



Erasmus+ CBHE Project: “Developing Interdisciplinary Postgraduate Programmes and Strengthening Research Networks in Geoinformation Technologies in Armenia and Kyrgyzstan (GeoTAK)”

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Erasmus+ CBHE Project

“Developing Interdisciplinary Postgraduate Programmes and Strengthening Research Networks in Geoinformation Technologies in Armenia and Kyrgyzstan (GeoTAK)”

Needs Analysis Report for the Republic of Armenia and the Kyrgyz Republic

WP1.1. Survey for identification of research & development needs

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1 INTRODUCTION

1.1 Antecedents of Geoinformation Technologies in Armenia and Kyrgyzstan

Armenia

Geoinformation technologies were first introduced in science in Armenia in the early 1980s, when The Laboratory of Physical and Mathematical Methods in Geology was established in the Institute of Geological Sciences in 1984. Later it was reorganized as a Geoinformation Laboratory for structural-thematic changes of the Geological Institute. With the development of information technology, particularly Geographic Information Systems – the activities of the laboratory also shifted from geological data statistics to spatial modeling of geological objects and processes, digital mapping and spatial statistics. The laboratory was one of the first to introduce GIS for mapping and management of mineral deposits, structural geology, hydrology, management of water resources.

Geoinformatics as a separate subject was introduced in the curricula of Armenian Higher Education Institutions started from 1990s and started be actively developed, especially when Armeian universities got possibility to take part in EU funded TEMPUS and ERASMUS+ projects. By the help of the mentioned projects (ECOMA, GIDEC, HERITAG, GeoTAK) Armenian universities (NUACA, YSU, ANAU) enriched their capacities in the field of geoinformation technologies. Particularly, they established new educational programs or reformed the existed ones, developed/reformed number of courses, developed new study materials, bought modern geodetic equipment, established new appropriate labs and staff members were trained.

Currently, geoinformation systems and related scientific disciplines are taught at Yerevan State University, National University of Architecture and Construction, Armenian National Agrarian University, Armenian State Pedagogical University and American University of Armenia. It is also included in the curriculum of the Master's program in Earth Sciences of the National Academy of Sciences.

Geoinformation technologies are widely used in a number of institutes of the National Academy of Sciences of the Republic of Armenia, in particular the Institute of Geological Sciences, the Center for Ecologanospheric Research, the Institute of Informatics and Automation Problems, the Scientific Center for Zoology and Hydroecology, etc.

Geo-spatial data for environmental management and decision support is mainly using by the Ministry of Economy, the Ministry of Nature Protection Ministry of Territorial Administration and Infrastructure, Misnistry of the Emergency Situation, and the Cadastre Committee.

The Ministry of Economy is responsible for data related to: Pastures and Agricultural Lands, Water. The ministry runs a central server, which hosts Armenian Soil Information System.

The Ministry of Nature Protection of the RA is responsible for data related to: Forests, Biodiversity, Water, Protected areas, Protected forest areas. Forest data is distributed via a client-server based National Forest Management Information System to the management authorities on the regional level. The Center of the Hydrometeorology and Monitoring (Structural unit of the ministry) is responsible for hydro-meteorological data.

The Ministry of Territorial Administration and Infrastructure is responsible for the spatial data related to the transport infrastructure, energetic lines and water supply.

Cadastre Committee of the RA is responsible for cadastral data in Armenia. The cadastre data contains information about ownership and land use (according to the Land Code of the RA) and is stored in the AutoCAD format .dwg. Cadastral data is disseminated based on a client-server construction to regional cadastral authorities. Processing is based on Microstation with an additional plugin (ArcPac 8) which enables certain GIS tasks.

Cadaster Committee currently implements a National Spatial Data Infrastructure in line with the EU framework for geo-data management, INSPIRE. This framework will facilitate and standardize geo-spatial data management among government institutions in Armenia. Any development of environmental geo-data or environmental information management systems should therefore consider

the technical, institutional, and regulatory requirements of the National Spatial Data Infrastructure in Armenia. NSDI is realized in the frame work of Integrated Cadaster Concept adopted by the Government of the RA.

There are a number of private organizations in Armenia, which carry out their main activities in the field of geoinformation technologies. The most famous and well-established companies are “Geocom”, “Locator”, “Georisk”, “IntelinAir”, “Geovibe”, Geomapis, and “Centre of Geospatial Technologies”.

Kyrgyzstan

The Geoinformation technology are one of the main fields that are rapidly increasing and need to establish close international academic and research cooperation in Kyrgyzstan. Use of Geoinformation technologies in the Central Asian Region is sharply increasing in such fields as land administration and city cadastre, forestry, ecological monitoring, disaster risk reduction, water management etc. According to the international experience the development of GIS projects within state and commercial development programs, especially in developing land administration in the transition period, creates the growing demand for specialists with deep theoretical knowledge as well as practical skills in GI technologies. The complication of commercial and industrial needs in developing advanced “spatial” projects and development of sophisticated software products also arise urgent demand for properly educated GIS specialists.

Geoinformation technologies have been used in Kyrgyzstan from the middle of 1990s. From the beginning the professional GIS education in Kyrgyzstan was mainly on the self education base. Not surprisingly one of the first GIS applications has started at the Kyrgyz Ministry of Emergency and Civil Defense, its first projects were on using GIS for mapping, modeling and monitoring of tailing dumps, landslides and other natural hazards in Kyrgyzstan. Purchase of GIS software (ArcView) and first training of staff members of this Ministry have launched the increasing interest in such education within different government, academic and private institutions. Also, the first internationally certified GIS trainers came from the Ministry of Emergency and Civil Defense. Other first international projects with GIS components, which have been realized in the same period, were the forestry, biodiversity, urban planning and national mapping initiatives. At the beginning stage GI training was completely within such international projects and provided by international training courses and visiting specialists.

The first academic courses on GIS were launched at the Kyrgyz-American Faculty of the Kyrgyz State National University in 1998-1999. In the same period GIS teaching is started at the Bishkek Humanity University and Kyrgyz-Russian Slavic University. “Introduction to GIS”, “Basics of Geoinformatics” and other courses with GIS components were implemented within the international curricula or taught by university teachers, who has participated in the first international GIS projects.

The second step of GIS education can be determined as period 2000-2005, when more and more universities of Kyrgyzstan, including Kyrgyz state university of construction, transport and architecture (KSUCTA), have implemented GIS courses into their curricula with different contents and orientations. Many academic programs in such fields as Ecology, Information Technology, Geography and Geology have included GIS courses. Some of universities have purchased and received granted GIS software and internationally trained teachers. There was emerging demand from industry and state agencies on geospatial modeling and data management in Kyrgyzstan.

The next step of GIS education can be stated from 2005 with start of the academic program “Applied Informatics in Geography” with qualification “Geoinformatic” at KSUCTA. Training of GIS specialists with higher education in Russia and other Former Soviet Union (FSU) countries has been started initially as branches of such Programs as “Applied Informatics in Geography”, “Cartography” or “Information systems and technology” with specialization on Geoinformatics.

Significant impulse to further development of GIS teaching was provided by realization of the Joint European Project “Education in Geodesy and Geoinformatics” financed by TEMPUS-TACIS Program of the European Commission and realized in 2005-2007 by the project consortium – Royal Institute of Technology in Stockholm (KTH), Salzburg University Centre for Geoinformatics (Z_GIS), KSUCTA and Kyrgyz agrarian university (KAU). This project had a big impact on improving teaching and curriculum

development on Geodesy and Geoinformatics at KSUCTA and KAU. New Bachelor (4 years, 240 ECTS credits) and Master (2 years, 120 ECTS credits) Curricula on Geodesy and Geoinformatics are designed and implemented at KSUCTA and KAU. They have included many new GI and RS disciplines, such as GIS, Geographic data models and data structures, Spatial data acquisition and integration, Remote sensing, Spatial analysis, GNSS technology, Web GIS, etc., developed within TEMPUS Project. The Geodesy and Geoinformatics Department is established at the Kyrgyz State University of Construction, Transportation and Architecture (KSUCTA) in 2006 as a result of realization of this project. Its potential has been strengthened with long term support from European partners, its staff members have received professional qualification and postgraduate degrees from internationally recognized universities, such as Royal Institute of Technology in Stockholm, Salzburg University, Asian Institute of Technology in Bangkok, Indian Institute of Remote Sensing, etc.

The second TEMPUS Project “Geoinformatics: Managing Energy, Resources, Environment (GEM)” (510978-TEMPUS-1-2010-1-AT-TEMPUS-JPCR), coordinated by the Paris Lodron Universitat Salzburg, is realized by European and Central Asian universities in 2010-2013 to develop syllabuses referencing blended learning media, to train academic faculty, to establish eLearning/blended learning study labs in order to ensure the long-term sustainability of the postgraduate Geospatial Master programs at KSUCTA and other Central Asian universities.

The present study shows the status and potential of the undergraduate and postgraduate GIT education in Kyrgyzstan. The experiences and preliminary studies on the higher education in Geoinformation Technologies in the region indicate that the Master programs are the most popular and efficient form of professional education supporting and benefiting from the ongoing and emerging scientific and applied research activities in the region.

Nevertheless, this survey and discussions with stakeholders show that there is an urgent need in developing PhD Programs in GIT and other Geosciences with solid content of advanced Geoinformation technologies implemented. The lack of Doctoral level education programs in Geodesy and Geoinformatics have a significant negative impact in the research and industrial applications of Geoinformation technologies in Kyrgyzstan.

1.2 Survey as a part of GeoTAK project context

The main goal of GeoTAK Erasmus+ project (hereinafter will specify as GeoTAK) is to develop postgraduate Higher Education programs in Geo-Information Technologies (GIT) and strengthening the links in research and innovation between Higher Education Institutions (HEI), industry and administration in Armenia and Kyrgyzstan.

In alignment with the goal of GeoTAK project the questionnaire survey has been designed in order to provide detailed information on the Geospatial education and industry in Armenia and Kyrgyzstan, as well as data on the characteristics and needs of the stakeholders in the Geoinformation field. It covers universities, research institutions, state agencies and companies providing information on use of GIT, the educational capacities of universities and professional environment of the industry, employees, Geospatial research and development, product and obstacles collected. The expected results of this online survey are mainly qualitative. Nevertheless, there are some quantitative results as well, which are been interpreted with the analysis exploring ‘what works and what does not’ in the Geospatial research and education. The results of Survey that are presented in this report provide an information that will help to identify the important for Armenia and Kyrgyzstan directions of research and development in the field of GIT based on which an interdisciplinary PhD program in GIT could be created at the partner universities with the active involvement of industry partners.

2 METHODOLOGY

2.1 Description of the methodology

The Survey methodology includes the following steps:

- Questionnaire development
- Stakeholders Sample creation
- Questionnaire addressing and gathering
- Analysis of Survey results
- Conclusion with Report development

Questionnaire development

The Questionnaires for respondents from universities and industry/administration have been developed within the frame of the project (See Annex 1 and Annex 2). The questions of the questionnaires have been formulated in alignment with the main goal of survey which is to identify the fields related to GIT where universities and industrial/administrative organizations can be linked for postgraduate interdisciplinary study program development. In particular, the **Enterprises of GIT and related areas** need to activate collaboration with universities and administration in order to hire professionals capable to face new challenges and business models based in new technologies and to give them credibility to collaborate with the administration. The creation of a NRN-GIT will be crucial for this target group. **The ministries, local governments and agencies** need to rely in well-formed professionals understanding and applying the new GIT tools and methods to solve social, environmental and land management problems, as well as reliable industries to subcontract some tasks dealing with complex data sets with geographic coordinates and references. The **Society at large** is demanding to solve daily problems related to the environment, agriculture production and forestry, infrastructures, cultural and natural tourism, where GIT are basic tools. Young people need to learn new technologies and skills to access to labour market.

The **Universities** need to update equipment for new technologies in Geoinformation, such as specialised GIS and remote sensing software, photogrammetry and GPS. They also need to train young teachers/researchers in GIT for application in solving most relevant environmental and natural resources problems, and to establish sustainable links with the companies. Fostering this collaboration will provide the baseline for industry and economic development in the country.

Respondents Sample creation (Armenia)

Forty-two industrial/administrative organizations participated in the Survey, out of which 27 are state organization, 14 are private, and 1 is NGO. To get the information about the status and numbers of employers the questionnaire includes questions formulated as: “Q.I.3.What is the ownership status of your organisation/company?” and “Q.I.4.What is the total number of employees?”. The results are given in Table 2.1.1.

Table 2.1.1 Ownership and sizes of industrial/administrative responded organizations

Ownership	Name of industrial and administrative organizations/companies	No. of employers	Number of respondents
State	Department of Geographical Data Management of Center for Geostatistics of Cadastre Committee of the RoA	1-15	2

	Cadastre Committee of the RoA, Department of Geodesy and Land Management	more than 100	1
	Cadastre Committee of the RoA	more than 100	5
	Cadastre Committee, Cadastral Assessment and Market Analysis Department	more than 100	1
	«Republican Geological Fund» (State non-profit organization); Acting under the Ministry of Territorial Administration and Infrastructure of the RA,	1-15	1
	Institute of Geological Sciences, The National Academy of Sciences of the RA	15-100	1
	Scientific Center of Soil Science, Agrochemistry and Reclamation named after H. Petrosyan	15-100	1
	Hydro-aeronautics and monitoring center (State non-profit organization)	more than 100	1
	“Hydrometeorology and Monitoring Center” State Non-Commercial Organization”, The Ministry of Environment of the RA	more than 100	1
	Forest monitoring service	1-15	2
	RA Ministry of Economy	more than 100	4
	RA Ministry of Emergency Situations (RA MES), State Academy of Crisis Management	more than 100	1
	RA MES "Territorial Seismic Protection Service" (State non-profit organization)	more than 100	1
	Forest Committee "Hayantar" of the Ministry of Environment (ME) (State non-profit organization)	more than 100	1
	RA Ministry of Environment	more than 100	3
	"Hydro-aeronautical Monitoring Center" of RA Ministry of Environment (State non-profit organization)	more than 100	1
Private	“Locator” CJSC	more than 100	1
	“Module”	15-100	2
	Development Ways ltd	1-15	1
	Center for Geospatial Technologies	1-15	1
	“GEORISK” research company	1-15	1
	"Geocom" LLC	1-15	1
	“Deltashin” LLC	1-15	1
	“Geovibe” LLC	1-15	1
	“Geomapis”	1-15	2
	Magistral Projects ltd.	1-15	1
	“Geovibe” LLC	1-15	1
NGO	Environmental Research and GIS Center NGO	1-15	1
	Total:		42

The names of eight universities (total number of respondents made 18) that participated in Survey are listed below:

Table 2.1.2. The Universities engaged in the Survey

##	Name of University	Number of respondents
1.	National University of Architecture and Construction of Armenia (NUACA)	3
2.	Yerevan State University (YSU)	5
3.	National Agrarian University of Armenia (NAUA)	4
4.	American University of Armenia (AUA)	1
5.	Vanadzor Branch of NAUA	1
6.	Sisian Branch of NAUA	1
7.	State Pedagogical University named after Khachatur Abovyan	2
8.	National Polytechnic University of Armenia (NPUA)	1
	TOTAL:	18

Respondents Sample creation (Kirgizstan)

52 industrial/administrative organizations are contacted with questionnaires within the GeoTAK survey activities. Total 47 persons from 34 industrial/administrative organizations (IAO) have responded and completed questionnaires, out of which 20 are state organizations, 11 are private, 1 NGO and 2 are other (JSC and Association). To get the information about the status and numbers of employers the questionnaire includes questions formulated as: “Q.I.3.What is the ownership status of your organisation/company?” and “Q.I.4.What is the total number of employees?”. The results are given in Table 2.3, 2.4 and 2.5.

Table 2.1.3. Ownership and sizes of industrial/administrative organizations responded

Ownership	No. of industries and administration	No. of employers
State		1-15
	14	16-100
	6	more than 100
Private	4	1-15
	1	16-100
	6	more than 100
NGO	1	1-15
		16-100
		more than 100
Other		1-15
		16-100
	2	more than 100

Table 2.1.4. Industrial and administrative organizations participated in the survey

Name of Industrial and administrative organizations	No. of respondents	No. of employees
1. Emergency monitoring and forecasting department, Ministry of Emergency Situations of the Kyrgyz Republic	3	16-100
2. State Agency on Land Resources under the Government of the Kyrgyz Republic	1	>100
3. National Statistical Committee of the Kyrgyz Republic	3	>100
4. Geoinformation Systems and Information Technology Department, State Institution "Cadastre" under the State Agency for Land Resources under the Government of the Kyrgyz Republic	2	16-100
5. State Cartographic and Geodesic Service under the State Agency for Land Resources under the Government of the Kyrgyz Republic	3	>100
6. Department of Geoinformation Systems, State Enterprise “Kyrgyzgiprozem” (Land management institute) under the State Agency for Land Resources under the Government of the Kyrgyz Republic	1	16-100
7. Osh Branch, State Enterprise “Kyrgyzgiprozem” (Land management institute) under the State Agency for Land Resources under the Government of the Kyrgyz Republic	1	16-100
8. Forest Enterprise Department of the State Enterprise "Kyrgyz Forestry and Hunting", State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic	1	16-100
9. Jalal-Abad Territorial Department of the Environment Protection, State Agency for Environment Protection and Forestry of KR	1	16-100
10. Urban Cadastre and Geoinformation Department, State Enterprise "Bishkekglavarhitektura"	1	>100
11. Central Asian Institute of Applied Geosciences (CAIAG)	2	16-100
12. Engineering Survey Department, Design and Survey Institute "Kyrgyzdortransproekt"	3	16-100
13. Design and Survey Institute "Kyrgyzdortransproekt"	1	16-100
14. Osh basin water management department, Ministry of Agriculture, Forestry and Water Resources of the Kyrgyz Republic	1	16-100
15. Karasuu district water management department, Ministry of Agriculture, Forestry and Water Resources of the Kyrgyz Republic	1	>100
16. State Enterprise “Kyrgyz Methodological Expedition of Geological and Economic Research”	1	16-100
17. State Enterprise “Osh Water supply and sewage”	1	>100
18. State Enterprise “Kyrgyz Geology”	1	16-100
19. State Enterprise “North Kyrgyz geological expedition”	1	16-100
20. State Enterprise “Kyrgyz Leading Engineering Researches Institute” (KyrgyzGIIZ)	1	16-100
21. Sibelius project MercyCo	1	1-15
22. “Komurchu” Assosication of coal miners	1	>100
23. ARIS - Community Development and Investment Agency	1	>100
24. Kumtor Gold Company	1	>100

25. Kyrgyzaltyn OJSC	1	>100
26. Altyn Alyans LLC	1	>100
27. Invest Mining LLC	1	1-15
28. KAZ Minerals Bozymchak LLC	4	>100
29. BIO LLC	1	1-15
30. Kara-Altyn LLC	1	16-100
31. Dzhamgyr LLC	1	>100
32. Full Gold Mining LLC	1	>100
33. Geo Centre LLC	1	1-15
34. GIS Pro LLC	1	1-15
Total number of IAO respondents:	47	

Universities responded. The names of 10 universities (total number of respondents - 26) that participated in the survey are listed below:

Table 2.1.5. Universities responded

##	Name of University	Number of respondents
1.	Kyrgyz State University of Construction, Transport and Architecture (KSUCTA)	4
2.	Kyrgyz State University of Geology, Mining and Natural Resources Development (KSMU)	6
3.	Osh State Technological University (OSTU)	5
4.	Kyrgyz National Agrarian University (KNAU)	1
5.	American University in Central Asia (AUCA)	2
6.	University of Central Asia (UCA)	1
7.	Kyrgyz State University named after I. Arabaev	2
8.	Osh State University (OSU)	3
9.	Osh State Pedagogical University (OSPU)	1
10.	Jalal-Abad State University (JASU)	1
	Total number of respondents from universities:	26

Questionnaires addressing and gathering

The Survey in Armenia has been implemented online. The questionnaires have been sent to appropriate organizations and universities where they have been distributed by e-mail addresses of appropriate employers.

