

Status of the DSinGIS Project

V. Balázsik

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
balazsik.valeria@amk.uni-obuda.hu*

L. Földváry

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
foldvary.lorant@amk.uni-obuda.hu*

A. Kovács

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
kovacs.anna@amk.uni-obuda.hu*

B. Márkus

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
markusbela@gmail.com*

A. Pödör

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
podor.anna@amk.uni-obuda.hu*

E. Tóth

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
toth.erzsebet@amk.uni-obuda.hu*

M. Verőné Wojtaszek

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
wojtaszek.malgorzata@amk.uni-obuda.hu*

Gy. Busics

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
busics.gyorgy@amk.uni-obuda.hu*

G. Nagy

*Institute of Geoinformatics
Alba Regia Technical Faculty
Óbuda University
Székesfehérvár, Hungary
nagy.gabor@amk.uni-obuda.hu*

Abstract— The objectives envisaged with the DSinGIS project is to establish a missing PhD level of the Uzbek educational system. The project has already established an accredited Doctoral School in the field of GISc, developed its programme, defined the requirements, advanced supporting teaching and learning materials in English and/or Uzbek languages. Also, the education capacity of 5 leading Uzbek universities has been developed by creating a Knowledge Centre at each Uzbek partner universities containing an e-learning platform with a jointly developed knowledge pool. However, there are certain delayed activities, which resulted in the extension of the project period by 6 months. These are the development of a Joint Research Centre, organizing a Summer School and the GI2020 scientific conference, and also the visiting research in the EU for 7 more Uzbek PhD students. The present paper provides an overview of the status of the activities. **Keywords:** GeoInformation Science, PhD programme, e-learning

I. INTRODUCTION

GeoInformation Science (GISc) is a relatively young science, however, has its roots thousands of years. It integrates three traditional geosciences (firstly, geodesy as the science of precise spatial data acquisition; secondly, geography as the science of studying human and physical aspects; finally, cartography as the science of making maps). The integration of these sciences is based on the rapidly evolving computer science. The methods of GISc are widely applied in other sciences, essential in decision making for sustainable development. GISc provides the theoretical foundation of handling geo-related (ie. spatially referenced) digital spatial data acquired primarily by satellite-borne methods. As a result, GISc delivers an essential tool for interpreting, visualizing and analysing measurements of Earth Observation satellite missions, such as Remote Sensing. It makes use of the methods of geospatial analysis and modelling, information systems design, geocomputation and geovisualization.

With the coordination of the Óbuda University, an Erasmus+ Capacity Building in Higher Education, Key

Action 2 project is conducted named Doctoral Studies in GeoInformation Sciences (abbreviated as DSinGIS). The wider aim of the project is to support Uzbekistan in sustainable development by GISc. The objectives envisaged with the project is to establish a missing puzzle from the Uzbek educational system after the MSc level has been completed and before the DSc is targeted. The project established an accredited Doctoral School in the field of GISc, developed its programme, defined the requirements, advanced supporting teaching and learning materials in English or Uzbek languages, all developed in accordance to international standards and in accordance to the Uzbek education system.

As a support for the new Doctoral programme, a network of activities is conducted to improve the educational and research capacity of the Uzbek society. Among these activities, an international network of the 5 leading Uzbek universities is established. Also, their education capacity is developed by creating a Knowledge Centre at each Uzbek universities containing an e-learning platform with a jointly developed knowledge pool. The knowledge pool is also supporting research activity of future PhD students. Furthermore, a Joint Research Centre, 5 research labs are developed to improve the research capacity of PhD programmes. Finally, annual GI conferences are organized to provide a platform for presenting research results.

There are several challenges in Uzbekistan, where GISc may efficiently support solutions, for such issues as climate change, land degradation, heavy use of agrochemicals, diversion of huge amounts of irrigation water from the two main rivers of the region, water scarcity, the chronic lack of water treatment, e.g. Aral Sea, or the growing threat to air quality.

The DSinGIS project shows synergies with other EU-funded project like “Furthering the Quality of Doctoral Education at Higher Education Institutions in Uzbekistan” [1], “Environmental Protection in Central Asia - Disaster Risk Management with Spatial Methods” [2] and “Sustainable development in rural areas of Uzbekistan” [3] projects.

