

ГЕОДЕЗІЯ

UDC 528.4:332.3

DOI <https://doi.org/10.32838/2663-5941/2020.4/39>

Liu Chang

Institute of Electronics and Information Engineering
of the Guangdong Ocean University

Mamonov K.A.

O.M. Beketov National University of Urban Economy in Kharkiv

Kondratyuk I.V.

Geodetic Survey Center LLC

Kanivets O.M.

Sumy National Agrarian University

GEOINFORMATION SYSTEMS: FEATURES OF REALIZATION OF THE EDUCATIONAL PROGRAM OF PREPARATION OF MASTERS¹

The necessity of preparation of specialists which can be qualified to apply geographic information system. It is established that there remain unresolved issues of definition and application of geographic information systems and training for the development of the modern educational system, scientific approaches. The aim of the study is to identify areas and characteristics of the formation and development of the education master's program in geographic information systems. To achieve this goal the following tasks: justification of the components of the master's program in geographic information systems; the practical aspects of the application of the master program in geographic information systems.

Defined objects of study: theoretical foundations, techniques, technologies and equipment for collection and analysis of geospatial data about the shape and size of the Earth, its reflection on the maps and plans, ensuring the construction of engineering structures (including underground) and the study of spatial relationships between objects and structures.

Formed learning objectives: developing graduates' ability to solve complex specialized tasks and practical problems in the course of professional activities or teaching that involves the use of theoretical knowledge in the field of geoinformation systems and technologies and equipment in the field of topographic and geodesic production with the aim of obtaining and analyzing geospatial data. In the framework of educational program implemented competency-based approach to the study of geographic information systems.

It is established that by implementing the educational master's programme can solved practical issues for creation of geoinformation monitoring maps for informed decision-making. The study suggests directions and define the elements of the formation and use of educational master program in geographic information systems. Its implementation allows to prepare modern specialists and to identify scientific aspects of the development of geoinformation systems in various fields.

Key words: *geographic information systems, educational master program, facilities and training goals, competencies, practical aspects of program implementation.*

Introduction. The current state of the state's economy requires a rethinking of approaches to ensuring its development. In this context the modern tools deserve attention, which allows

to form a quantitative basis for making sound management decisions. One such tool is geographic information systems, which combine quantitative methods and research models that allow you to visualize processes, which increases the level of monitoring of processes occurring in the state. The use of geographic information systems requires the training of specialists who can use geographic

¹ This article are supported by the project of Enhancing School With Innovation of Guangdong Ocean University's (230420023), by the program for scientific research start-up funds of Guangdong Ocean University, and planning project for Educational Science Planning of Heilongjiang Province (GJB1319104).

information systems. Therefore, the research topic is relevant, its solution allows to solve a set of complex problems.

Analysis of existing research. Directions and features of the use of geographic information systems and technologies are presented in the developments [1–10].

Along with this, the issues of defining and applying geographic information systems and training specialists for the development of a modern educational system and scientific approaches remain unresolved.

Materials and methods. The research uses general scientific methods: systematization, comparison, dialectical development of systems, methodology of normative-legal and information-analytical support of geoinformation systems and special methods of geoinformation analysis.

The purpose and objectives of the study. The purpose of the study is to determine the directions and features of the formation and development of the educational master's program geographic information systems. To achieve this goal the following tasks are solved:

- substantiation of the components of the master's program in geographic information systems;
- description of practical aspects of application of the master's program in geographic information systems.

Main part. The master's program in geographic information systems is determined by the relevant components. In particular, the objects of study are identified: theoretical foundations, methods, technologies and equipment for collecting and analyzing geospatial data on the shape and size of the Earth, its display on maps and plans, ensuring the construction of engineering structures (including underground) and studying geospatial relationships between objects and structures.

Learning objectives are formed: formation of graduates' ability to solve complex specialized tasks and practical problems in the process of professional activity or training, which involves the application of theoretical knowledge of geographic information systems and technologies and equipment in topographic and geodetic production to obtain and analyze geospatial data.

Theoretical content of the subject area: knowledge about the shape and size of the Earth, concepts and principles of topographic and geodetic activities and land cadastre, as well as their information support. Basic knowledge of natural sciences and in-depth knowledge of mathematics and information technology.

Methods, techniques and technologies: field, in-house and remote research methods, methods of collecting and processing geospatial data, geoinformation systems, technologies of field and in-house works.

Tools and equipment: geophysical, navigation, aerosole equipment, photogrammetric and cartographic systems, specialized GIS, surveying, and photogrammetric software for solving applied tasks in geodesy and land management [11].