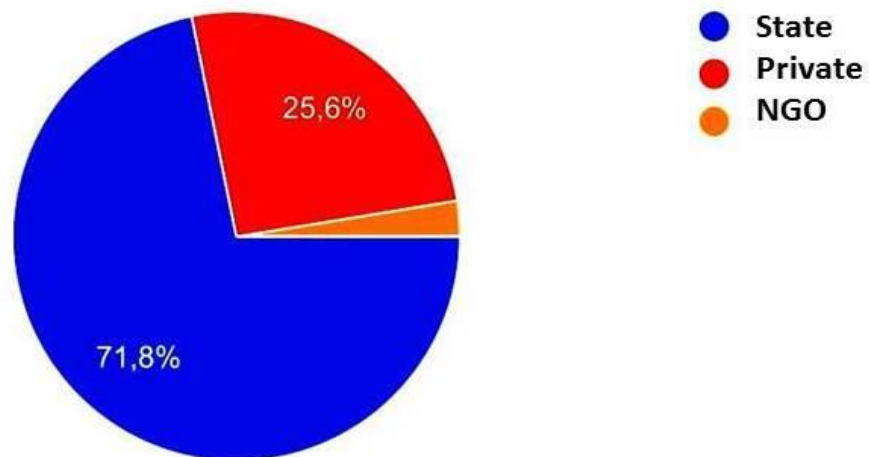
The Survey in Kirgizstan has been implemented in hybrid format: online and offline. The questionnaires have been sent to selected 54 industrial/administrative organizations and 12 universities where they have been distributed by e-mail addresses of appropriate employers, physically delivered and collected by GeoTAK team members.

3 SURVEY RESULTS (ARMENIA AND KIRGIZSTAN)

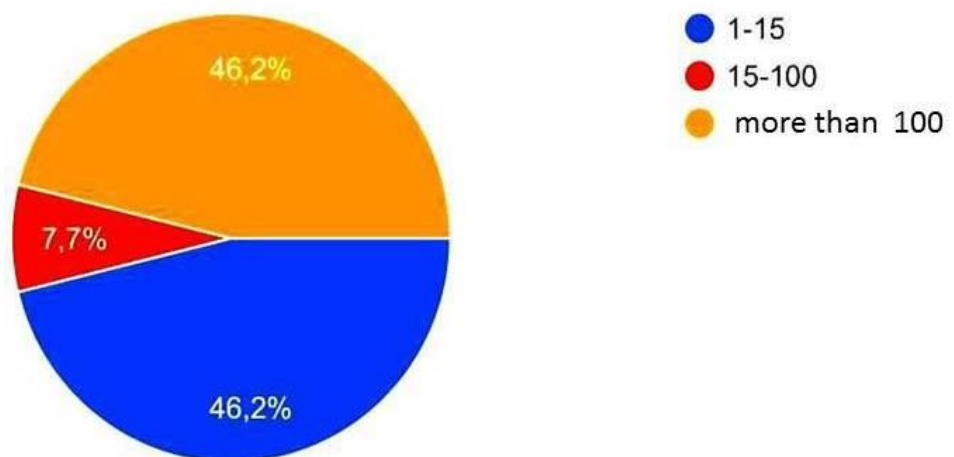
ARMENIA

3.1 Statistics of results: Industrial/Administrative organizations/companies (Armenia)

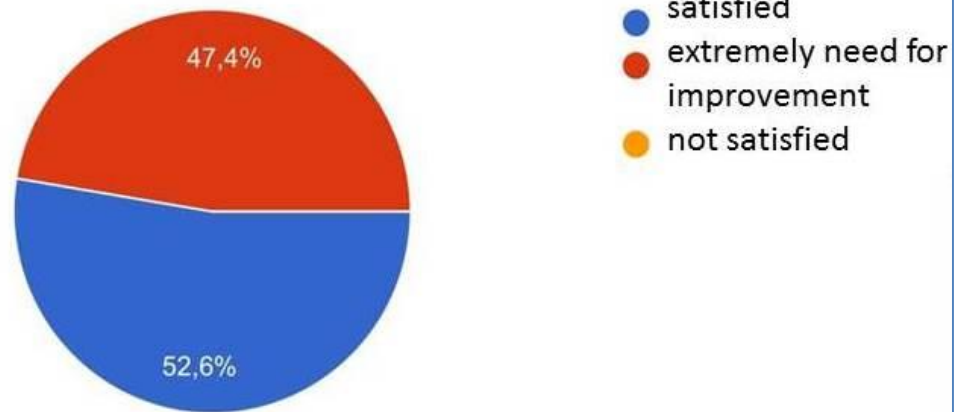
Q.I.3 What is the ownership status of your organisation/company?



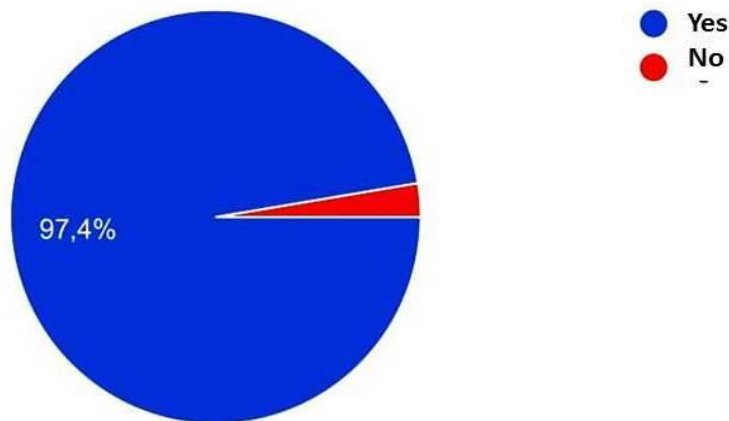
Q.I.4 What is the total number of employees?



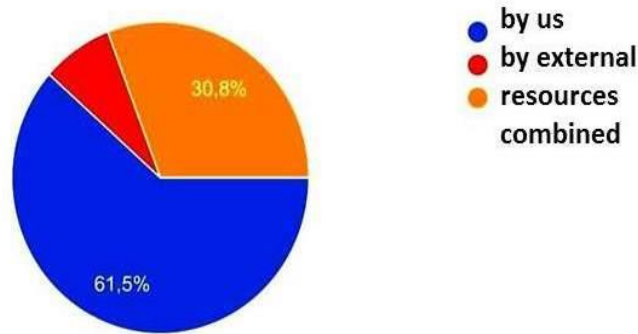
Q.I.5 Is the organisation/company satisfied with its human resources in the field of GIT?



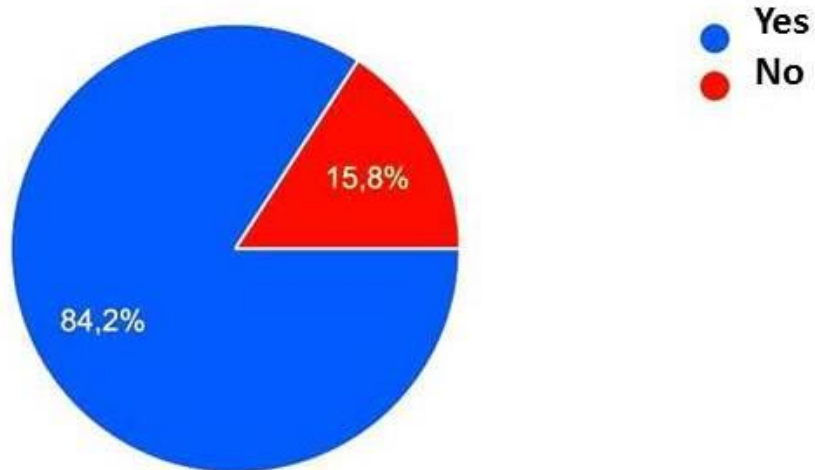
Q.I.6 Do you use internal or/and external geo data bases, spatial analysis, surveys or models during the decision-making procedure?



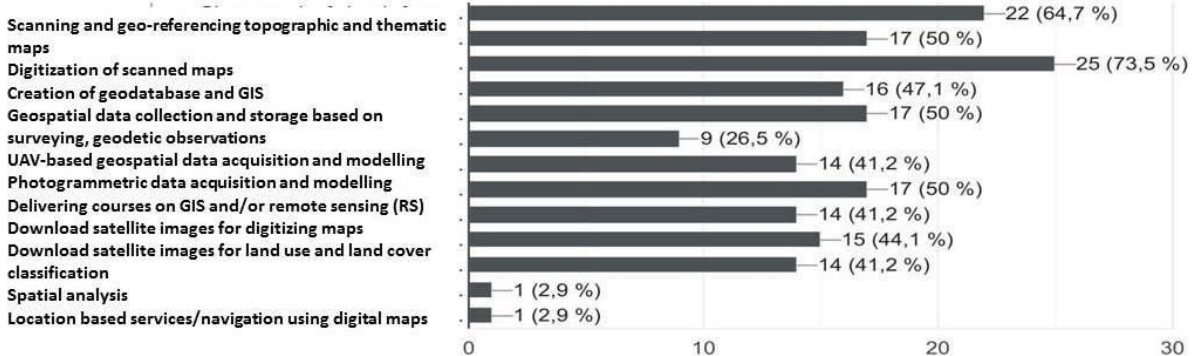
Q.I.7 Is the geo data processing and analysis accomplished by your own organisation/company or external organisation is involved?



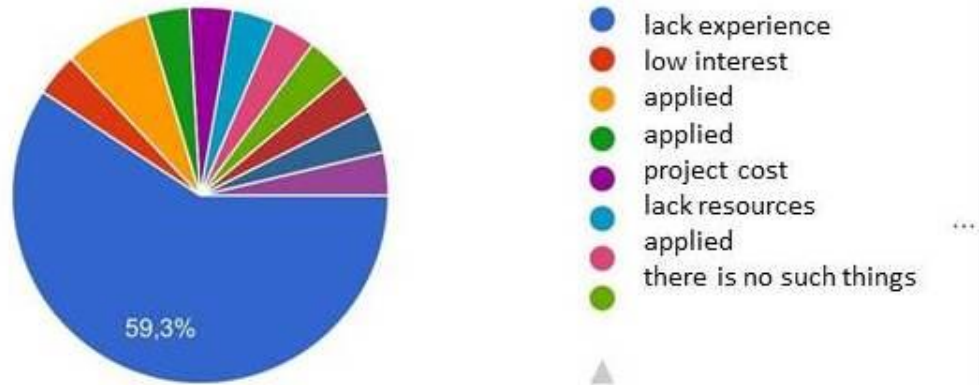
Q.I.8 Do you currently use GIT in your organisation?



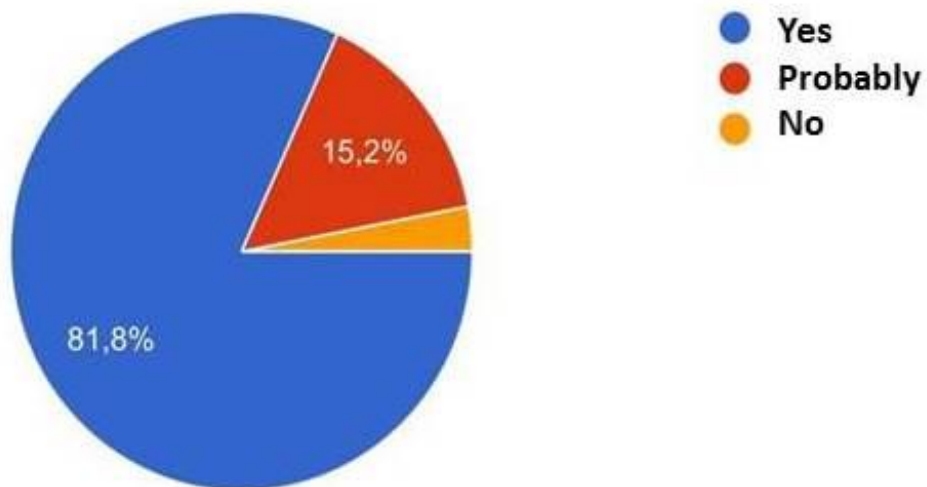
Q.I.9 For what purpose do you use GIT?



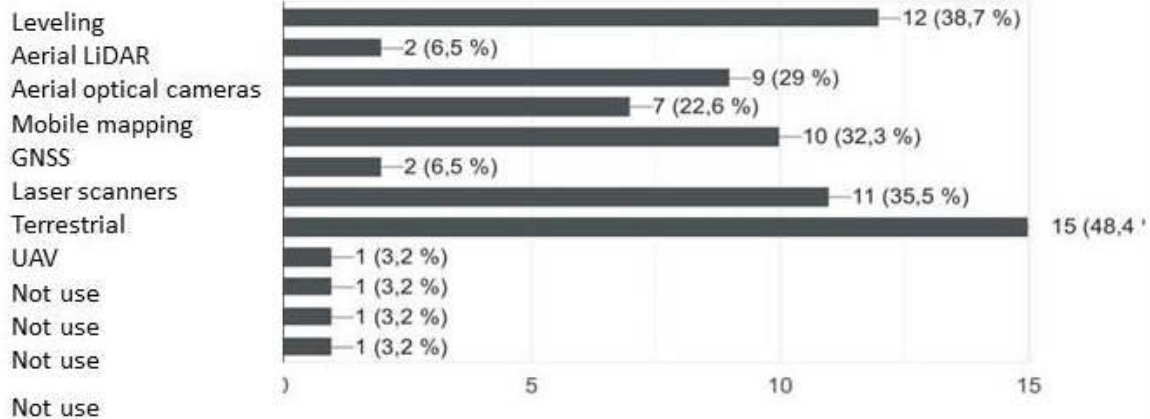
Q.I.10 What is the reason that GIT has not been used in your company?



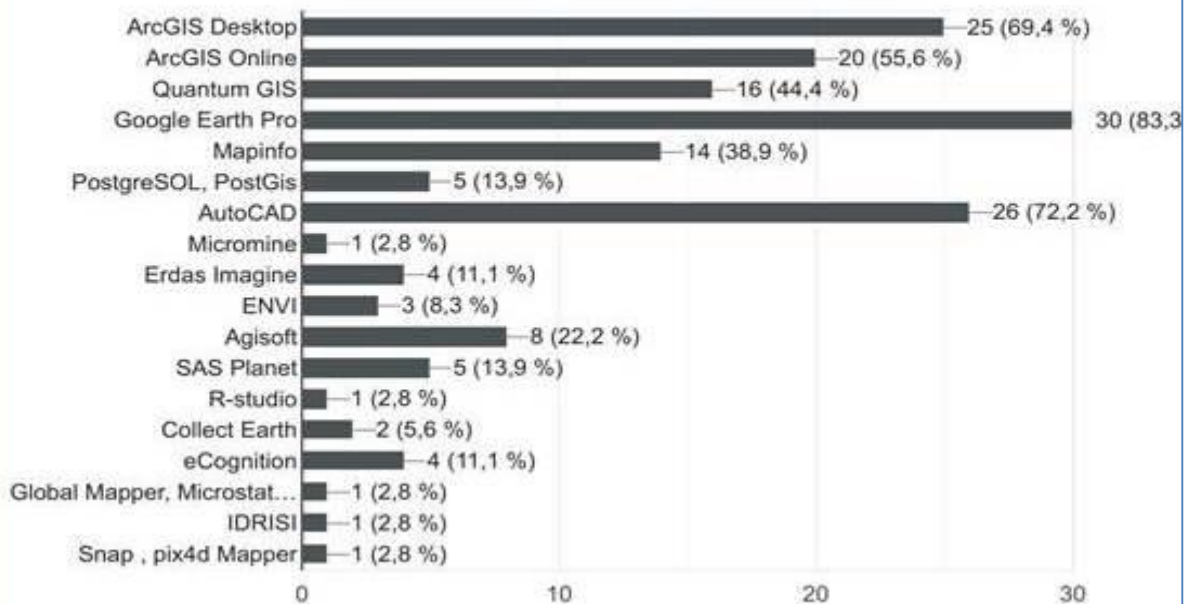
Q.I.11 Would you like to apply GIT / GIS software in the future?



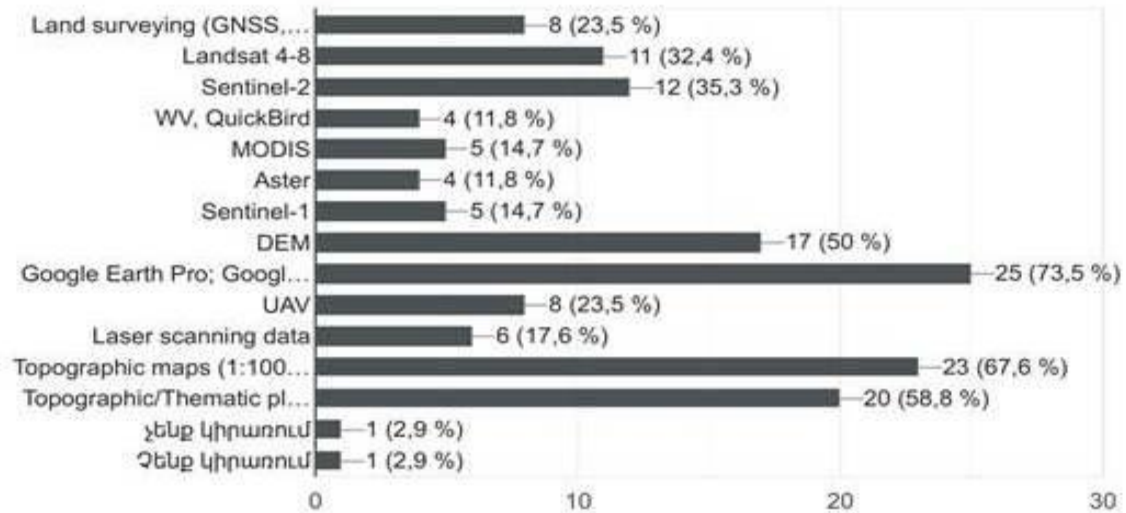
Q.I.12 What type of surveying /remote sensing / photogrammetric equipment do you use?



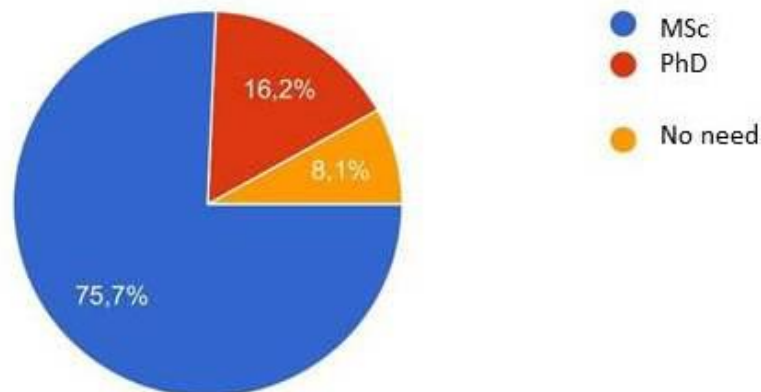
Q.I.13 What type of surveying /GIS / photogrammetric software do you use?



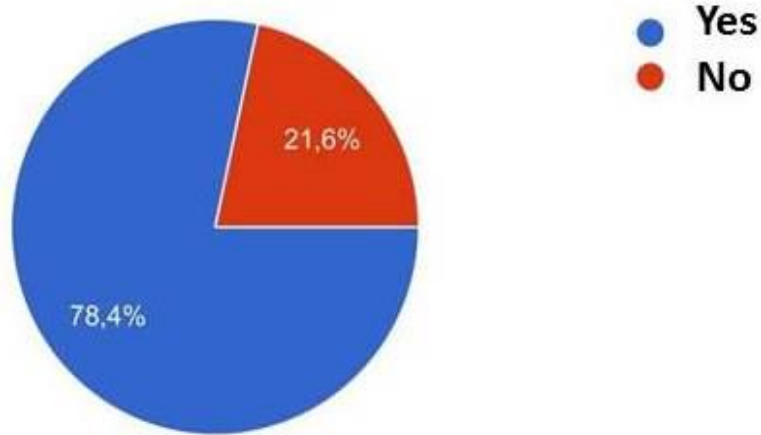
Q.I.14 What type of surveying /remote sensing / photogrammetric data sets do you use?