The DSinGIS project was originally intended to be completed by 14 October 2020, but due to the COVID-19 pandemic, some important tasks must have been postponed, accordingly, the project run was requested to be extended by half a year. The aim of the present paper is to overview the results so far, and also to outline the remaining tasks. The paper also intends to update the status and planned timeline of the project activities presented at H-SPACE conference in February 2020 [4]. For up-to-date information on the DSinGIS project, visit the website at <http://www.dsingis.eu/home/>, which can be reached by the QR code on Figure 1 as well. Also, actual tasks and challenges of project implementation can be reached at [5].



Fig. 1. QR code of the dsingis.eu webpage

TABLE I. THE CONSORTIUM

Partners		
HEI	abbr.	Country
Obuda University	OU	Hungary
Paris Lodron University of Salzburg	PLUS	Austria
Royal Institute of Technology	KTH	Sweden
Leibniz Institute of Agricultural Development in Transition Economies	IAMO	Germany
Tashkent Institute of Irrigation and Agricultural Mechanization Engineers	TIIAME	Uzbekistan
National University of Uzbekistan named after Mirzo Ulug'bek	NUU	Uzbekistan
Karakalpak State University named after Berdakh	KSU	Uzbekistan
Samarkand State Architectural and Civil Engineering Institute	SamSACEI	Uzbekistan
Tashkent Institute of Architecture and Civil Engineering	TIAC	Uzbekistan
Associated partners		
HEI	abbr.	Country
State Committee of Republic of Uzbekistan on Land Resource	GKZGDK	Uzbekistan
Ministry of Higher and Secondary Specialized Education	MHSSE	Uzbekistan
Supreme Attestation Commission under the Cabinet of Ministers	SAC	Uzbekistan

II. THE CONSORTIUM

The project is implemented in an international cooperation of 9 higher education institutes (HEI) additionally to the 3 ministerial institutions contributing as associated partners. The majority of the consortium is Uzbek HEIs consisting of

all relevant universities in the field of Geoinformatics. The list of the involved institutions is summarized in Table I.

III. ESTABLISHMENT OF THE DOCTORAL SCHOOL

The DSinGIS project focuses on the development of a PhD level educational system. The demand on establishing a Doctoral School in the field of Geoinformation Science is in line with the aims of the Ministry of Higher and Secondary Specialized Education of Uzbekistan (MHSSE). The project specified a PhD programme and methods to deliver its courses.

As a major achievement of the project is that the establishment of the Doctoral School has already been registered in 2019 by the Supreme Attestation Commission under the Cabinet of Ministers (SAC) as a state-recognized PhD programme.

The PhD programme consists of 18 courses divided into 6 compulsory courses and 12 advanced courses in 3 specializations. Among the 18 courses, 8 are prepared in English and 10 in Uzbek language. The rationale behind the share of languages is a consequence of the project partners are expected to contribute equally to the course development, each HEIs developing 2 courses. The structure of the programme and the content of the courses are as follows.

I. Compulsory courses prepared in English

1) Spatial representations and Spatial Data Infrastructures (SDI). The course provides a comprehensive overview on the state-of-the art of SDI, the underlying principles, as well as technological and non-technological components of SDIs.

2) Spatial statistics. The course aims at advancing knowledge on spatial data analysis and spatial statistics. It focuses on methods that are relevant in fields related to sustainable resource use and development of rural areas, such as land use change, climate change, soil degradation, and spatial analysis of well-being.

3) Global Navigation Satellite Systems (GNSS). This course provides the students with an in-depth knowledge about global navigation satellite systems, in particular positioning methods and algorithms as used in the fields of geoinformation science. The course focuses on high accuracy positioning methods, long term static observation methods for deformation monitoring and reference networks, and on atmospheric effects on GNSS signals.

4) Visually interfacing with spatial information. This course aims at introducing the complex field of visually interfacing with spatial information. Techniques and tools as well as concepts and standards to find, filter and visualize spatial data are presented. Technical skills and human-computer interaction competencies are built up.

5) Research methodology and scientific communication. This course introduces to students general research methods as well as practical research process, with focus on critical and creative thinking, addressing also scientific writing and communication in different forms and different media. Furthermore, social impact of scientific research, commercialization of research results through innovation is concerned.

