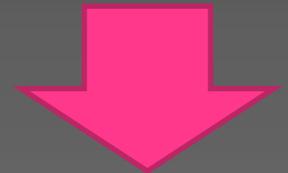
WHAT HAPPENS TO CADASTER?

- The main factors that will affect the development of cadastral systems include: globalization, urbanization, e-government, climate change, the needs of nature management, 3D-visualization and analysis technologies, standardization, interoperability.
- The most promising concepts of the cadastre of the future should be: accurate cadastre (virtual cadastral models will be closer to the real situation); object-oriented cadastre (the object of accounting is not land, but property); 3D / 4D inventories (inventories will include the third (height) and fourth (time) dimensions); real-time inventories (changes to inventories and access to them will take place online); global cadastres (national cadastres are gradually transformed into a global cadastral network); organic cadastres (cadastres will be adapted to take into account the uneven or fuzzy boundaries of natural objects)



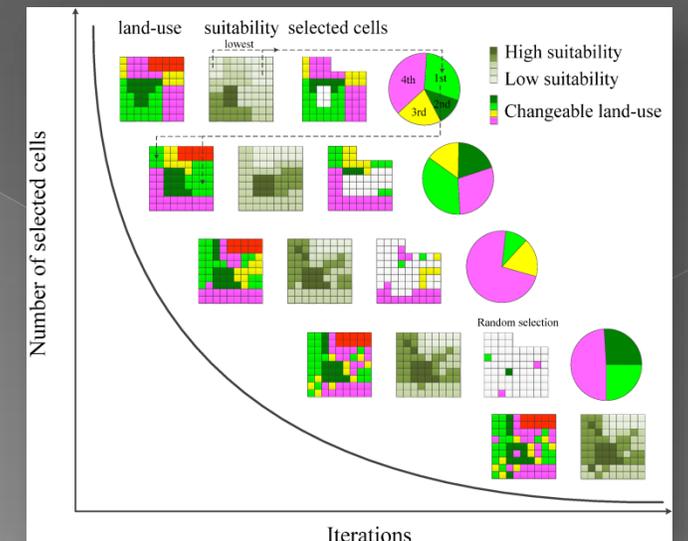
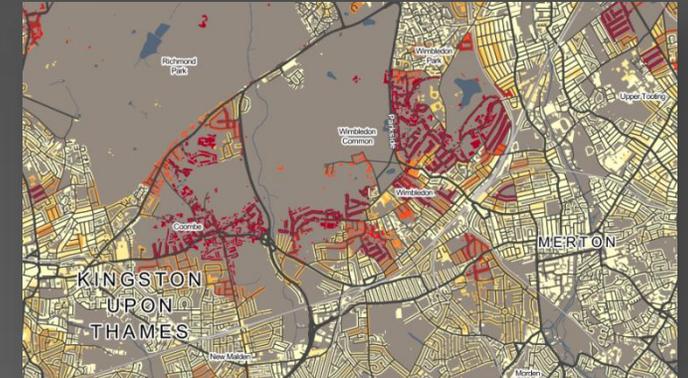
WHAT HAPPENS TO APPRAISAL?

- In the next decade, we can expect a "big reset" of valuation activities. The main driver of change will be the automation of valuation and the widespread use of computer models in real estate valuation, based on automated monitoring and forecasting of the market environment, as well as neural network technologies, Big Data and Deep Learning.
- A promising source of information for property valuation is the use of social networks.
- We can expect a gradual transition of professional real estate appraisers to other niches, such as working as financial analysts, portfolio management and investment analysis, tax consulting or litigation.



WHAT HAPPENS TO LAND MANAGEMENT?

- Land development and spatial planning is quite conservative and relies heavily on established local traditions, regulations and design approaches.
- It can be expected that promising technologies of spatial planning should be: extended spatial analysis; multi-agent systems; spatial optimization models; system dynamic models; creation of virtual worlds; new methods of visualization.
- We should also expect wider use of web services in spatial planning, as well as the use of crowdsourcing in this area, when the design decision will not be the result of the author's idea of a particular design engineer, but a joint achievement of the local community through web interfaces of various public discussions and social networks.
- It will be necessary to take into account the economic consequences of spatial planning as much as possible, because designers often forget that every project decision to change the function of the territory or land use restrictions has very specific consequences for changes in land values, the need for further expropriation of private real estate



WHAT HAPPENS TO LAND GOVERNANCE?

Analyzing the program documents of international organizations on the current tasks of land governance, we can note the following areas where the most in demand qualified knowledge and skills of land surveying specialists:

- ◉ managing conflicts related to access to land resources caused by global migration flows, climate change, military conflicts;
- ◉ management of public lands;
- ◉ expropriation of land in the public interest;
- ◉ regulation of the transfer of rights to real estate, sale, lease of real estate;
- ◉ real estate taxation system and its optimization (property taxes);
- ◉ organization of mortgage lending;
- ◉ e-government and public services in land relations;
- ◉ overcoming poverty on the basis of responsible land management.



It is very important for modern land surveyors to move from just "collecting geodata" to developing and making decisions on land and other resources management - this will ensure sustainability and demand for the profession!

Big and small conclusions!



- We always have to "play ahead" so that our students always have the most relevant knowledge!
- It is pointless to base curricula on "national law" or "traditions", as some universities do, because they are not ideal!
- Training courses should be interesting for foreign students!
- Demonstration of advanced technologies should be a training priority!
- Surveying profession provides an incredible number of interesting topics for research by masters and graduate students!

Thank you for your attention!

martyn@nubip.edu.ua

On September 16-17, 2021,
we invite you to take part in

INTERNATIONAL SCIENTIFIC-PRACTICAL CONFERENCE
**"CHALLENGES OF MODERN LAND MANAGEMENT:
DIGITALIZATION, TECHNOLOGICAL CHANGES AND
ECONOMIC TRANSFORMATIONS"**

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