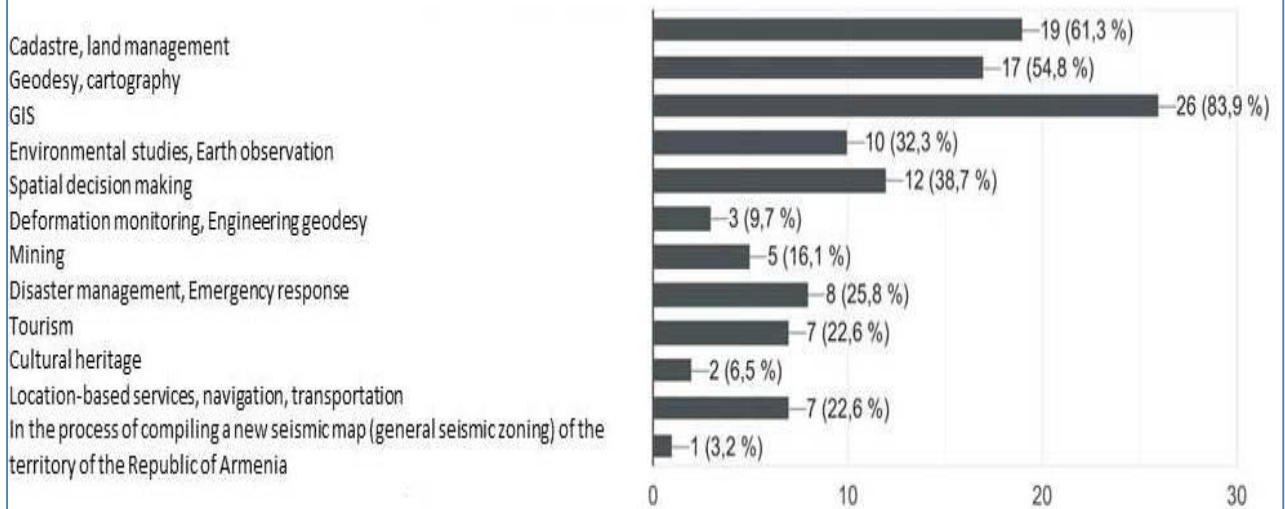
Q.I.15 What postgraduate level staff members with GIT competencies does your organisation need?



Q.I.16 Did your company had GIT related project in the last 5 years?



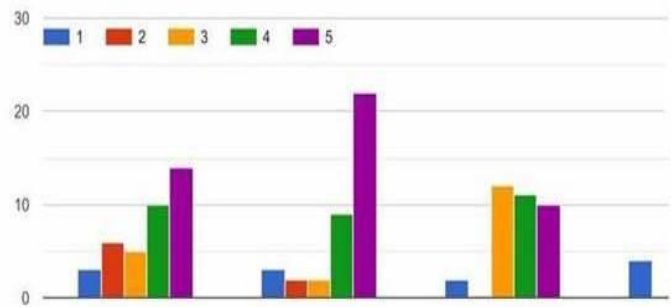
Q.I.16.1 If yes, in which application areas?



Q.I.17 Which GIT related knowledge areas / skills do you find important from the below proposed?

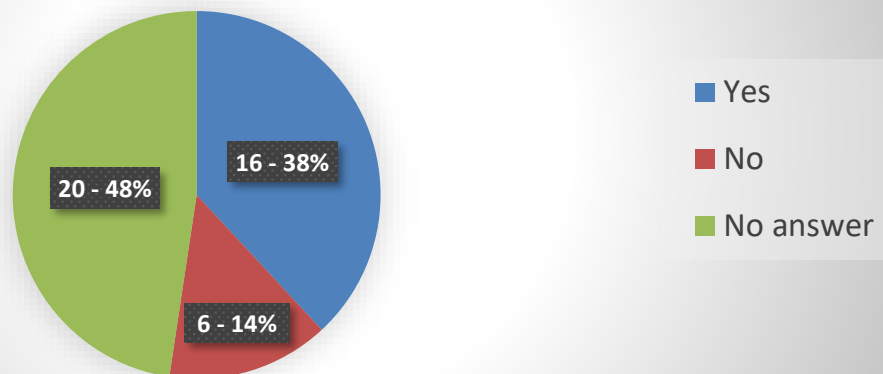
No	knowledge areas / skills
1	Programming skills
2	Data acquisition and data integration skills
3	Cadastral and land information knowledge
4	Spatial data infrastructure knowledge
5	Spatial database management skills
6	GIS knowledge and skills
7	Spatial analysis knowledge
8	UAV piloting, data acquisition and processing
9	Geodetic measurements and survey using total stations
10	Advanced GNSS positioning
11	Knowledge on the geodetic reference systems
12	Remote sensing knowledge
13	Photogrammetric knowledge
14	Skills in remote sensing/photogrammetric software
15	Management skills

Q.I.17 Which GIT related knowledge areas / skills do you find important from the below proposed?



Q.I.18 Do you have relevant ongoing GIT projects / partnerships / activities at your organisation/company?

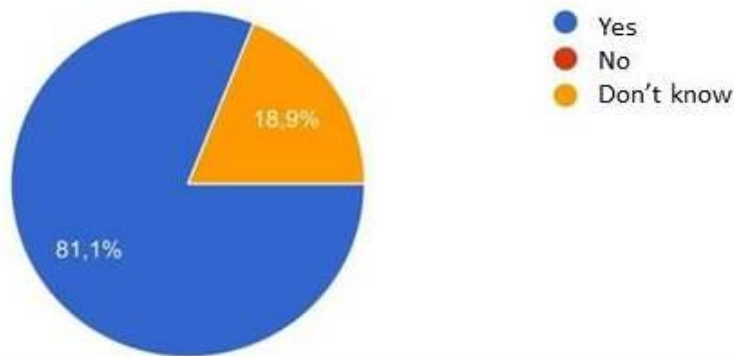
Do you have relevant ongoing GIT projects / partnerships / activities at your organisation/company?



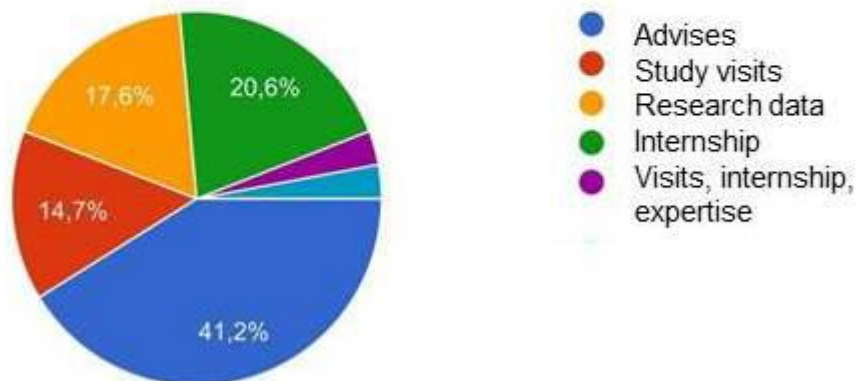
Some comments:

- a. Update and replenish existing databases
- b. Compilation of thematic maps
- c. Creating two-dimensional and three-dimensional representations
- d. GIS training courses
- e. Seismic risk management
- f. Sevan Lake basin management plan
- g. Gagarin city plan development

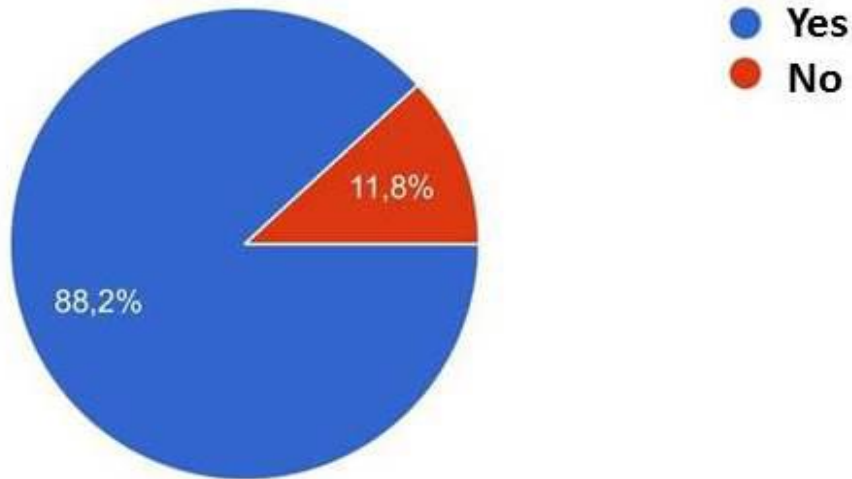
Q.I.19 Would you be interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies?



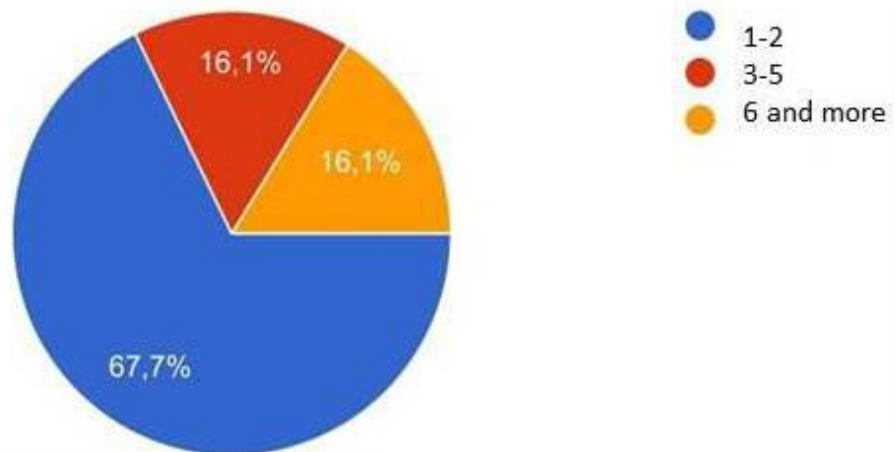
Q.I.20 In what way can your organisation/company contribute into this GeoTAK project?



Q.I.21 Would you employ a Geoinformatics MSc/PhD graduate in your company?



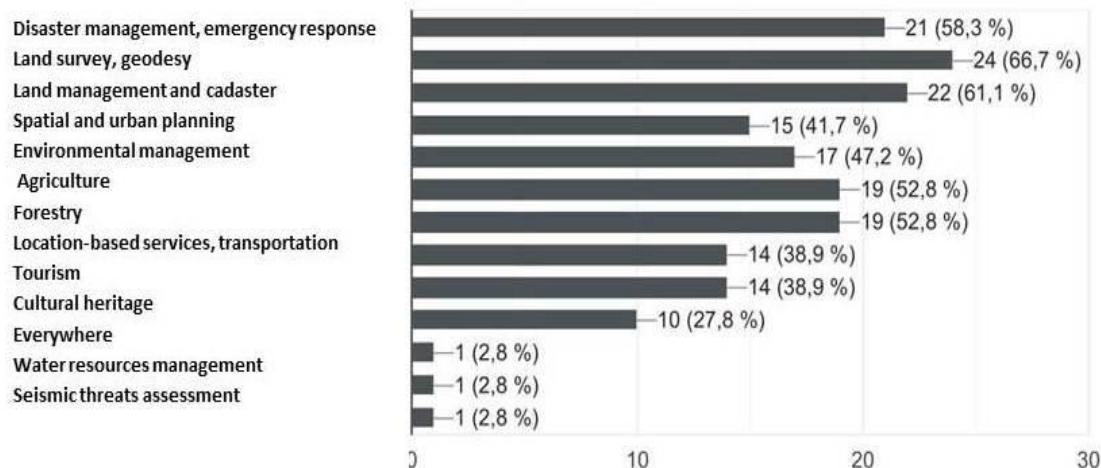
Q.I.21.1 If yes, how many?



Q.I.22 Please, identify the main barriers in the use of geospatial information?



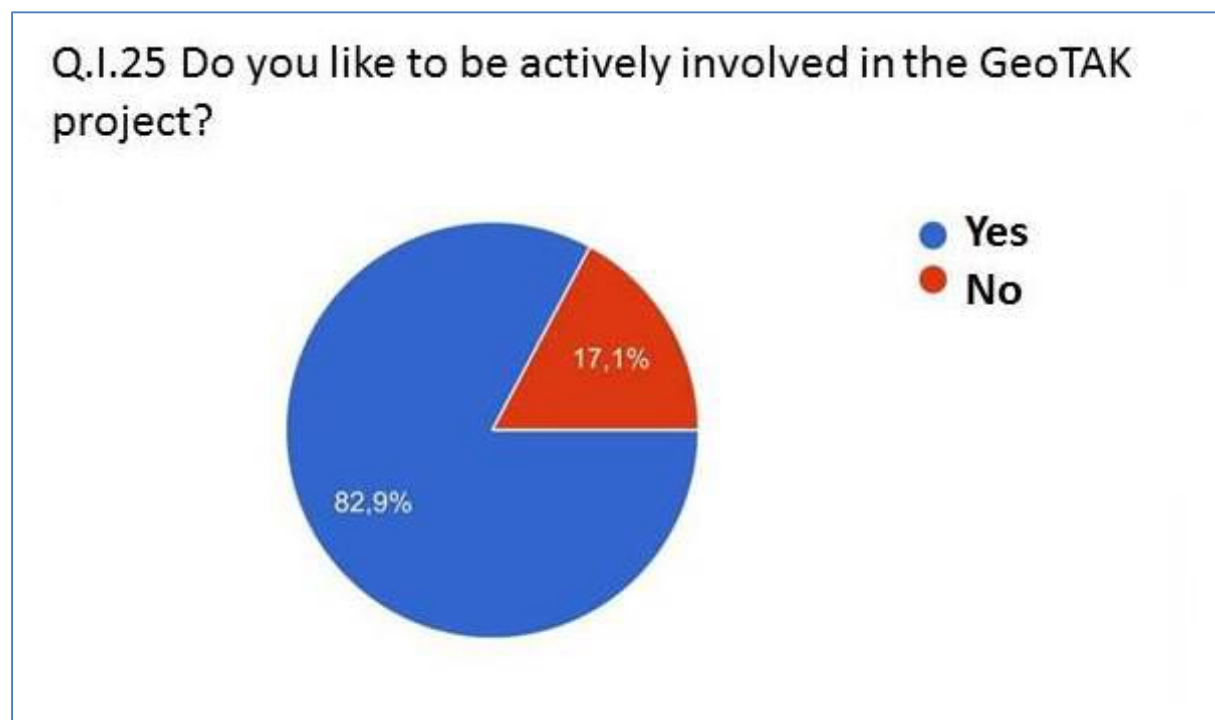
Q.I.23 Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions:



Q.I.24 Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future

##	GIT areas	Number of mentions
1.	Regulation of defense, emergency situations, traffic	5
2.	Land resources management	4
3.	Cadastre	1

4.	Agriculture	9
5.	Real estate management	1
6.	Cultural heritage	1
7.	Emergency Situations, Disaster Management	6
8.	Public administration and local government	2
9.	Forestry	2
10.	Tourism	2
11.	Urban Development	2
12.	Water resources management	2
13.	Climate change assessment and forecast	2
14.	In the relevant departments of the Ministry of Environment	1
15.	Biodiversity	1



3.2 Statistics of results: Universities (Armenia)

The questionnaire for universities has included questions about the existing academic programs in Geospatial and Earth sciences formulated as: “Q.U.3. Main academic and research activities at your university/institute by writing the names of BSc/MSc/PhD programmes on GIT related sciences”, “Q.U.4. Name 3 most important research areas at your institution with GIT used” and “Q.U.5. What kind of relevant ongoing GIT projects/partnerships/activities do you have at your university/institute?”. The results are given in Table 3.2.1, 3.2.2 and 3.2.3 below.

Table 3.2.1 Main study programs on GIT related sciences

No.	Level of the academic program	Name of the academic program
1	Bachelor	Geology, Geography, Cartography Architecture and Construction Geodesy, Cadastre, GIS Land construction, land Cadastre Land improvement, use of land and water resources, hydraulic structures Nature use and ecology Mining and Mineral extraction
2	Master	Architecture and Construction Geodesy, Cadastre, GIS, GIS Management of Cultural Projects Mineral exploration, Cartography and Cadastral work, Social and Physical geography Rural land mapping, Water resources mapping, Water and soil-land Cadastre and monitoring Sustainable Agriculture Mining and Mineral extraction
3	Aspirantura (Candidate of Sciences)	Architecture and Construction Geodesy, Cadastre, Cartography, GIS General Geology, Geography Land construction, Land Cadastre Land improvement, use of land and water resources, hydraulic structures Development and exploitation of mineral deposits General geology, Geography

Table 3.2.2. The most important GIT related research areas

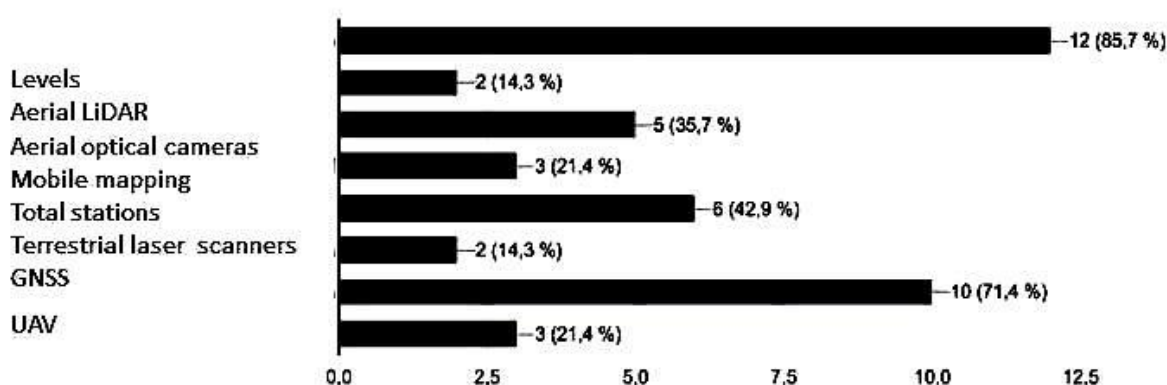
No.	Research areas	Responses	Percentage
1.	Geography	5	25.0
2.	Geology and mining	4	20.0
3.	Land management and cadaster	2	10.0
4.	Architecture and Construction	2	10.0
5.	Geodesy, Surveying	1	5.0
6.	Land construction	1	5.0
7.	Land improvement	1	5.0
8.	Land and water resources use	1	5.0
9.	Hydraulic structures	1	5.0
10.	General agriculture, soil science, hydromelioration u agrochemistry	1	5.0

11.	Development and exploitation of mineral deposits	1	5.0
Total		19	100

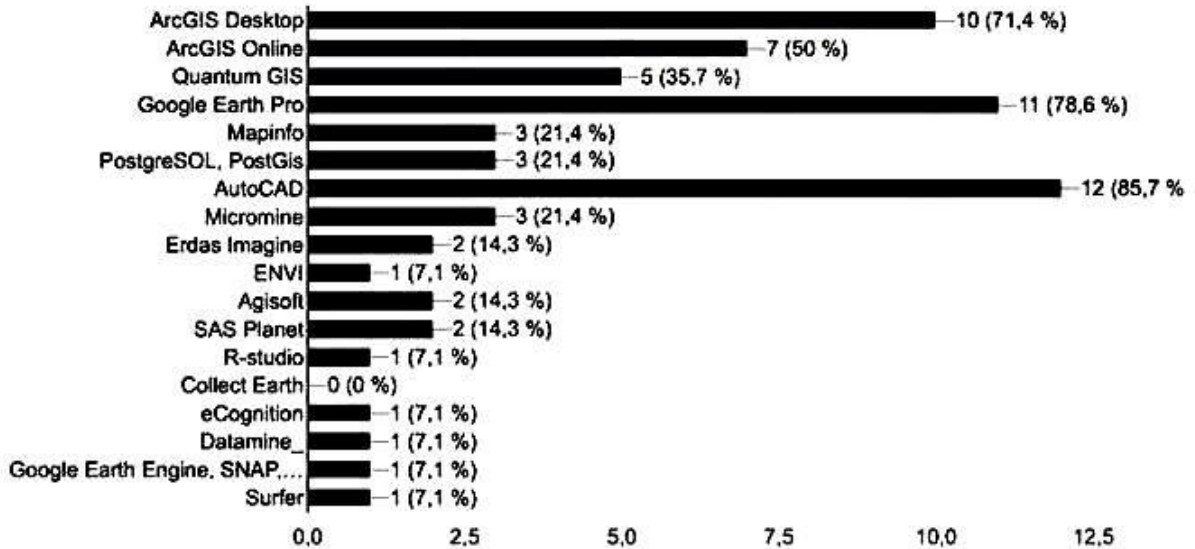
Table 3.2.3. Ongoing GIT projects / partnerships / activities at the respondent university/institute

No.	Name of the project / partnership / activity	Percentage
1	Cooperation with the "Datamine" company within the framework of education and training at the university of geo-information technology software packages in the field of mining.	34
2	“Copernicus” assisted environmental monitoring across the Black Sea Basin – PONTOS	11
3	Identification of migration problems in the mountainous settlements of the Republic of Armenia	11
4	NUACA and Cadastre Committee bilateral cooperation	11
5	German-Armenian Network on the Advancement of Public Participation GIS for Ecosystem Services as Means for Biodiversity Conservation and Sustainable Development (GAtES)	11
6	Subconscious field and situational research methodology studies	11
7	With the RA Ministry of Culture	11
Total		100

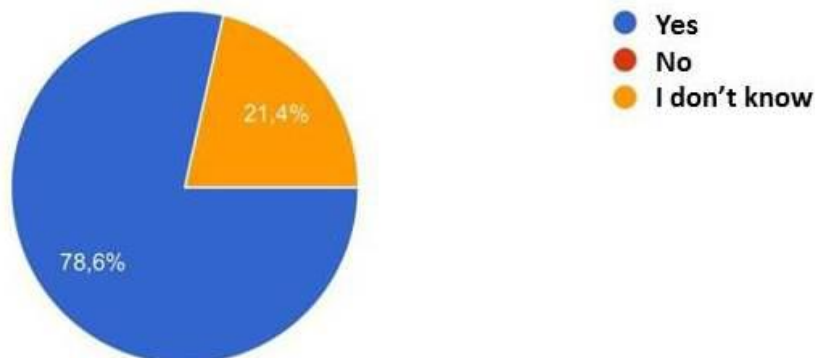
Q.U.6 What type of surveying /remote sensing / photogrammetric equipment do you use?