Defines General competence (LC):

1. The ability of oral and written communication in Ukrainian and foreign languages.
2. The ability to learn to perceive the knowledge obtained in the field of geodesy, photogrammetry, land surveying, cartography and Geoinformatics and integrate them with existing ones.
3. The ability to be critical and self-critical to understand the factors that have a positive or negative impact on communication, and the ability to identify and consider these factors in concrete communicative situations.
4. Ability to plan and manage time.
5. The ability to produce new ideas, to show creativity and the ability of systematic thinking.
6. The ability to search and critically analyze information from different sources.
7. To be focused on safety.
8. The ability to a flexible way of thinking which enables to understand and solve problems and tasks while maintaining a critical attitude to established scientific concepts.
9. The ability to use knowledge in practice.
10. To have research skills.
11. To have skills of development and project management.
12. Ability to work both individually and in a team.
13. Ability to communicate effectively on professional and social levels.
14. The potential for further training.
15. Responsible for the quality of work performed [11].

Special competence who are studying the master educational programme (SK) with the following:

1. Knowledge of scientific concepts, theories and methods necessary for understanding the principles of operation and function of the modern geodetic photogrammetric instrument and navigation systems and their equipment.
2. Knowledge of the main normative legal acts and reference materials, standards and technical conditions, instructions and other normative-administrative documents in their professional activities.

3. Knowledge of technical characteristics, design features, purpose and rules of operation of geodesic, photogrammetric, nautical equipment and equipment.

4. Knowledge of specialized software and geographic information systems and basic programming skills for solving practical professional problems.

5. Knowledge of professional and civil security in the tasks of professional activity.

6. Knowledge of modern technological processes and systems of technological preparation of production.

7. The ability to apply and integrate knowledge and understanding of related disciplines in the engineering industries.

8. Ability to use and implement new technologies, to participate in modernization and reconstruction of equipment, devices, systems and complexes, in particular with the aim of increasing their effectiveness and precision.

9. The ability to understand and take into account the social, environmental, ethical, economic aspects influencing the formation of technical solutions.

10. Ability to use professionally-profiled knowledge and practical skills for solving typical problems of the specialty, and selection of technical means for their implementation.

11. The ability to use knowledge and skills to calculate a priori estimates of the accuracy and selection of technologies for the design and execution of applied professional task.

12. The ability to identify, classify and describe the digital model through the use of analytical methods and modelling techniques.

13. The ability to explore a problem and identify constraints including those arising from issues of sustainable development and the impact on the environment.

14. The ability to substantiate the choice of methods for solving specialized problems, critically evaluate obtained results and to defend their decisions.

15. The use of appropriate terminology and forms of expression in professional activity [11].

Selected special (professional) competencies of choice (VSC):

1. Ability to design, organize and perform geodetic works using modern methods, instruments and software.

2. Ability to apply geographic information technologies for modeling and analysis of spatial objects and phenomena; to develop geographic information systems for various purposes.

3. Ability to apply knowledge of laws, standards and methods for the valuation of land and real estate.

4. Ability to apply knowledge on land management, rational use of land resources, improving the efficiency of land use with the use of modern technologies of land management design and land accounting.

The learning outcomes of the educational master's programme geo-information technologies are:

– use oral and written technical Ukrainian language and be able to communicate in a foreign language (English) in the circle of specialists in geodesy and land management;

– to know the theoretical foundations of geodesy, higher geodesy and engineering, topographic and thematic mapping, compilation and map updating, remote sensing and photogrammetry, land management, property valuation and land cadastre;

– know the regulatory-legal framework for ensuring the rational use, protection, registration and assessment of lands at the national, regional, local and household levels, procedures of state registration of land plots, other real property and limitations in their use;

– to apply the methods and technology of creation of the state geodetic networks and special engineering-geodetic networks, topographic surveys of the area, topographic and geodetic measurements for survey, design, construction and operation of engineering structures, public, industrial and agricultural complexes, using modern ground-based and aerospace methods;

– use methods of collecting information in the field of geodesy and land management, its classification in accordance with the intended design or production specifications;

– use geodetic and photogrammetric equipment and technology, methods of mathematical processing of geodetic and photogrammetric measurements;

– to use methods and techniques of land use planning, territorial and economic land management, planning, use and protection of land, cadastral surveys and maintenance of the state land cadastre;

– to develop projects of land management, land and cadastral documentation and documentation on land valuation, to make maps and prepare cadastral data with the use of computer technology, geographic information systems and digital photogrammetry;