6) Advanced remote sensing and digital image processing: This course aims at advancing remote sensing and digital image processing knowledge, techniques and skills for getting information from imagery and ability to solve complex tasks based on remote sensing. Emphasis is placed on gaining a practical understanding of the principles behind each technique and a consideration of their appropriateness in different applications.

II. Courses for specializations (there are 3 specializations, each consists of 4 courses, mostly in Uzbek language; when it is in English, it is noted).

II/1. Geodesy:

7) Geodetic Reference Systems. This course aims to deepen the theoretical knowledge and practical skills for the development and management of research projects.

8) Advanced theory of errors. This course consists of studying the theoretical foundations of multivariate statistical analysis in relation to the processing and analysis of geodetic measurements.

9) Satellite gravimetry (in English). The course aims at advancing on physical geodesy knowledge from observational aspects, focusing on obtaining positioning and physical information from satellite-borne observations.

10) 3D laser scanning and mapping by UAV. This course focuses on application of 3D laser scanners and unmanned aerial vehicles in analysing data and creating digital maps or update existing maps.

II/2. Geoinformatics:

11) Geo-databases and distributed architectures. This course is on developing techniques and skills for designing and building a geospatial database, as well as managing such distributed geodatabases, and working with multi-user spatial data base.

12) Advanced thematic mapping. The course supports candidates in cartography, thematic mapping, cartosemiotics, contemporary issues of spatial data representation, use of automation and tools in geovisualisation.

13) Advanced spatial analyses. This course aims to provide knowledge and skills necessary to investigate the spatial patterns, advanced analytical and practical skills to identify and apply the correct analytical tools for problem solving, and to appropriately interpret the analysis results.

14) Integration of remote sensing and GIS. The main aim of this course is exploring the synergies of integrated remote sensing systems and GIS.

II/3. GIS applications:

15) Spatial decision support in land management. The course is aimed to get an idea of the current regulatory and legal acts that regulate the subject of green law, and the application of this knowledge in practical activities, with emphasis on the current legislation of Uzbekistan.

16) Land use economics. This course is aimed at promoting the knowledge of doctoral students in the field of land use and its economics.

17) Spatial simulation of environment. This course is a critical introduction to spatial simulation of ecosystems, embedding of the PhD student in modern research practices, introducing a young scientist into up-to-date context and language of the simulation domain, including proper software background.

18) Sustainable resource management (in English). This course introduces key concepts related to natural resource management for food security and sustainable development. The course summarizes major trends in changes in resource management globally, across scales, and by geographic zone and country, considering also impacts of global climate change on water and land use, and their implications for sustainable resource management.

IV. KNOWLEDGE POOL

Beyond the courses of the PhD programme, a knowledge pool is built providing a theoretical background for the PhD students in the field of GISc and related disciplines. The knowledge pool consists of a glossary of geospatial terms, proceedings of annual scientific conferences organized within the frame of this project, relevant digital libraries and scientific journals, 8 modules developed within the Tempus GE-UZ project [6], 18 modules developed within the Erasmus+ DSinGIS project, online library/database such as Scopus, EBSCO, Sciencedirect and Proquest, products of PhD students in GISc (e.g. DSinGIS Grantholders' technical reports, papers/articles, presentations and posters), MSc, PhD thesis related to GISc, GIS related scientific journals and articles, and also GISCA&GI-Forum conferences Proceedings [7]. The structure of the Knowledge Pool is presented on Fig. 2.

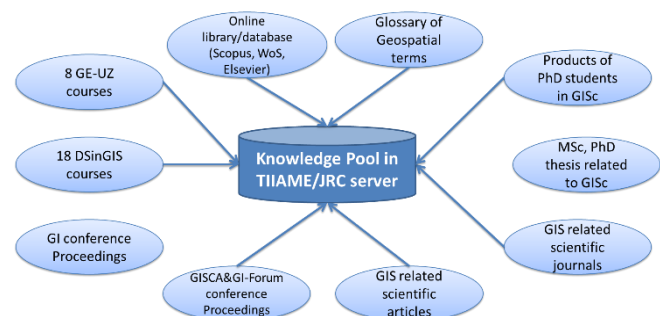


Fig. 2. Structure of the Knowledge Pool

The glossary of geospatial terms is containing more than 1000 terms in Uzbek, helping interdisciplinary communications.