Q.U.7 What type of surveying /GIS / photogrammetric software do you use?

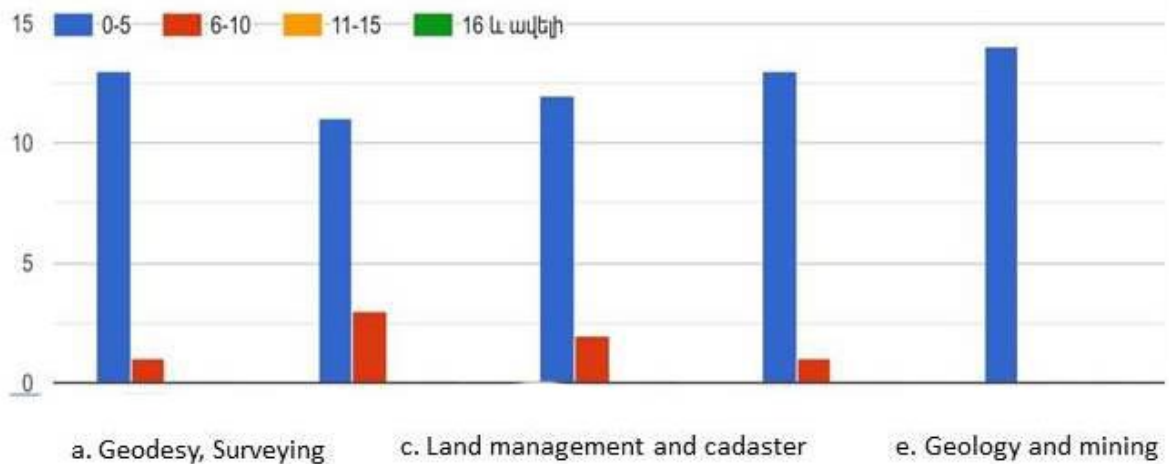


Q.U.8 Is your university/institute interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies??

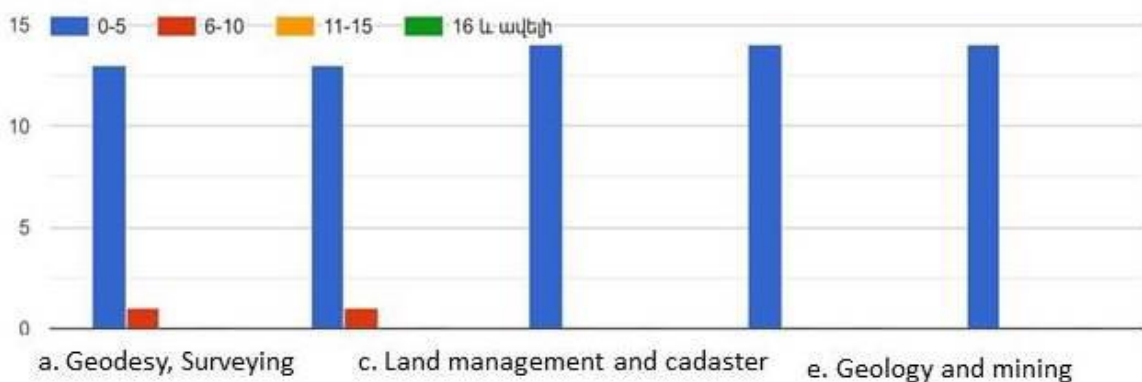


Q.U.9 Number and qualification of the academic and research staff of your institution interested in GIT

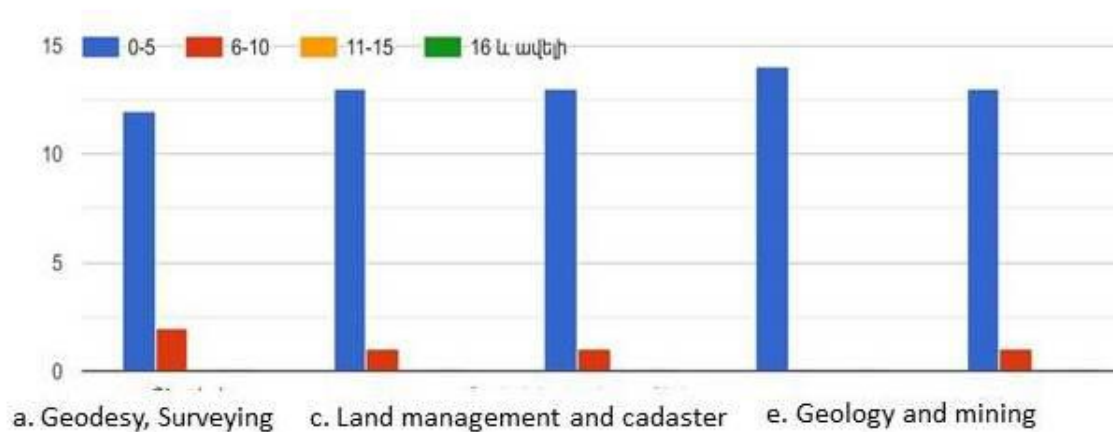
Q.U.9.1 The number of MSc staff interested in GIT



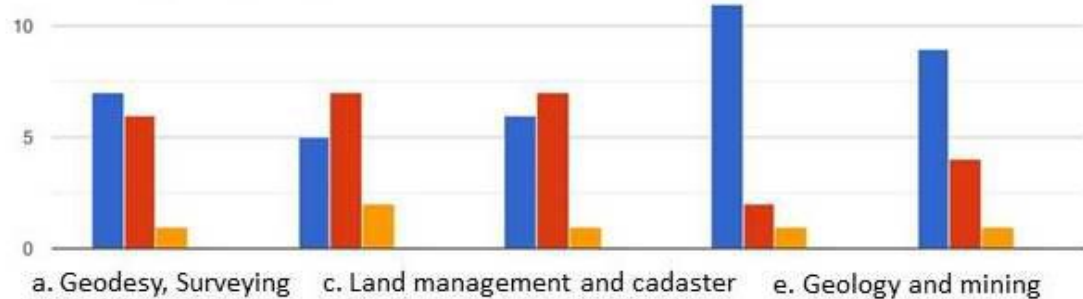
Q. U.9.2 The number of PhD (aspirantura) staff interested in GIT



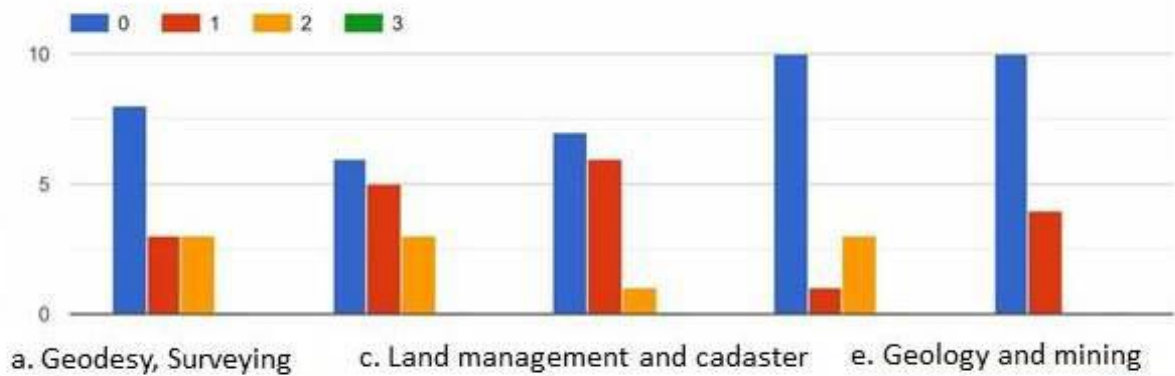
Q. U.9.3 The number Doctor of Sc. staff interested in GIT



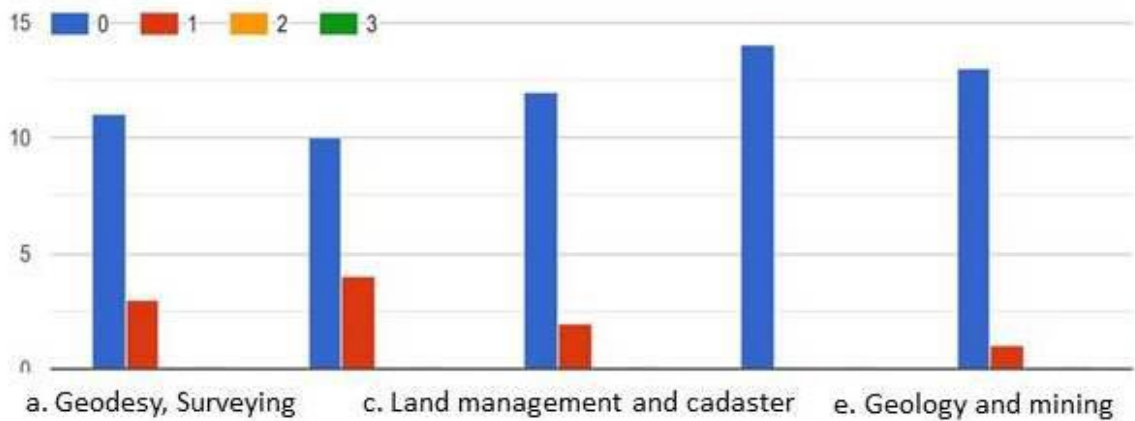
Q.U.10 Number of related study programs in your institution Q.U.10.1 Number of BSc study programs



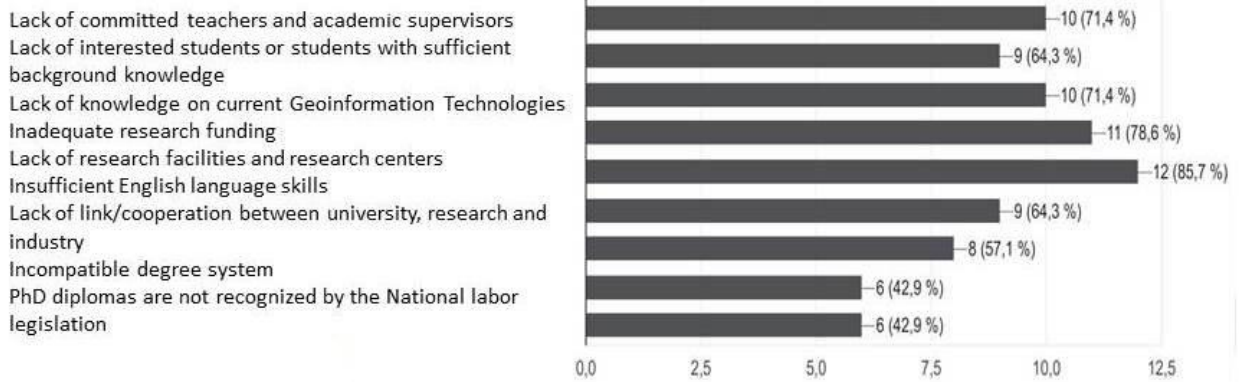
Q.U.10.2 Number of MSc study programs



Q.U.10.3 Number of PhD study programs

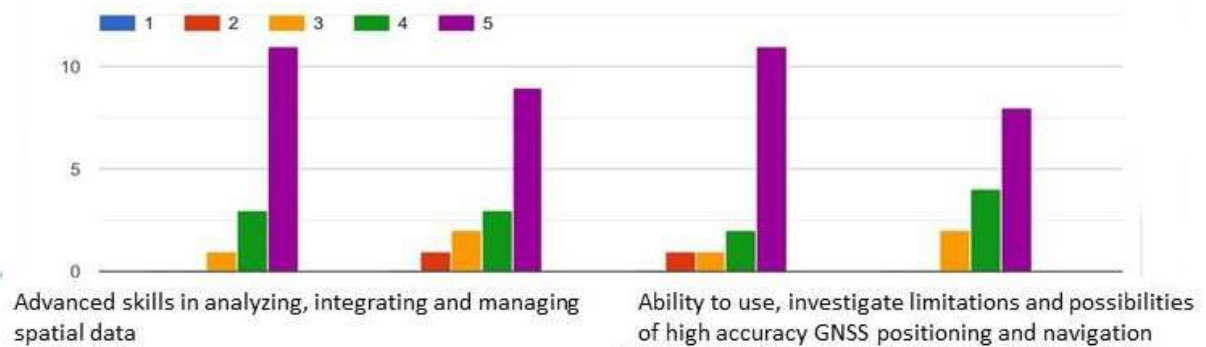


Q.U.11 What are the main difficulties/hinders for GIT Master/Doctoral (PhD) studies in the country?

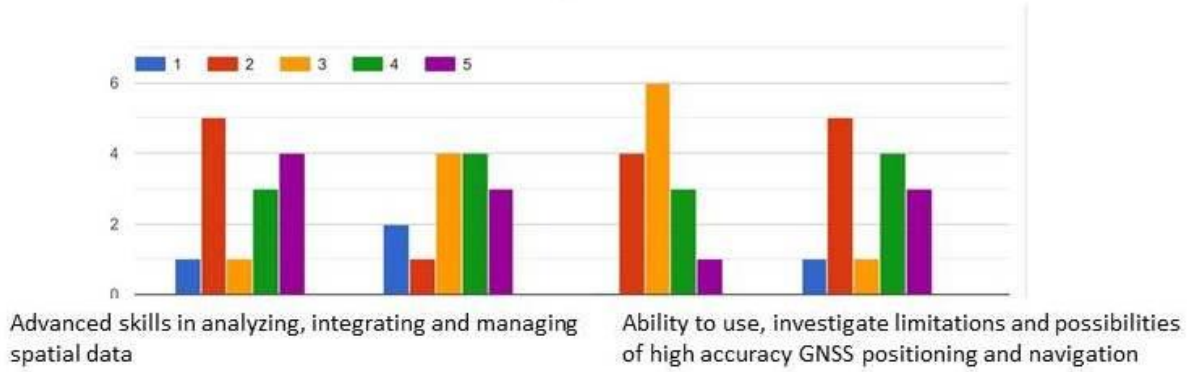


Q.U.12 Competences: Evaluate the importance of the following competences and skills, and the competence level presently at your institution (grading from 1 to 5, where 5 corresponds to most important or very high level)

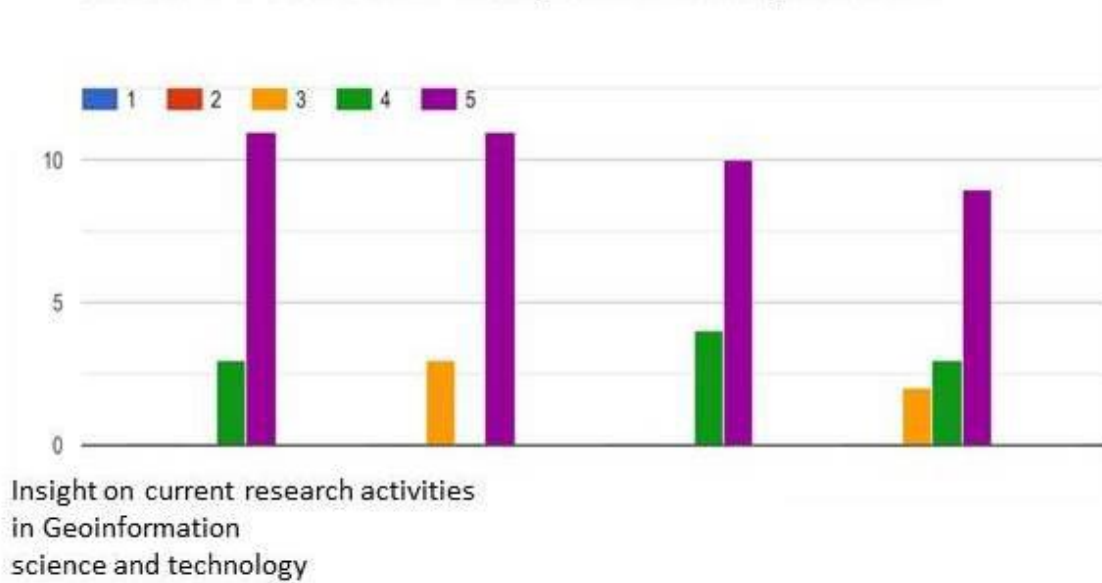
Q.U.12. 1 Professional competences importance