– processing the results of geodetic measurements, topographic and cadastral surveys using GIS technology and computer software and database management system;

– possess the technologies and techniques of planning and execution of geodetic, topographic and cadastral surveys and computer processing of the results of surveys in geographic information systems;



Fig. 1. Geographic information map of generalizing spatial indicators of territorial development of land use of regions, rel. from

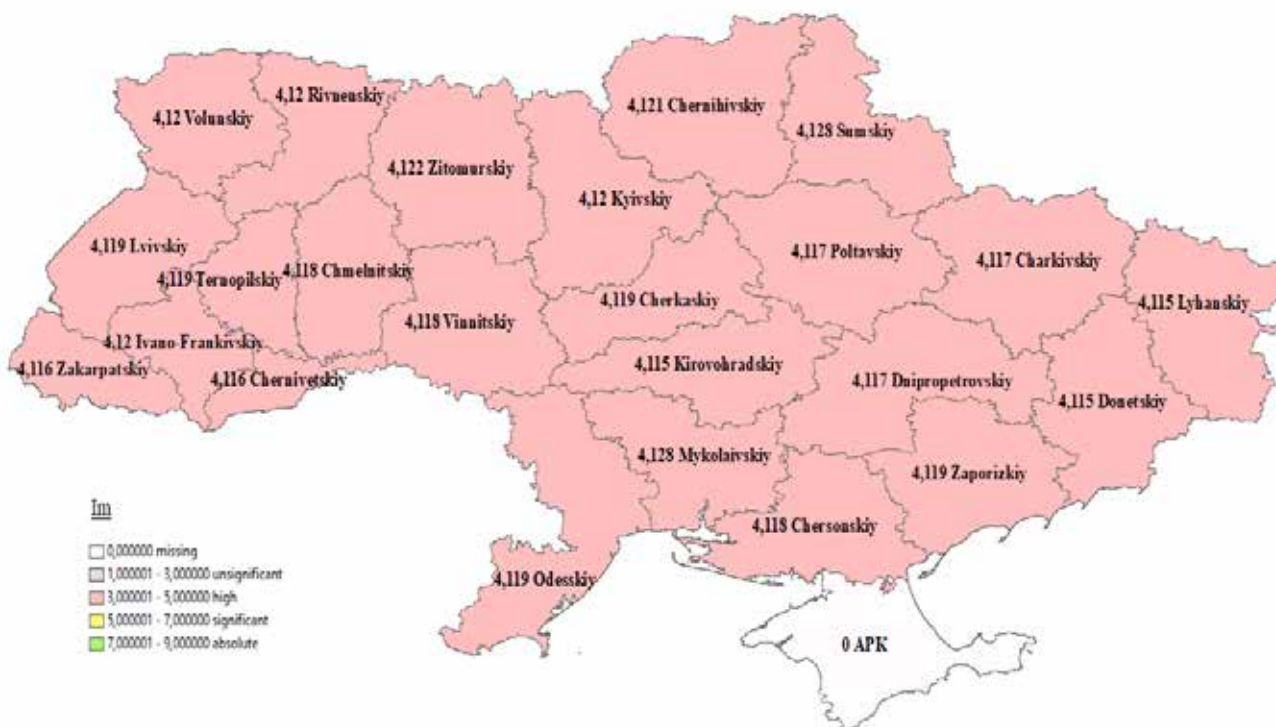


Fig. 2. Geoinformation map of generalizing town-planning indicators of territorial development of land use of regions, rel. from



Fig. 3. Geoinformation map of generalizing investment indicators of territorial development of land use of regions, rel. from