GISc conferences are organized annually (by the date of the present paper, 2 of the planned 3 have already been completed successfully), the submitted papers are published in a conference proceedings and selected papers in local journals.

According to the DSinGIS work plan in total 15 selected doctoral candidates will receive grant to study in one of EU partner institutions (60 days/person) in 3 cohorts. The candidates have been carefully selected by the Admission and Examination Committee. The doctoral candidates will be actively involved in project evaluation, dissemination and

exploitation (see section VI. later). They should prepare travel reports focused on their research activities during their study visits in EU partner universities.

V. KNOWLEDGE CENTRES AND JOINT RESEARCH CENTRE

Advanced IT network is installed at each UZ partner institution, which handles a Moodle Learning Management System. The centres are equipped by GIS and Remote Sensing specific devices. The centres have an IT platform for acquiring and sharing knowledge, videoconference system will be installed for frequent communication between doctoral schools, and it helps collaborative, blended learning. Each centre is equipped with a server, a video conferencing system set, and 3 workstations with advanced GIS & Remote Sensing software. An interactive projector set supports professional presentations of doctoral students.

A sustainable Joint Research Centre (JRC) is also planned for the benefit of doctoral candidates in geoinformatics, not exclusively DSinGIS partners, but covering the interdisciplinary applications in the country. The JRC is established at TIAME, but the related equipment purchase must have been delayed due to the COVID-19 related preventive actions in social distancing and closing several institutions. JRC will be equipped with advanced hardware and geospatial software. The technical / scientific staff will be offered by TIAME for free. JRC will result directly improved quality of doctoral researches and increased collaboration within partners and wider GI community. The long run benefits of JRC: (1) UZ institutions are able to increase cooperation with EU research institutes, (2) Industry in geospatial sector able to offer innovative business products, (3) Society benefit from innovations, e.g. smart city concept to enhance quality, performance and interactivity of services, to reduce costs and resource consumption and to improve contact between citizens and government.

VI. COMPETENCE DEVELOPMENT

There is a lack of experiences in the new educational methodologies and international tendencies in the Uzbek GI community. The aim of the project is to improve the knowledge, skills and competences of related Uzbek staff regarding management, administration, supervision and mentoring in doctoral studies. The competence development activity focuses on three target groups: 1) management/administration staff, 2) teaching staff and supervisors and 3) doctoral candidates.

There are trainings and workshops are organized in order to improve the competences of the different target groups of the Uzbek HEIs. Also, annual international GISc conferences are organized, which is a huge opportunity for the Uzbek Geoinformatic society to participate and present up-to-date researches in the field of GISc and related sciences. The main parameters of such events are summarized in Table II.

A major success of the competence development activities is the annually organized scientific conferences. On one hand, the number of the published papers is beyond expectation. But what is more important is that annually an increase of the level of the submitted papers can be observed. Also, the number of researches performed in international cooperation could be observed. Originally, 3 GI conferences were planned. In 2018 and 2019 it was implemented according to the plans. In 2020, the GI2020 conference was agreed to be organized jointly with the GISCA2020 international conference, several publications

from the DSinGIS community has been submitted. The GISCA2020 conference was finally held in 1–3 June 2020 in an online form. The online participation provided a kind of challenge for the young Uzbek GI community, and their participation turn to be below the expectations. In order to provide an appropriate forum for the young Uzbek colleagues, a face to face conference has been decided to be held as soon as the international pandemic situation enables organization of such conferences. By September of 2020, the proposed date of the 3rd GI conference is January or February 2021.