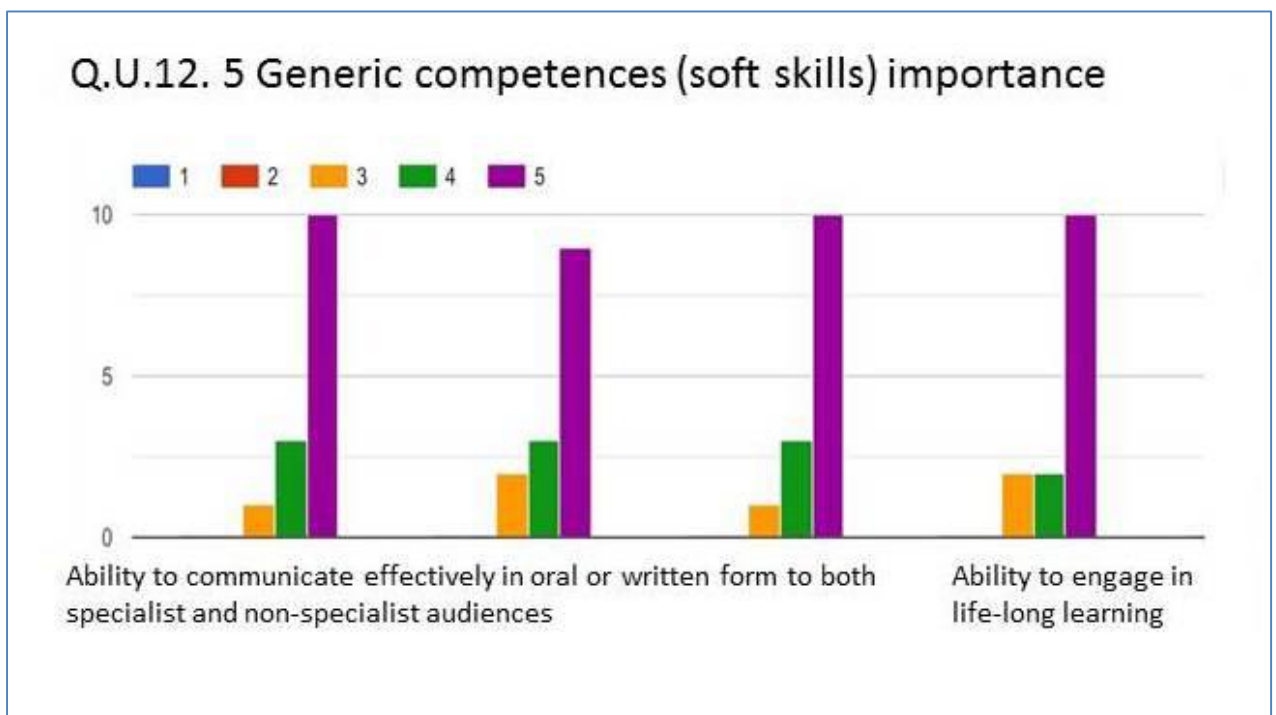
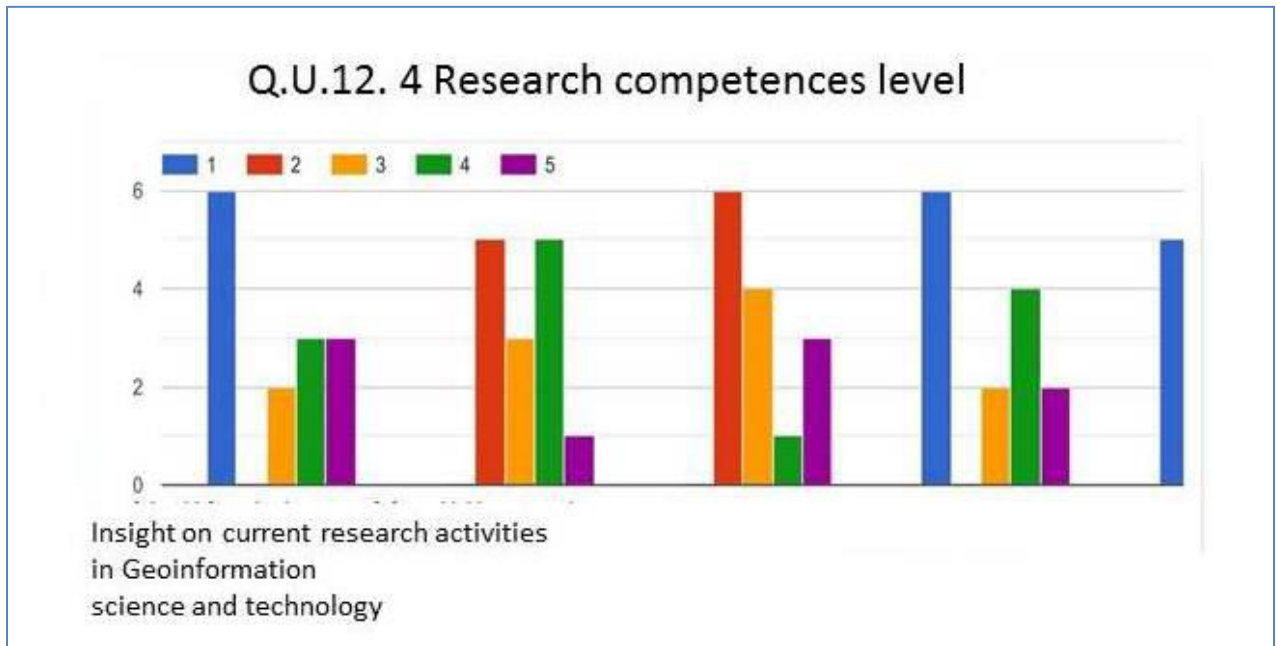


Q.U.12. 2 Professional competences level

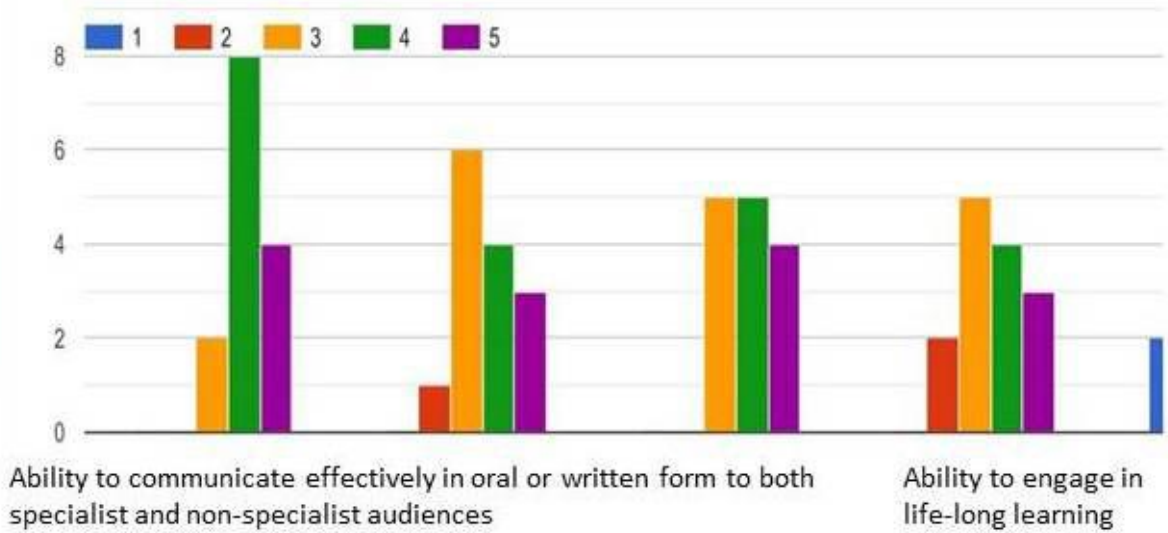


Q.U.12. 3 Research competences importance

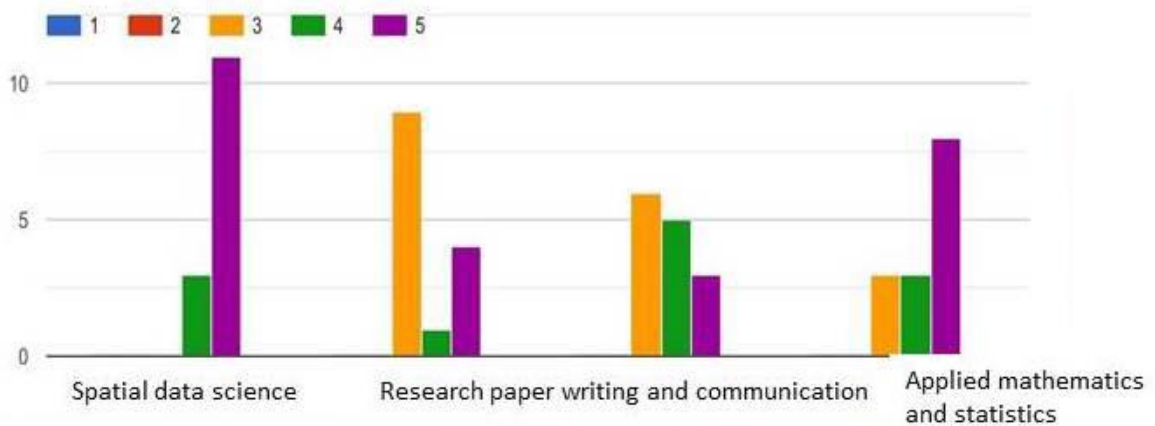




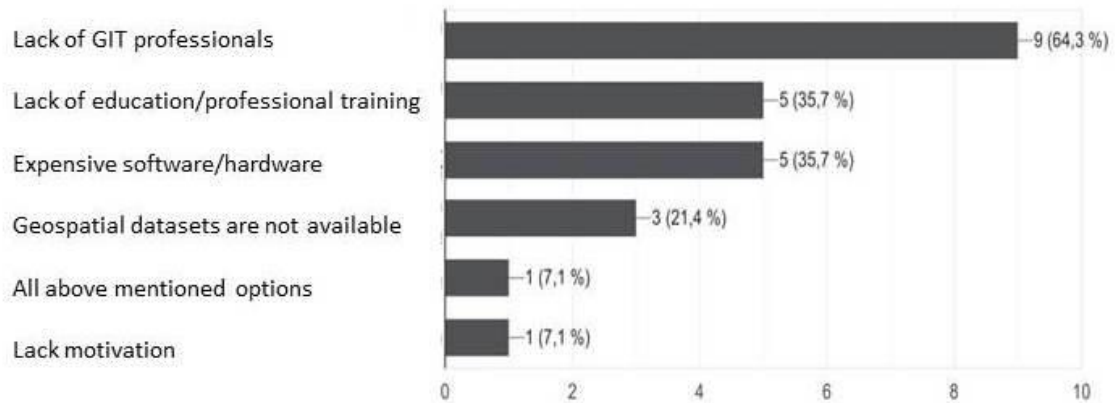
Q.U.12. 6 Generic competences (soft skills) level



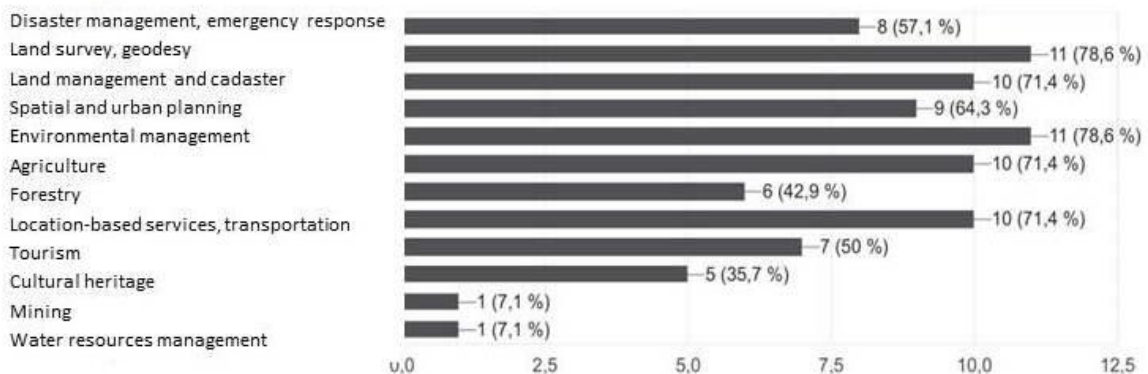
Q.U.13 How important are the following courses which could support potential MSc/PhD students? (grading from 1 to 5, where 5 corresponds to most important)



Q.U.14 Please, identify the main barriers in the use of geospatial information?



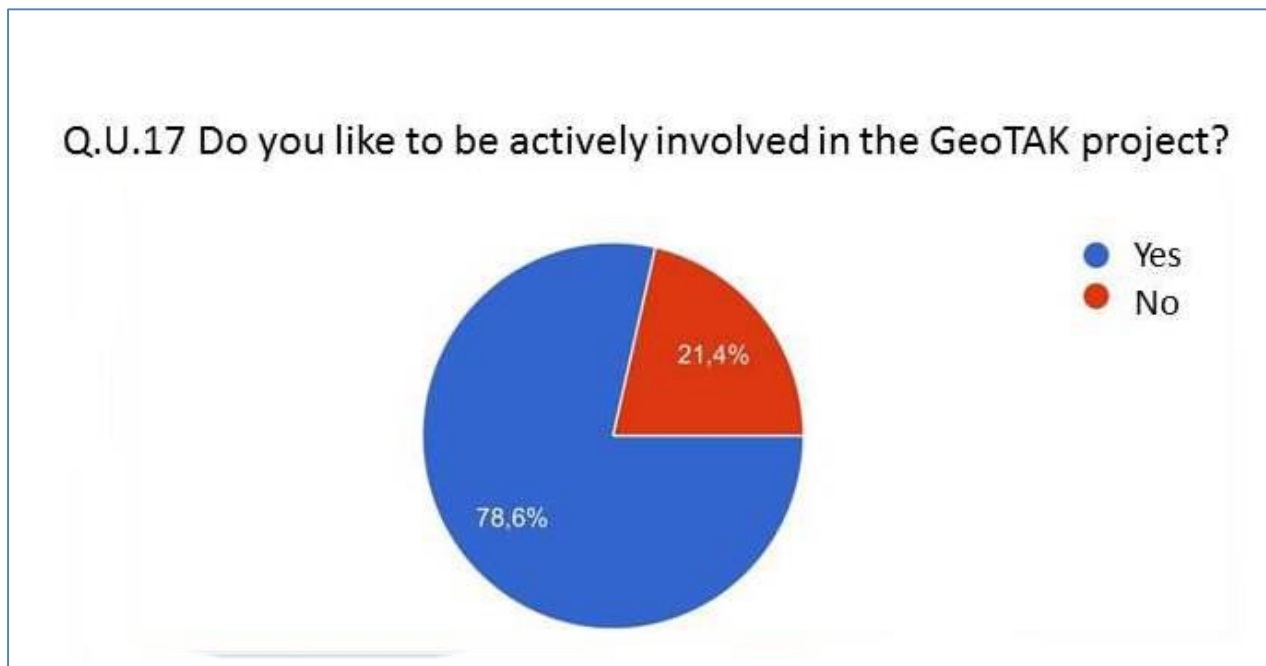
Q.U.15 Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions:



Q.U.16 Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future:

- Efficient use of water resources
- Efficiency of land resources use
- Sustainable management of agro-landscapes
- Urban Economy, Infrastructure management
- Protection of historical and cultural monuments
- Construction of underground structures

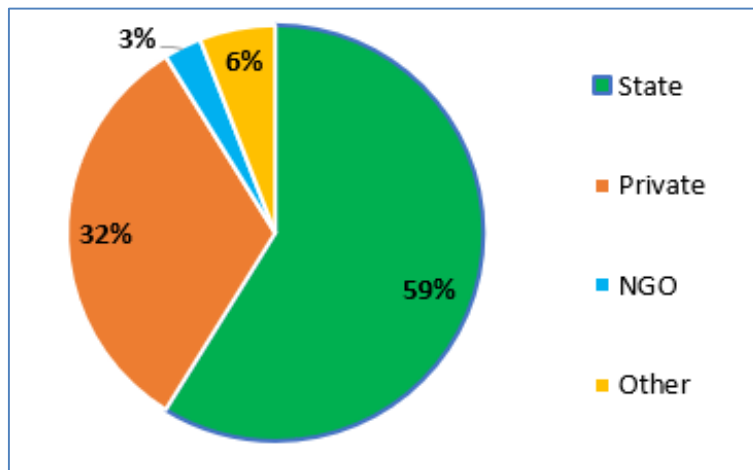
- Tourism
- Transport
- Emergency situations
- Security
- Service
- Geology



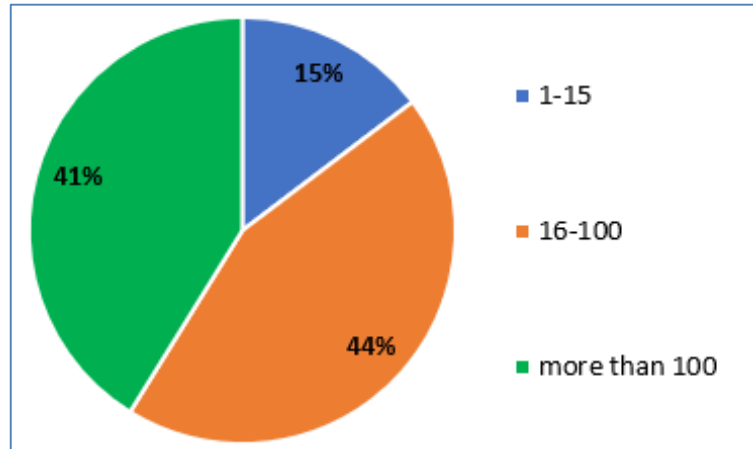
KIRGIZSTAN

3.3. Statistics of results: Industrial/Administrative organizations/companies (Kirgizstan)

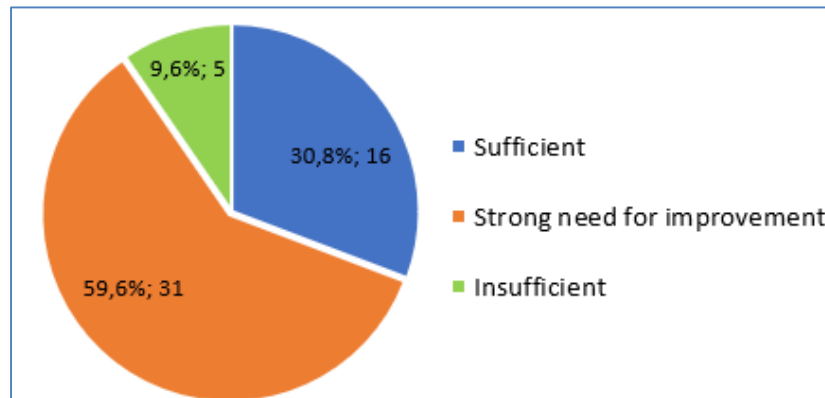
Q.1.3. What is the ownership status of your organisation/company?



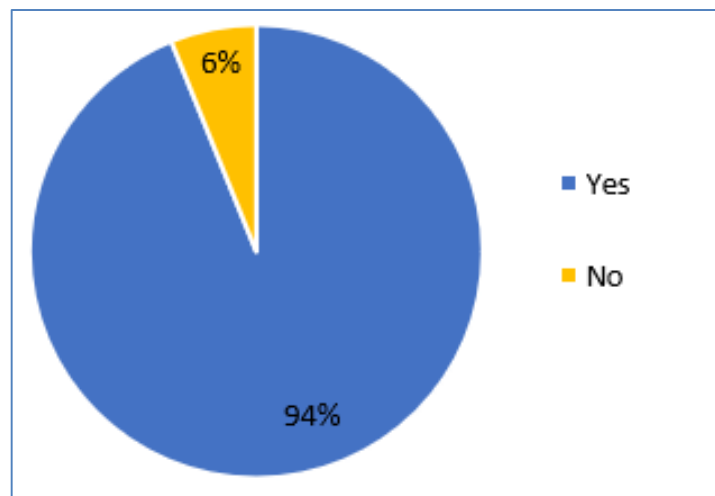
Q.1.4. What is the total number of employees?



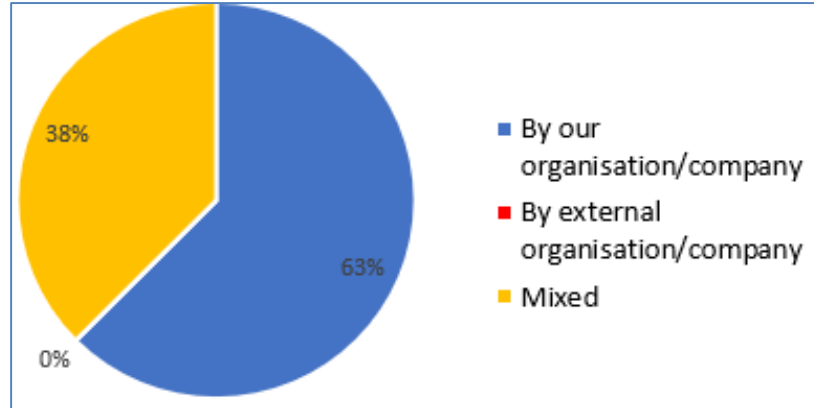
Q.1.5. Is the organisation/company satisfied with its human resources in the field of GIT?



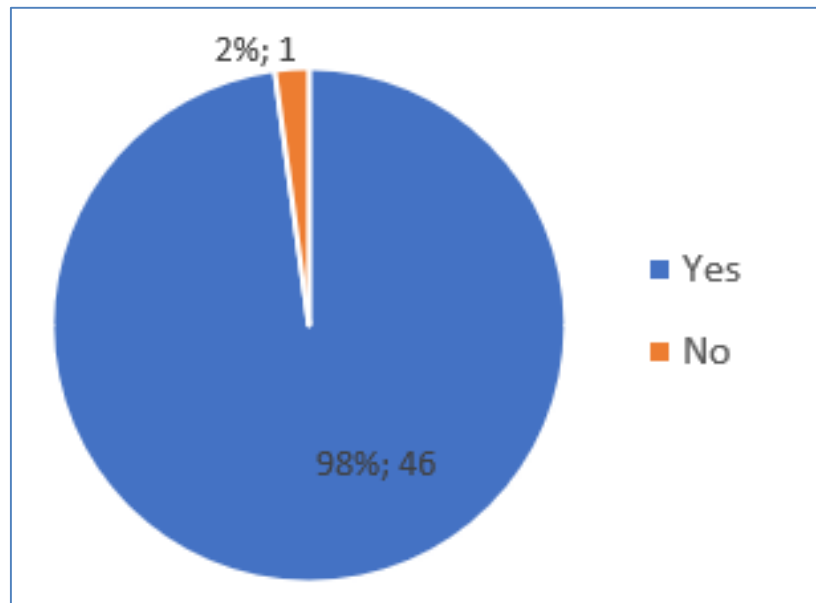
Q.1.6. Do you use internal or/and external geodatabases, spatial analysis, surveys or models during the decision-making procedure?