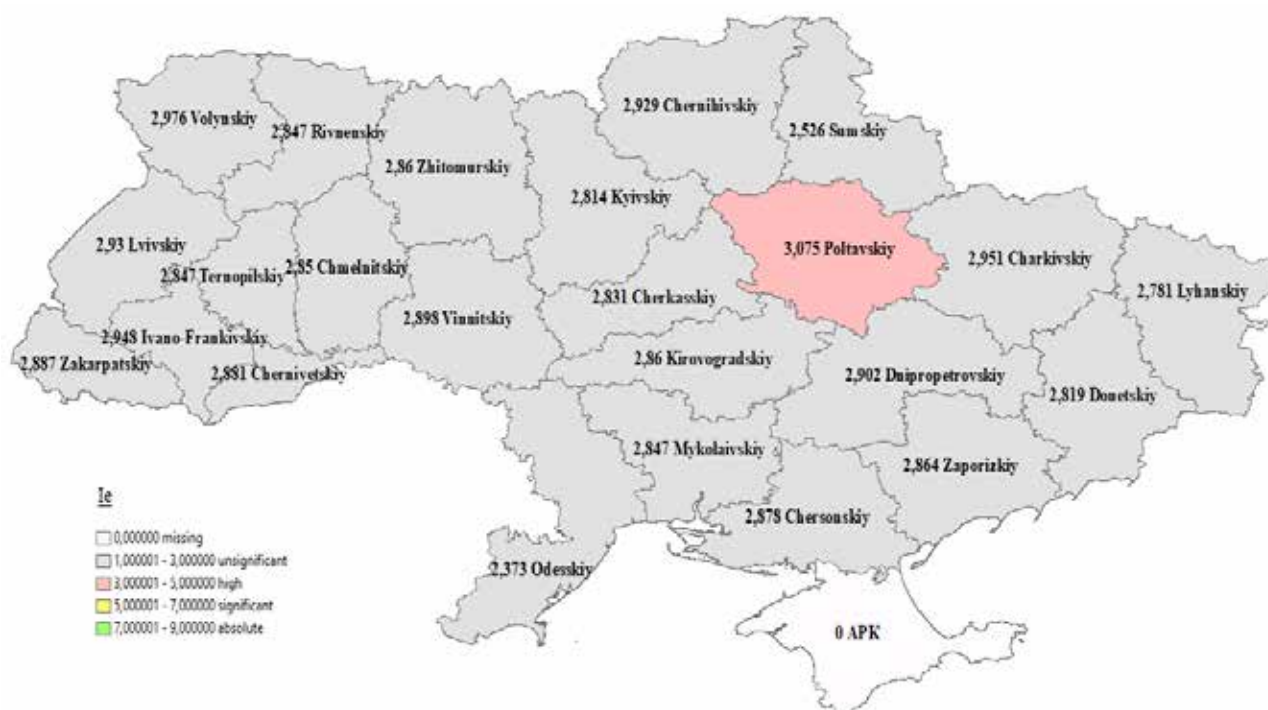


Fig. 4. Geoinformation map of generalizing ecological indicators of territorial development of land use of regions, rel. from

- to know the methods of land use planning, territorial and economic land management, planning, use and protection of land taking into account the influence of several socio-economic, ecological, landscape, environmental and other factors;
- to know the methods of organization of topographic surveying production from field measurements to the management and implementation of topographic and land-based products using knowledge of the fundamentals of legislation and production management;
- possess modern methods, instruments and software for the design, organization and execution of geodetic works;
- own geo-information technology for modeling and analysis of spatial objects and phenomena;
- to perform the valuation of land and immovable property;
- owning modern technologies of land use planning and registration of lands for rational use of land resources, improve the efficiency of land use [11].

According to the developed program the modules are defined:

- basic principles and approaches to the development and application of geographic information systems;
- geoinformation systems tools;

- features of application of geoinformation systems: general approach;
- application of geographic information systems at the regional level;
- use of geographic information systems in housing and communal services;
- application of geographic information systems in construction;
- use of geographic information systems in other areas of regional development.

Implementing the educational master's program, practical issues regarding the formation of monitoring geoinformation maps for making informed decisions can be solved (Fig. 1–4).

Conclusions. As a result of the research the directions and elements of formation and use of the educational master's program on geographic information systems are offered. Its implementation allows to train modern specialists and determine the scientific aspects of the development of geographic information systems in various fields. The practical directions of realization of the educational master's program on geoinformation systems on the basis of the constructed geoinformation maps of indicators of territorial development of land use of regions are considered, that has allowed to form monitoring system for increase of efficiency of decision-making in system of land relations.

References:

1. Генсецький М.П. Методичні основи геоінформаційного забезпечення інженерних комунікацій в експлуатаційних системах : дис. ... канд. техн. наук : 05.24.01. Київськ. нац. ун-т буд-тва і архіт. Київ, 2004. URL: <http://disser.com.ua/content/20248.html>.
2. Корнієць А.В. Особливості застосування ГІС-технологій в Україні. *Матеріали науково-практичної конференції, присвяченої Міжнародному дню геоінформаційних систем. (Харків, 19 листопада 2015 р.)*. Харків : Харків. нац. ун-т міськ. госп-ва ім. О.М. Бекетова, 2015. С. 47–50.
3. Мамонов К., Корнієць А. Застосування геоінформаційних систем для моніторингу використання земель міст. Міжнародна науково-технічна конференція молодих вчених “GeoTerrece-2017” (14–16 грудня 2017 р.) : збірник матеріалів. Львів : Видавництво Львівської політехніки, 2017. С. 216–218.
4. Мамонов К.А., Штерндок Е.С. Методи і моделі оцінки формування, розподілу та використання земель мегаполісу, що застосовуються у системі геоінформаційного забезпечення. *Економічна кібернетика: аспекти становлення і розвитку електронної економіки* : матеріали всеукр. наук.-практ. конф. (Дніпро, 1–2 берез 2017 р.) Дніпро : Пороги, 2017. С. 92–96.
5. Палеха Ю.Н., Олещенко А.В., Соломаха И.В. Применение ГИС-технологий в градостроительных проектах на государственном и региональном уровнях. *Ученые записки Таврического национального университета им. В.И. Вернадского. География*. 2012. 25 (64). № 1. С. 155–166.
6. Штерндок Е.С. Моделирование влияния пространственных факторов на оценку та використання земель мегаполісу : дис. ... канд. техн. наук : 05.24.04. Харківський національний університет міського господарства імені О.М. Бекетова, 2017. 246 с.
7. Шипулін В.Д. Основи ГІС-аналізу : навчальний посібник. ХНУМГ ім. О.М. Бекетова. Харків. 2014. 336 с.
8. Шипулін В.Д. Основні принципи геоінформаційних систем : навчальний посібник. ХНАМГ. Харків. 2010. 313 с.
9. Goodchild M.F. Geographical information science. *International Journal of Geographical Information Systems*, 1992, No. 6 (1), Pp. 31–45.

10. ISO 19152:2012 Geographic information – Land Administration Domain Model (LADM). 2012. 118 p. URL: http://www.iso.org/iso/catalogue_detail.htm.

11. Освітня програма (освітньо-професійна). Геодезія та землеустрій. Другий (магістерський) рівень вищої освіти. Галузь знань: 19 «Архітектура та будівництво». Спеціальність: 193 «Геодезія та землеустрій». Харків : ХНУМГ ім. О.М. Бекетова, 2017. 21 с.

Лю Чан, Мамонов К.А., Кондратюк І.В., Канівець О.М. ГЕОІНФОРМАЦІЙНІ СИСТЕМИ: ОСОБЛИВОСТІ РЕАЛІЗАЦІЇ ОСВІТНЬОЇ ПРОГРАМИ ПІДГОТОВКИ МАГІСТРІВ

Обґрунтована необхідність підготовки спеціалістів, що можуть кваліфіковано застосовувати геоінформаційні системи. Встановлено, що залишаються невирішеними питання щодо визначення та застосування геоінформаційних систем та підготовки спеціалістів для розвитку сучасної освітньої системи, наукових підходів. Метою дослідження є визначення напрямів та особливостей формування й розвитку освітньої магістерської програми «Геоінформаційні системи». Для досягнення поставленої мети вирішуються такі завдання: обґрунтування складників магістерської програми з геоінформаційних систем; характеристика практичних аспектів застосування магістерської програми з геоінформаційних систем.

Визначені об'єкти вивчення: теоретичні основи, методики, технології та обладнання для збирання та аналізу геопросторових даних про форму та розміри Землі, її відображення на картах і планах, забезпечення зведення інженерних споруд (включаючи підземні) та вивчення геопросторових зв'язків між об'єктами та структурами.

Сформовані цілі навчання: формування у випускників здатності розв'язувати складні спеціалізовані завдання та практичні проблеми в процесі професійної діяльності або навчання, що передбачає застосування теоретичних знань з геоінформаційних систем та технологій і обладнання у галузі топографо-геодезичного виробництва з метою отримання та аналізу геопросторових даних. У рамках освітньої програми реалізовано компетентнісний підхід до вивчення геоінформаційних систем.

Встановлено, що, реалізуючи освітню магістерську програму, можуть бути вирішені практичні питання щодо формування моніторингових геоінформаційних карт для прийняття обґрунтованих рішень. У результаті дослідження запропоновані напрями та визначені елементи формування й використання освітньої магістерської програми з геоінформаційних систем. Її реалізація дає змогу підготувати сучасних спеціалістів та визначити наукові аспекти розвитку геоінформаційних систем у різних сферах.

Ключові слова: геоінформаційні системи, освітня магістерська програма, об'єкти і цілі навчання, компетентності, практичні аспекти реалізації програми.