TABLE II. EVENTS FOR COMPETENCE DEVELOPMENT

event	target group	topics	date and location
Training for management and administration	administrative staff, senior managers	management, administration, quality management, quality enhancement, internationalization issues	22-26 May 2018 Hungary
Workshop on learning support methodologies	Teaching staff, scientific advisors	learning support methodologies, eLearning tools and competencies in mentoring	15-18 October 2018 Uzbekistan
1st GI Conference	Teaching staff, research community, PhD students and PhD candidates	presenting and discussing research findings, interests of young and senior, Uzbek and international GI scientists	19-20 October 2018 Uzbekistan
Workshop on interdisciplinary doctoral courses	Teaching staff, scientific advisors	experiences on interdisciplinary GISc issues of doctoral courses	June-July 2019 Austria
Training on supervision and research methodologies	Teaching staff, scientific advisors	supervision and research methodologies in GISc	15-18 October 2019 Uzbekistan
2nd GI Conference	Teaching staff, research community, PhD students and PhD candidates	presenting and discussing research findings, interests of young and senior, Uzbek and international GI scientists	22-23 October 2019 Uzbekistan
Geoinformatics Summer School	PhD students	practical and methodological skills for advanced use of spatial analysis methodologies and techniques of GISc	postponed Uzbekistan
GISCA Conference [7]	Teaching staff, research community, PhD students and PhD candidates	presenting and discussing research findings, interests of young and senior, Uzbek and international GI scientists	1-3 June 2020 online
3rd GI Conference	Teaching staff, research community, PhD students and PhD candidates	presenting and discussing research findings, interests of young and senior, Uzbek and international GI scientists	postponed Uzbekistan

Also, a relevant contribution to competence development is that the project provides scholarship for the young PhD student generation for a 2-month visiting research at an EU partner university to get international experiences. The list of the awarded researchers and their parameters of visit is listed in Table III.

TABLE III. SCHOLARSHIP AWARDEES

name	HEI	host	date
Yakhshimurad Khudaybergenov	KSU	IAMO	October - November 2018
Mamanbek Reimov	TIIA ME	OU	January – March 2019
Zokhid Mamatkulov	TIIA ME	OU	January – March 2019
Otabek Avezbaev	TIA C	PLUS	March – May 2019
Kuwaitbay Bekanov	KSU	IAMO	April – May 2019
Sitora Sodikova	Sam SAC EI	PLUS	May – June 2019
Ilhom Abdurahmanov	TIIA ME	OU	February – March 2020
Medetbay Uteuliev	KSU	OU	February – March 2020
Azizjon Ruziev	NUU	OU	postponed
Abduljalil Muminov	NUU	IAMO	postponed
Vohidjon Niyazov	Sam SAC EI	OU	postponed
Sherzod Uzokov	Sam SAC EI	PLUS	postponed
Akbarjon Khamraliev	TIIA ME	OU	postponed
Barno Khalilova	TIIA ME	PLUS	postponed
Ilkhomjon Abdullaev	NUU	OU	postponed

The candidates are selected carefully by an Admission and Examination Committee. In addition to UZ supervisors EU teachers are assigned to mentoring learning, supporting researches. As it can be seen in Table III, 7 candidates among the 15 could have not fulfil their travel due to the COVID-19 pandemic.

VII. SUMMARY

With the coordination of the OU, an Erasmus+ Capacity Building in Higher Education, Key Action 2 project named Doctoral Studies in GeoInformation Sciences is conducted. The wider aim of the project is to support Uzbekistan in sustainable development by GISc. The objectives envisaged with the project is to establish a missing puzzle from the Uzbek educational system after the MSc level has been completed and before the DSc is targeted. The project established an accredited Doctoral School in the field of GISc, developed its programme, defined the requirements, advanced supporting teaching and learning materials in English or

Uzbek languages, all developed in accordance to international standards and in accordance to the Uzbek education system.

As a support for the new Doctoral programme, a network of activities is conducted to improve the educational and research capacity of the Uzbek society. Among these activities, an international network of the 5 leading Uzbek universities is established. Also, their education capacity is developed by creating a Knowledge Centre at each Uzbek universities containing an e-learning platform with a jointly developed knowledge pool. The knowledge pool is also developed supporting research activity of future PhD students. Furthermore, a Joint Research Centre, a research lab is to be developed to improve the research capacity of PhD programmes. Finally, annual GI conferences are organized to provide a platform for presenting research results.

As a consequence of the COVID-19 pandemic, certain activities could have not been completed according to the schedule, which resulted in the extension of the project period by 6 months. These activities are the development of a Joint Research Centre, the organization of the Summer School and of the face-to-face GI2020 scientific conference, and also the visiting research in the EU of 7 Uzbek PhD students could have not been completed.

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