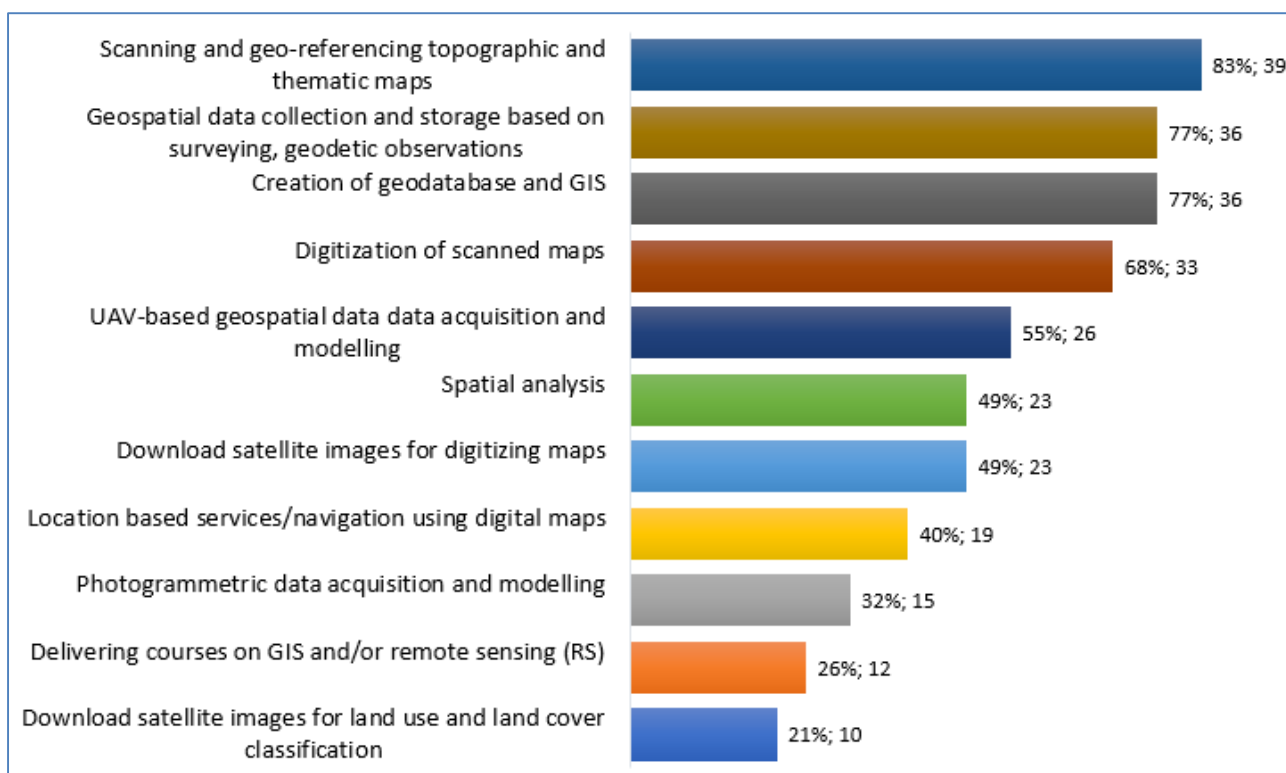
Q.1.7. Is the geodata processing and analysis accomplished by your own organisation/company or external organisation is involved?



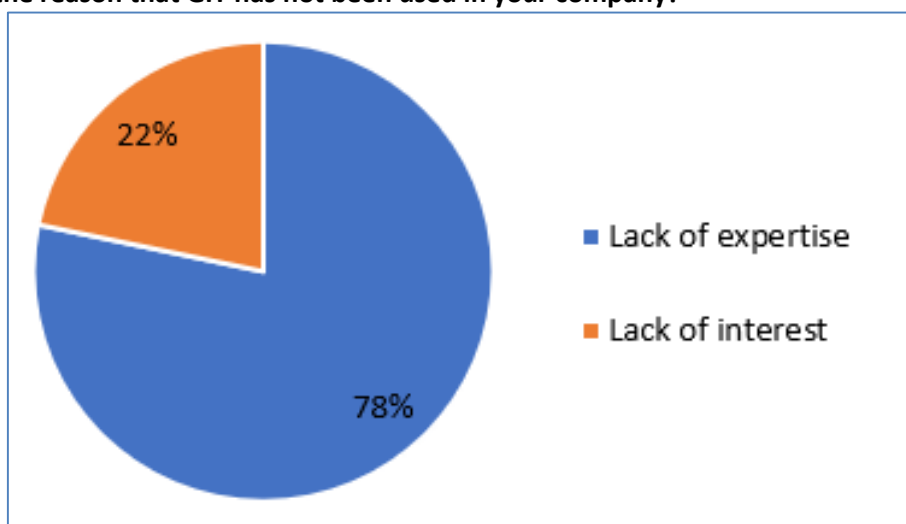
Q.1.8. Do you currently use GIT in your organisation?



Q.1.9. For what purpose do you use GIT?



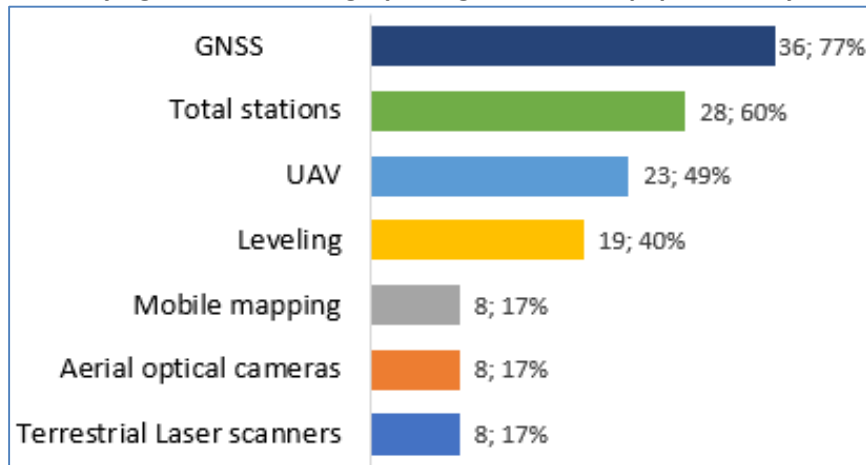
Q.1.10. What is the reason that GIT has not been used in your company?



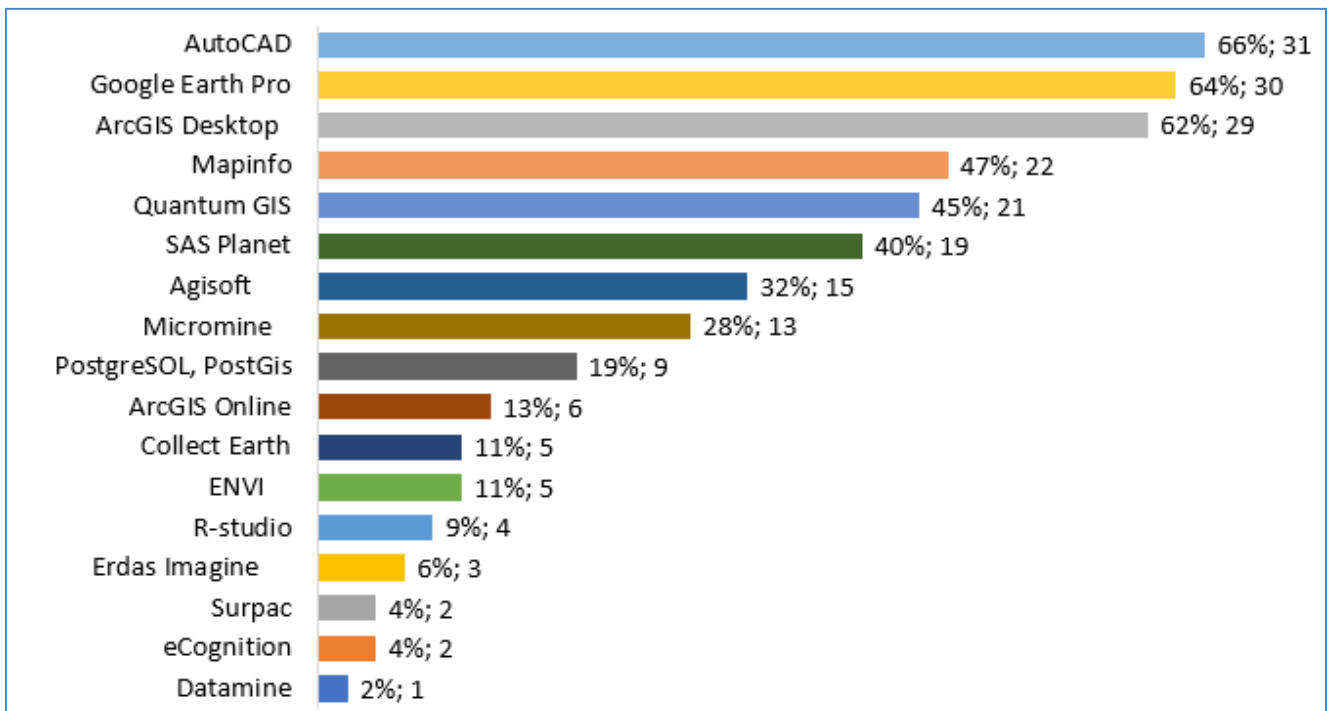
Q.1.11. Would you like to apply GIT / GIS software in the future?

All 47 responded industrial/administrative organizations are willing to apply GIT / GIS software

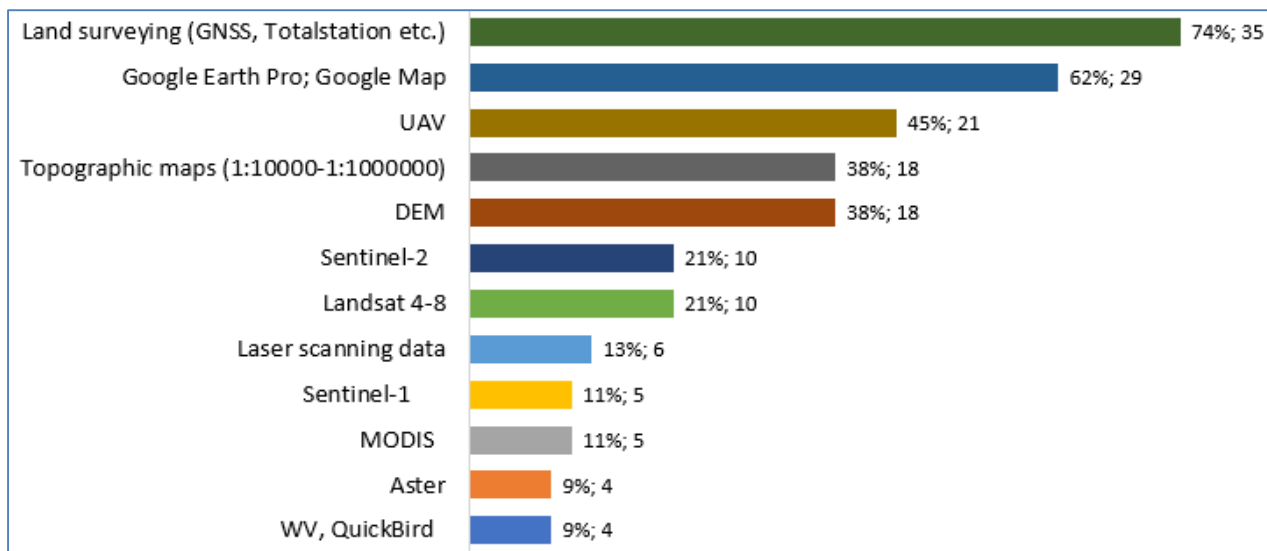
Q.1.12. What type of surveying /remote sensing / photogrammetric equipment do you use?



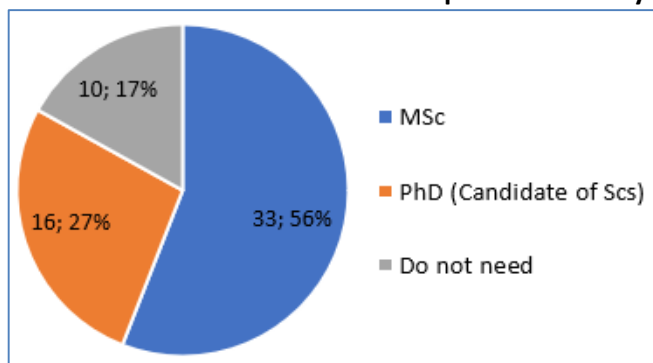
Q.1.13. What type of surveying /GIS / photogrammetric software do you use?



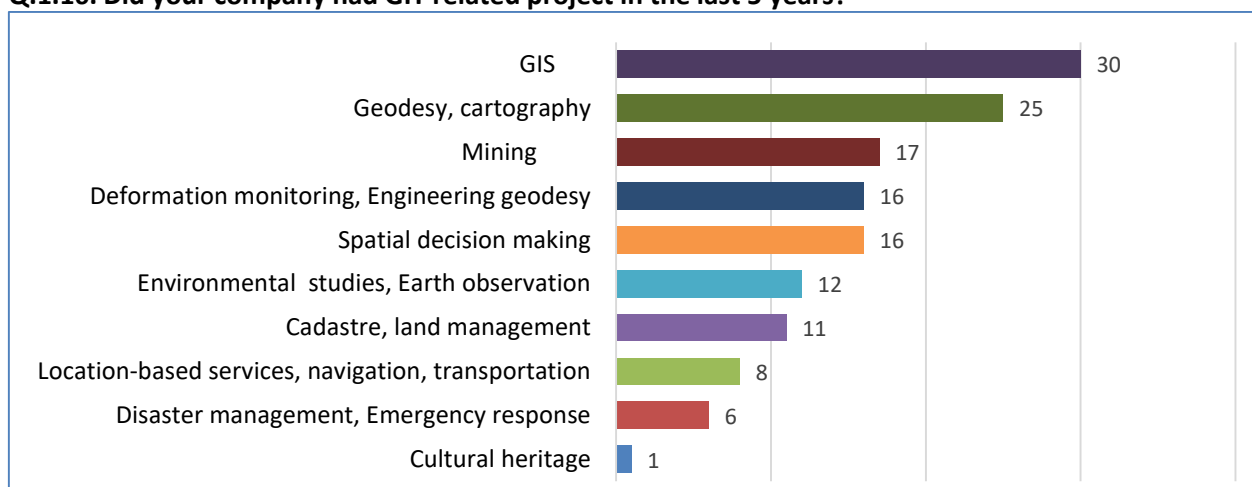
Q.1.14. What type of surveying /GIS / photogrammetric data sets do you use?



Q.1.15. What postgraduate level staff members with GIT competencies does your organisation need?



Q.1.16. Did your company had GIT related project in the last 5 years?



Q.1.17. Which GIT related knowledge areas / skills do you find important from the below proposed?

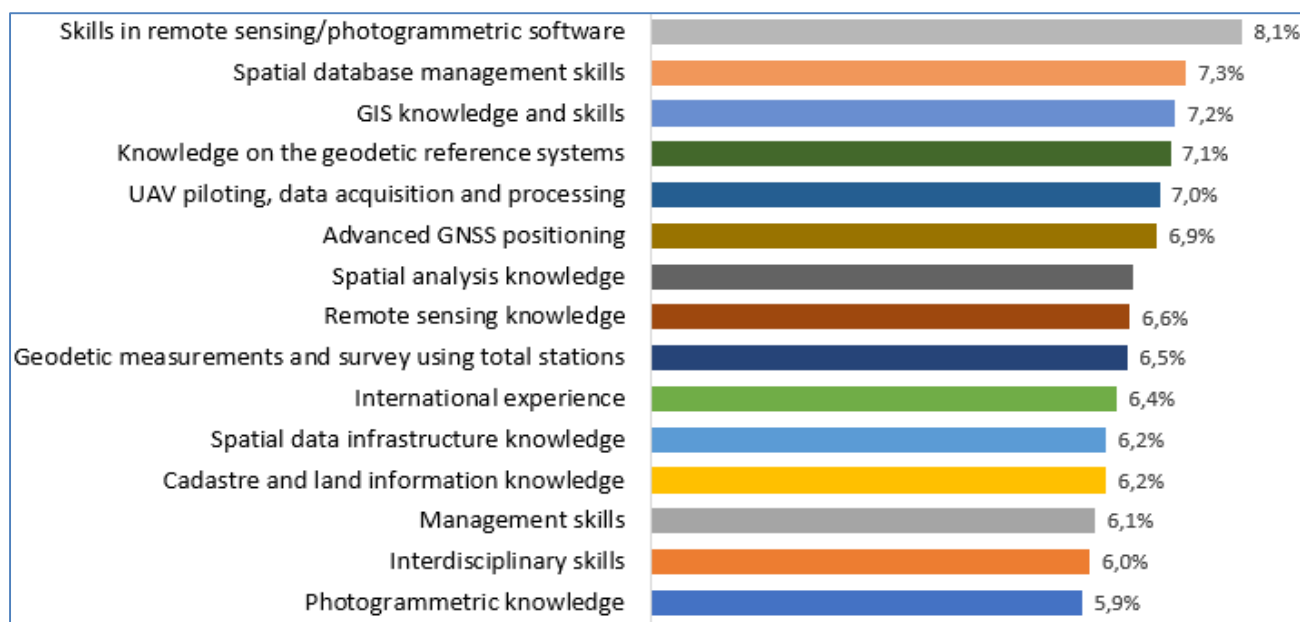
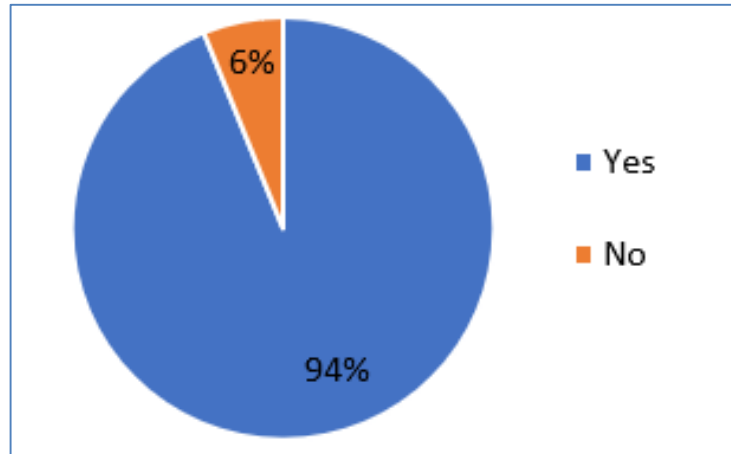


Table 3.3.1. Do you have relevant ongoing GIT projects / partnerships / activities at your organisation/company? (Q.1.18)

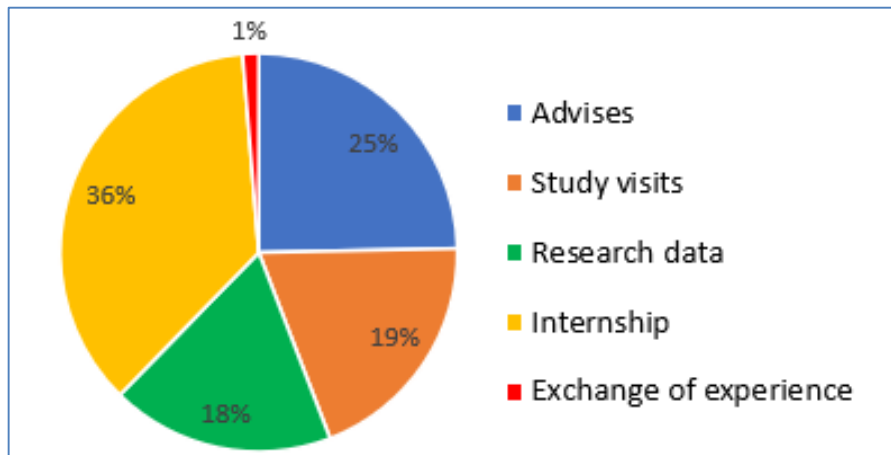
Nº	Projects / partnerships / activities
1	Kyrgyz-Norwegian project "Maps for statistics"
2	Alternative North-South Road
3	Reconstruction of the Balykchy-Karmudo-Karakol highway
4	Rehabilitation of the Osh-Batken-Isfana highway
5	World Bank, FAO, UNDP project
6	Forest Management Information System
7	Digitization of pastures
8	Forest management IP
9	Project PRZHR 2
10	IP Creation Project (Geoportal)
11	Project to collect indicators for INFORM
12	Srk company carries out aerial photography for us using drones
13	Reconstruction of the Suusamyr - Talas - Taraz highway
14	Rehabilitation of the Bishkek-Osh highway
15	Reconstruction of the Almaty-Bishkek-Tashkent highway
16	QGIS
17	Livestock and Market Development Project -1-2
18	Local Community Support Project (CASA-1000 PPMS)
19	Rural Water Supply and Sanitation Improvement Project (PSVS)
20	Development of the hydrological map of Kyrgyzstan
21	Monitoring of the groundwater level

22	Project on investigation and mining of coal in Sulyuktu
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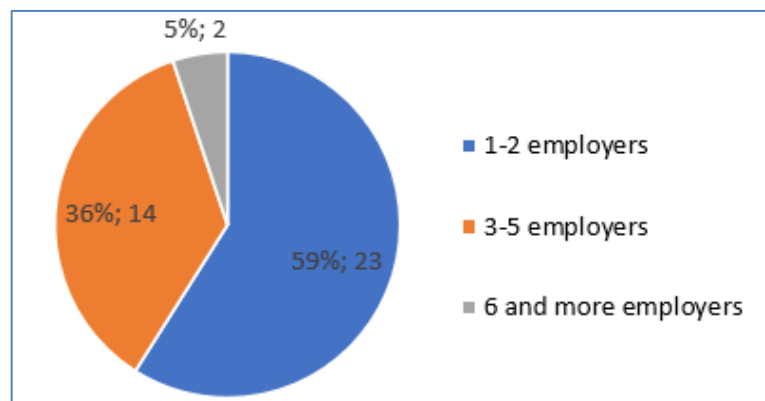
Q.1.19. Would you be interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies?



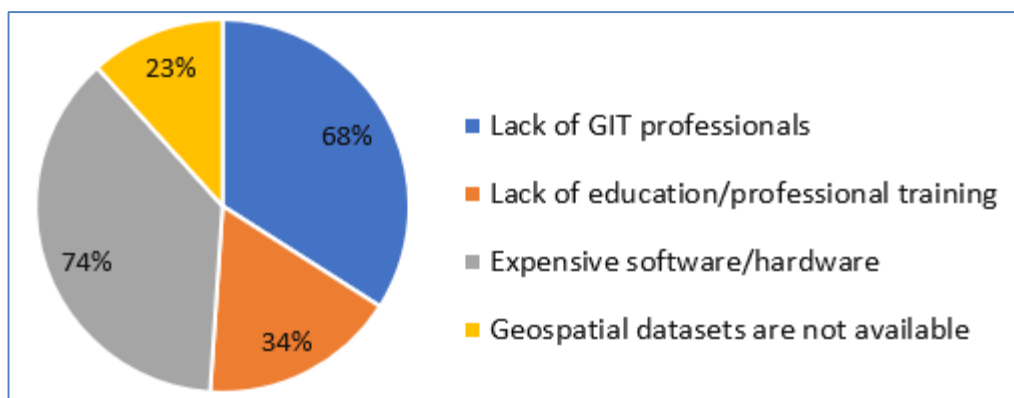
Q.1.20. In what way can your organisation/company contribute into this GeoTAK project?



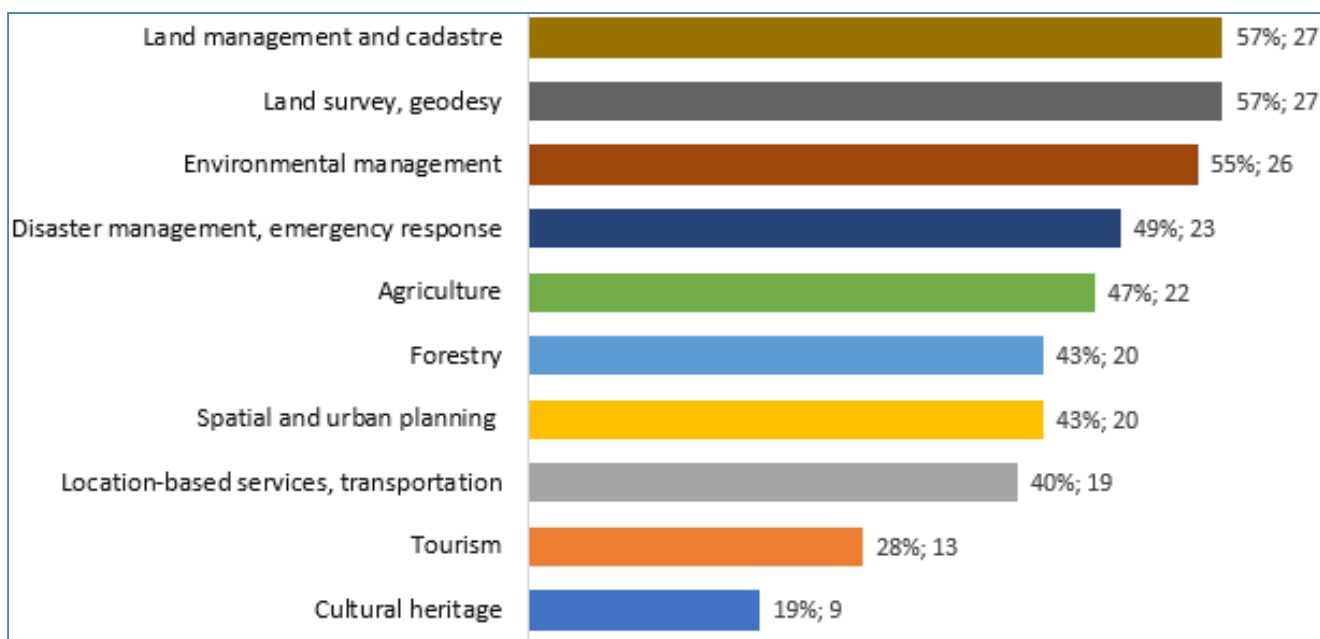
Q.1.21. Would you employ a Geoinformatics MSc/PhD graduate in your company? If yes, how many?



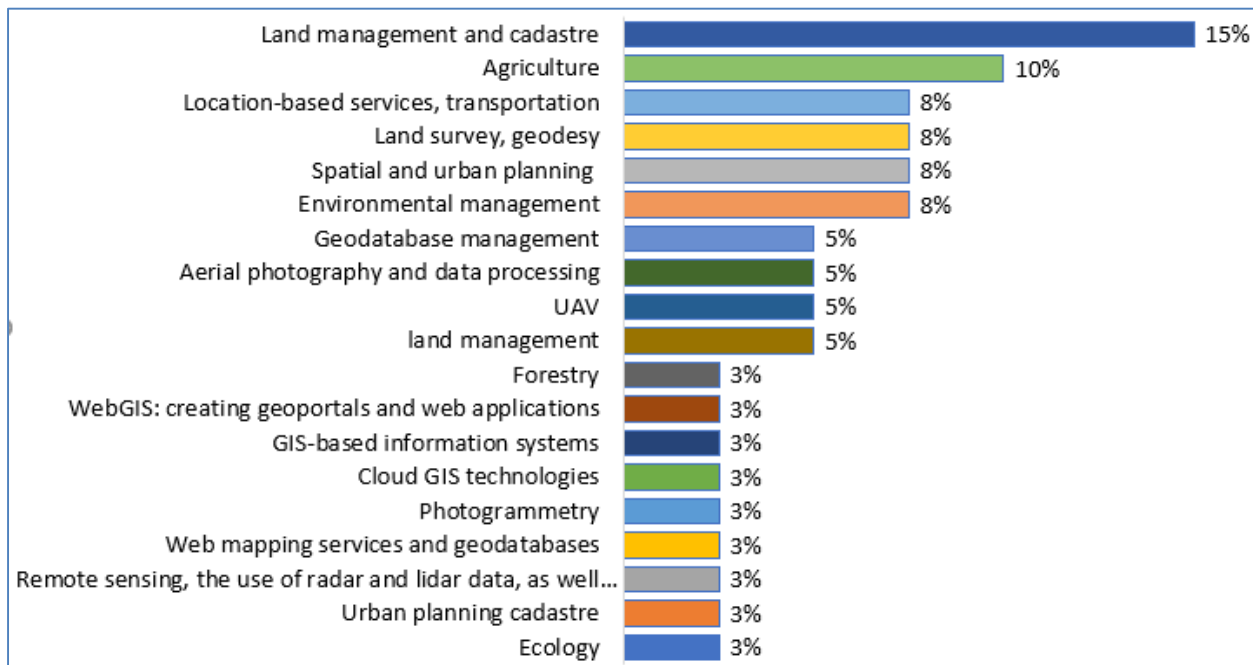
Q.1.22. Please, identify the main barriers in the use of geospatial information?



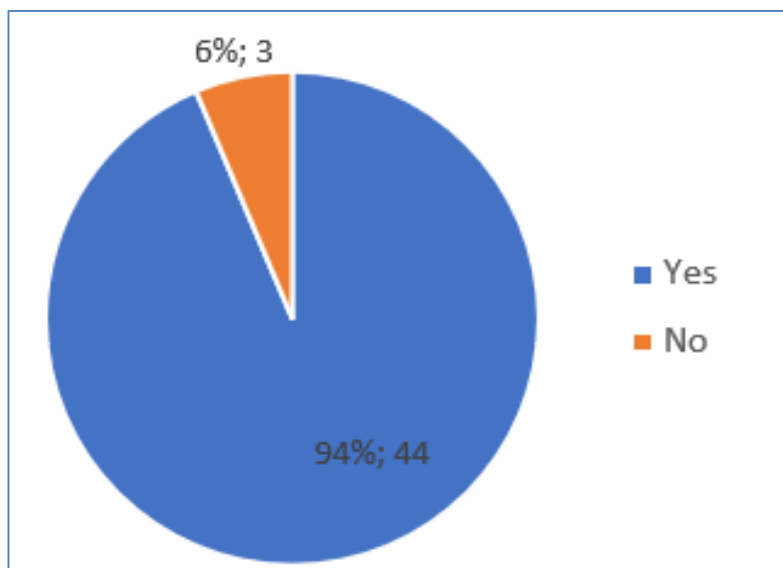
Q.1.23. Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions



Q.1.24. Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future



Q.1.25. Do you like to be actively involved in the GeoTAK project?



3.4 Statistics of results: Universities (Kirgizstan)

Universities need to update equipment for new technologies in Geoinformation, such as specialized GIS and remote sensing software, photogrammetry and GPS. They also need to train young teachers/researchers in GIT for application in solving most relevant environmental and natural resources

problems, and to establish sustainable links with the companies. Fostering this collaboration will provide the baseline for industry and economic development in the country.

The questionnaire for universities have included questions about the existing academic programs in Geospatial and Earth sciences formulated as: “Q.2.3. Main academic and research activities at your university/institute by writing the names of BSc/MSc/PhD programmes on GIT related sciences”, “Q.2.4. Name 3 most important research areas at your institution with GIT used” and “Q.2.5. 4. What kind of relevant ongoing GIT projects / partnerships / activities do you have at your university/institute?”. The results are given in Table 3.4.1.

Table 3.4.1. Number of study programs on GIT related sciences

<i>No.</i>	<i>Level of the academic program</i>	<i>Name of the academic program</i>
1	Bachelor	Geodesy and remote sensing Cartography and geoinformatics Applied geology Environmental sustainability and climatology Geography Ecology and nature use Water resources and water use Protection of environment and rational use of natural resources Construction Architecture Urban planning Applied informatics Oil and gas engineering Metallurgy Technosphere safety Technological machines and equipment Mining engineering Geological exploration technology Physical processes of oil and gas production
2	Master	Geodesy and remote sensing Cartography and geoinformatics Applied geology Applied geodesy Oil and gas engineering Metallurgy Technosphere safety Technological machines and equipment Mining engineering Environmental sustainability and climatology Geography Ecology and nature use Water resources and water use Environmental protection and rational use of natural resources

		Construction Architecture Urban planning Applied informatics
3	Aspirantura (Candidate of Sciences)	Aplied geology Oil and gas engineering Metallurgy Technosphere safety Technological machines and equipment Construction Architecture Ecology and nature use Geography
4	PhD	Geodesy and geoinformation technologies ((planned at KSUCTA) Aplied geology (planned at KSMU) Mining engineering (planned at KSMU) Geoinformatics (planned at KSMU)
5	Doctoral Program (Doctor of Sciences)	Construction Architecture Geography

Q.2.4. The most important GIT related research areas

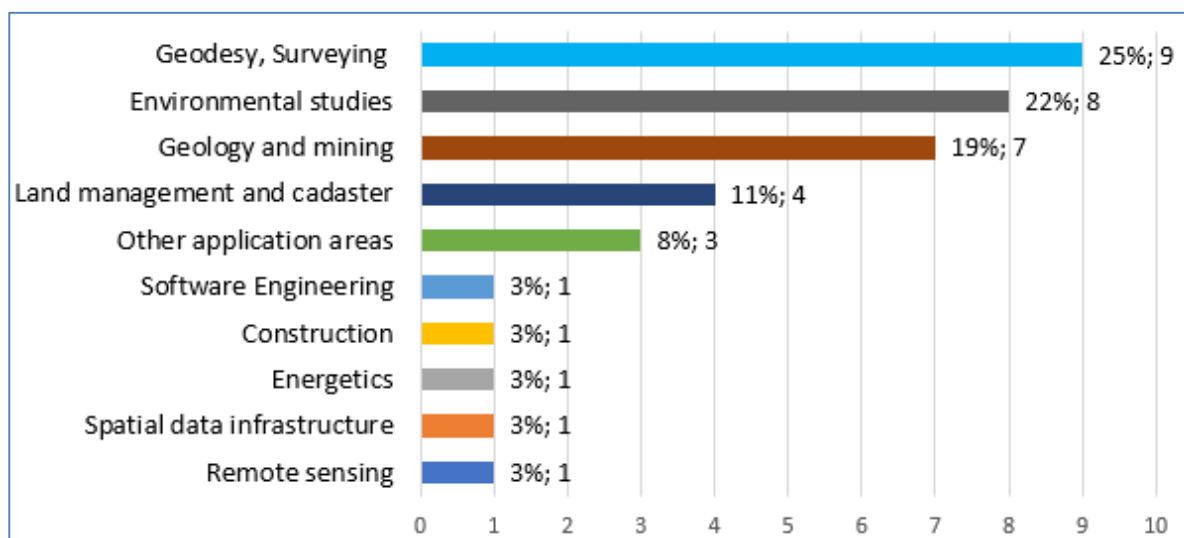
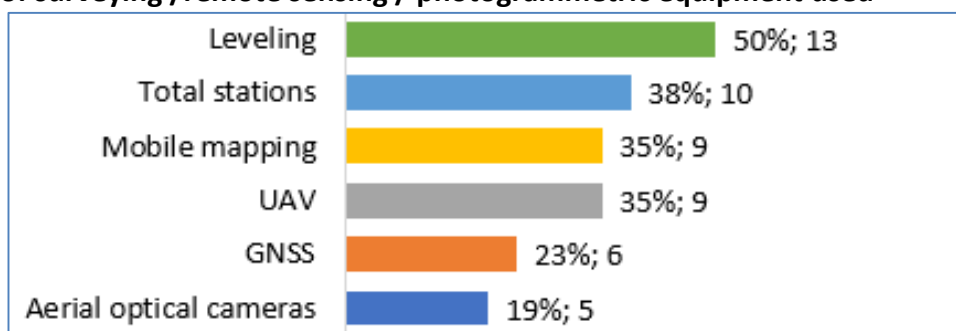


Table 3.4.2. Ongoing GIT projects / partnerships / activities at the respondent university/institute

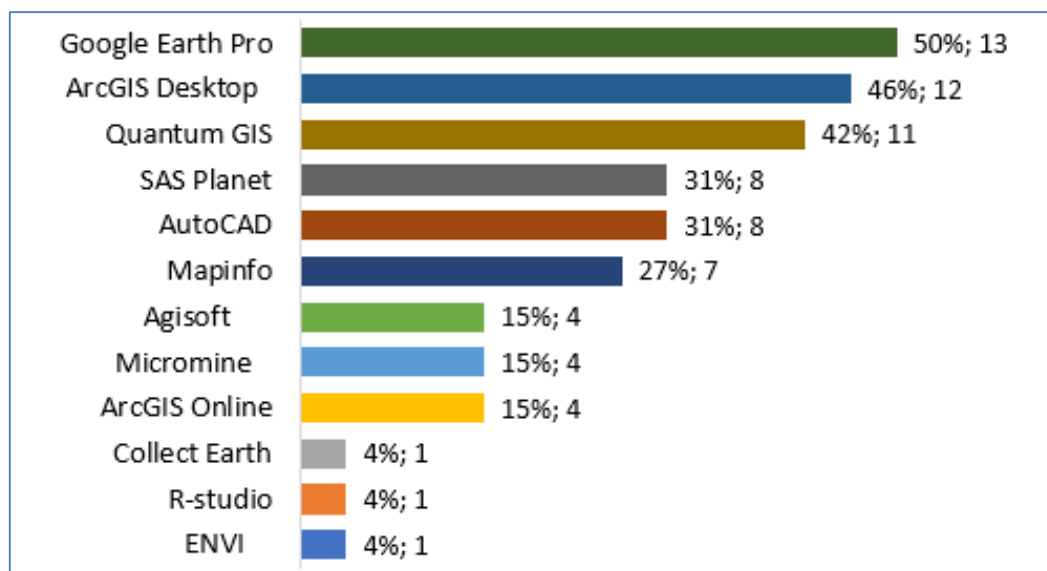
No.	Name of the project / partnership / activity	Number
1	USAID projects	1
2	AUCA projects	1
3	ISTC projects	1
4	Erasmus+. Environmental Protection in Central Asia: Disaster Risk Management with Spatial Methods	1

5	Scientific and technical projects of the National Academy of Sciences of the Kyrgyz Republic	1
6	JSPS Core-to-Core Program	1
7	Scientific and technical assessment of lands disturbed by mining operations and creation of digital maps	1
8	Environmental Protection In Central Asia (EPCA): Disaster Risk Management With Spatial Methods	1
Total		8

Q.2.6. What type of surveying /remote sensing / photogrammetric equipment used



Q.2.7. What type of surveying /GIS / photogrammetric software used



Q.2.8. Would you be interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies?

All 10 responded universities are interested in joining a National GIT Research Network.

Table 3.4.3. Number and qualification of the academic and research staff interested in GIT (Q.2.9)

GIT related sciences	MSc	Cand.Sc. / PhD	Doctor of Sc.	Sum
Environmental studies	18	18	3	39
Cartography and Geoinformatics	10	5		15
Geodesy, Surveying	6	7	1	14
Geology and mining	3	5	2	10
Remote sensing	3	4	2	9
Land management and cadaster	3	5	1	9
Nature Management	2	1	1	4
Other application areas	1	3	3	7
Agriculture		1		1
Total	46	49	95	190

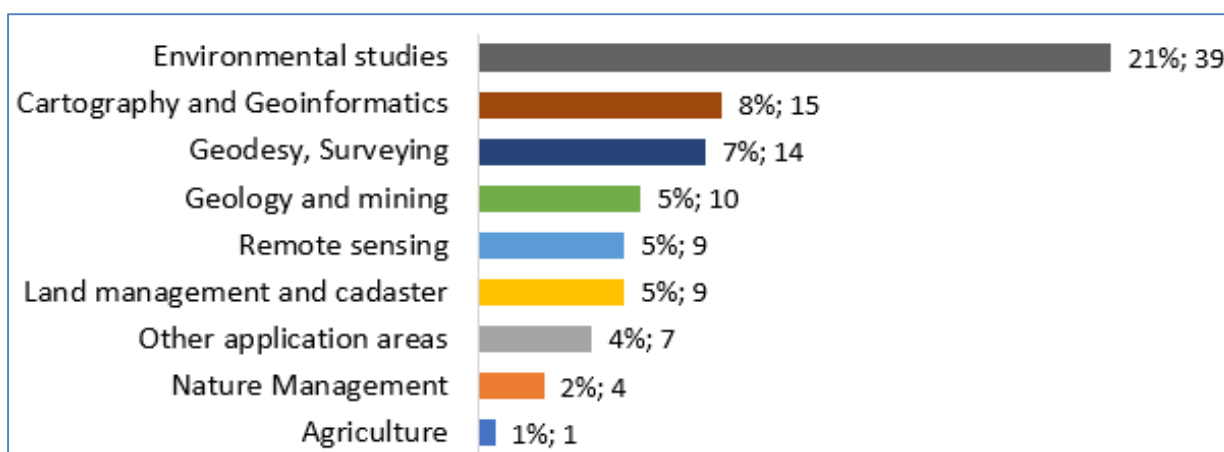
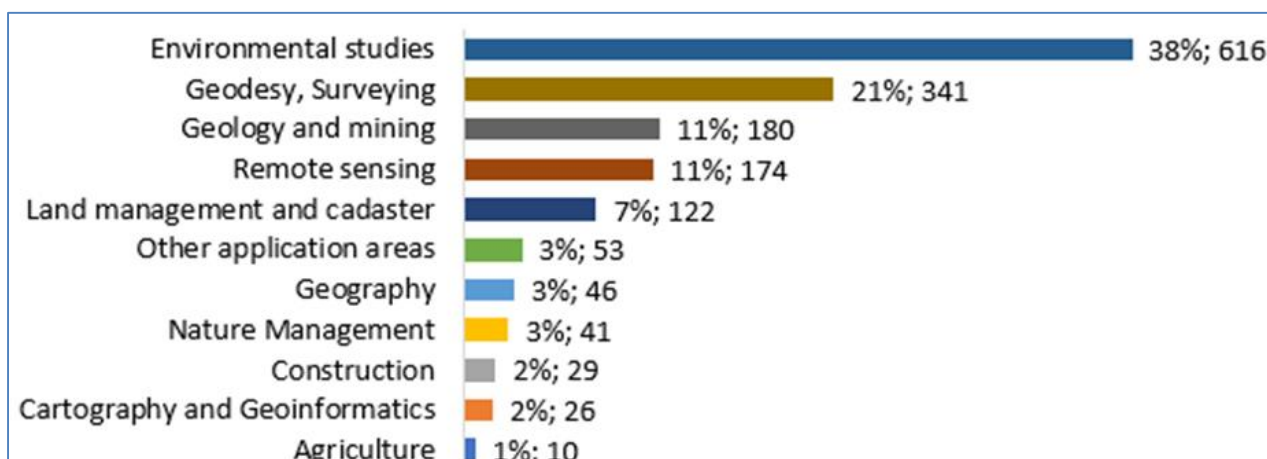
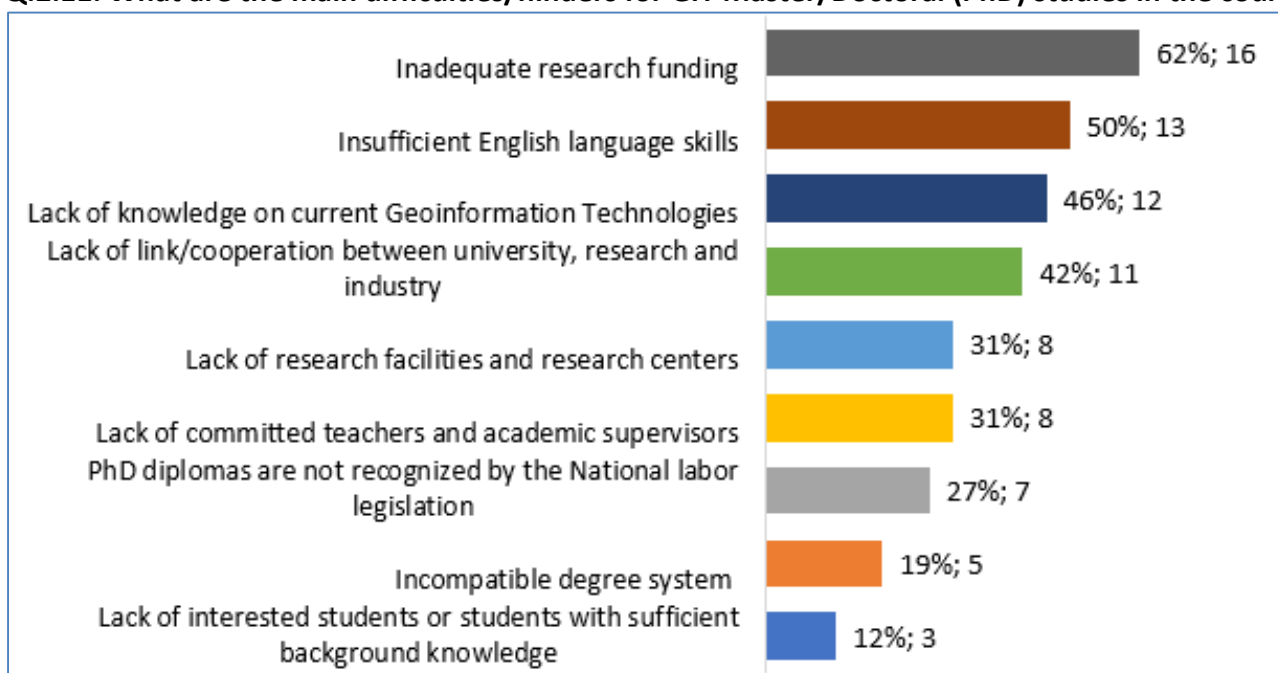


Table 3.4.4. Number of students in the related programmes (Q.2.10)

GIT related sciences	BSc	MSc	Cand.Sc. / PhD	Sum
Agriculture	10			10
Cartography and Geoinformatics	3	23		26
Construction		25	4	29
Nature Management	30	10	1	41
Geography	46			46
Other application areas	53			53
Land management and cadaster	122			122
Remote sensing	173	1		174
Geology and mining	175	5		180
Geodesy, Surveying	314	27		341
Environmental studies	602	14		616
Total	1528	105	5	1638

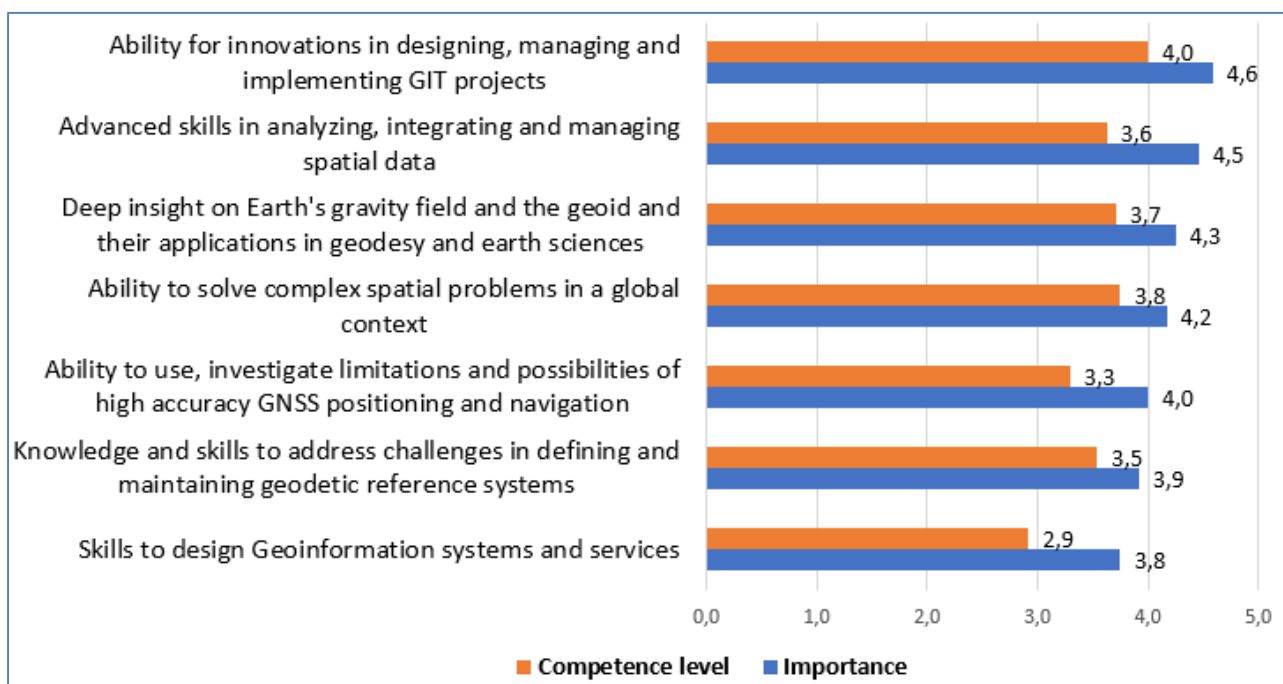


Q.2.11. What are the main difficulties/hinders for GIT Master/Doctoral (PhD) studies in the country?

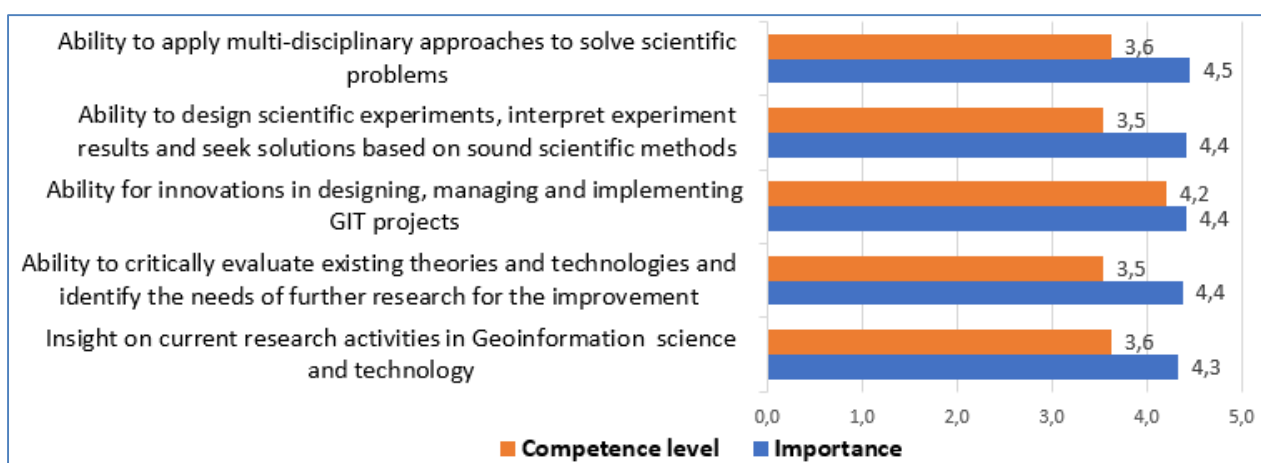


Q.2.12. Competences: the importance of the following competences and skills, and the competence level presently at the institution

Q.2.12.1. Professional competences (grading from 1 to 5, where 5 corresponds to most important)



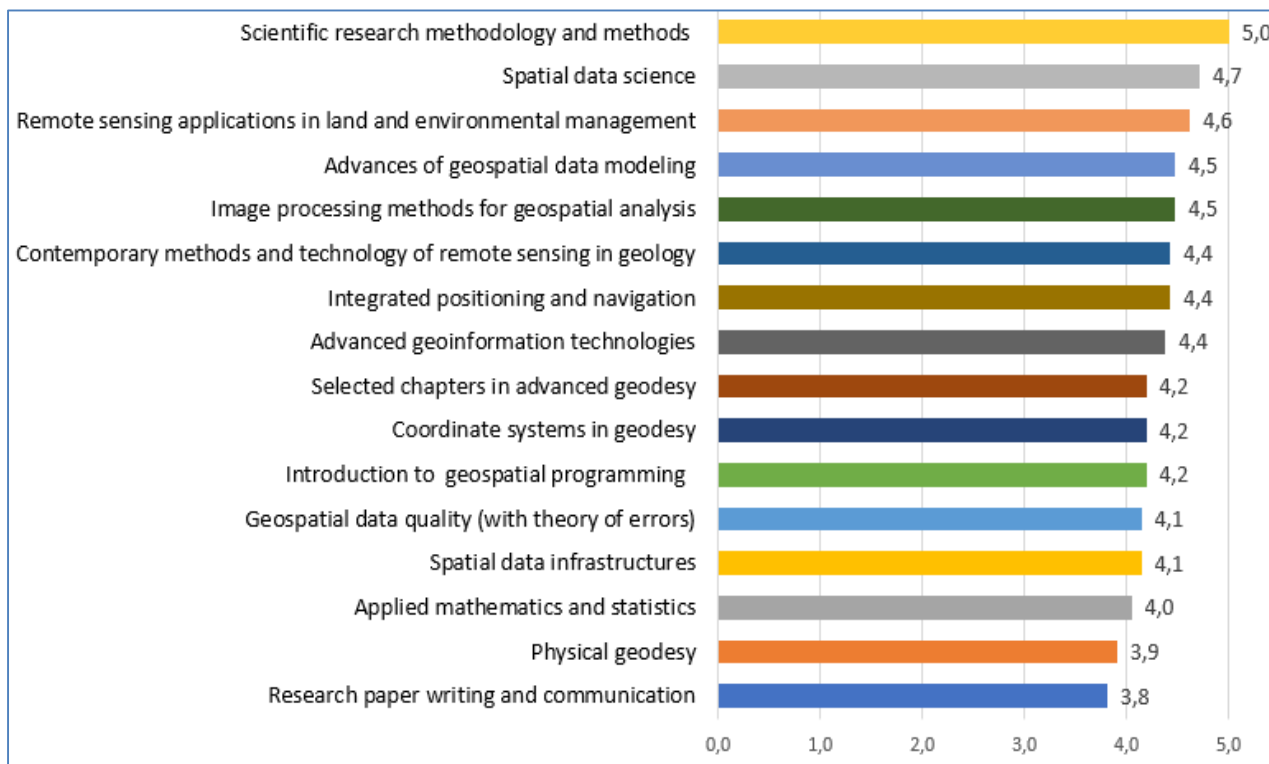
Q.2.12.2. Research competences (grading from 1 to 5, where 5 corresponds to most important)



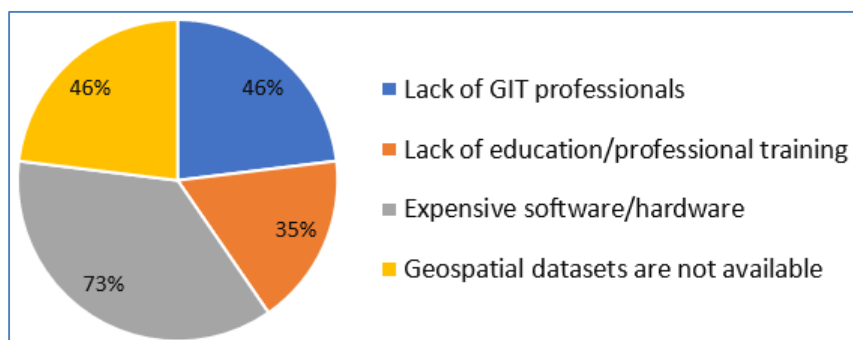
Q.2.12.3. Generic competences (soft skills) (grading from 1 to 5, where 5 corresponds to most important)



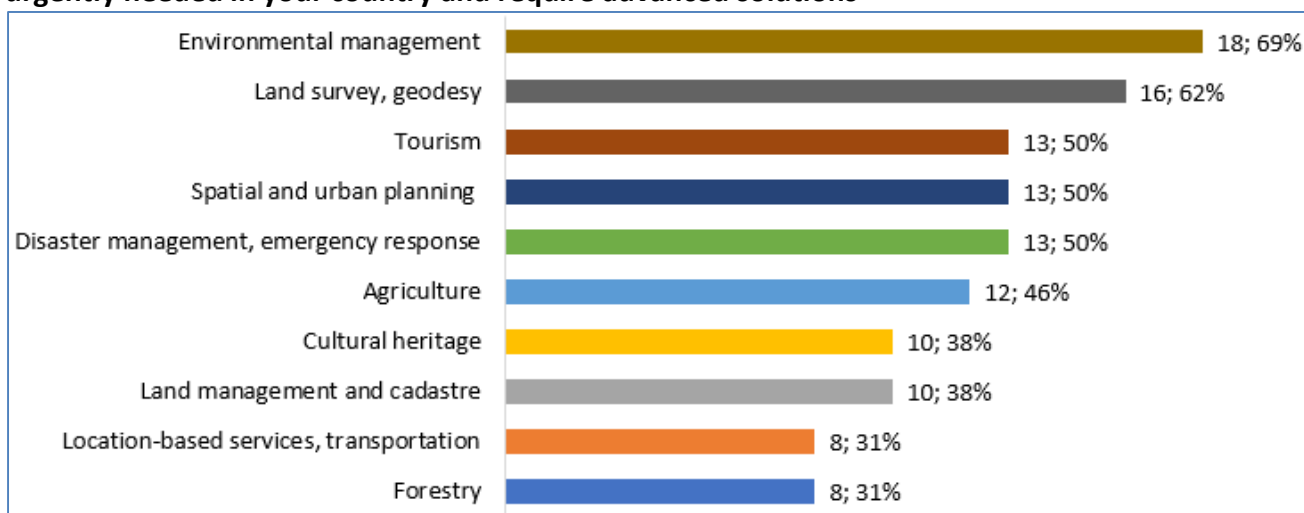
Q.2.13. How important are the following courses which could support potential MSc/PhD students? (grading from 1 to 5, where 5 corresponds to most important)



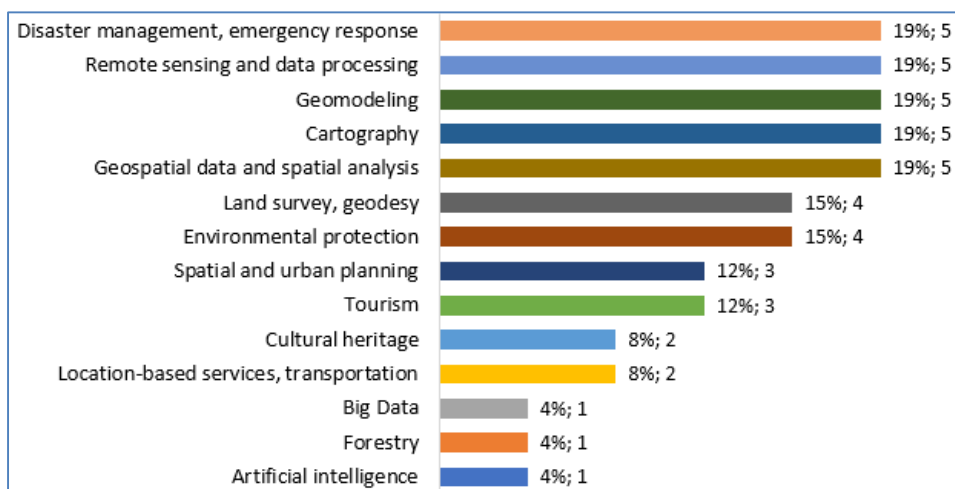
Q.2.14. Please, identify the main barriers in the use of geospatial information?



Q.2.15. Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions



Q.2.16. Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation



4 ANALYSIS OF CURRENT SITUATION

4.1 Analysis of current situation in Armenia

Forty-two respondents of industrial and administrative organizations/companies (hereinafter IAOC) took part in the survey, out of which 64.3% were government organizations, 33.5% - private companies, 2.2% - NGOs. Twenty-eight organizations have been involved in the survey. The sample included large, medium and small organizations/companies. Thus, 46.8% of organizations and companies have more than 100 employees, 6.8% - 15 to 100 employees, and 46.4% - with 1 to 15 employees.

A significant part (52.6%) of IAOC respondents noted that their organization/company is satisfied with the quality of its personnel in the field of GIT. However, the percentage of those respondents who expressed an opposite assessment of the current situation regarding GIT professional staff was quite high (47.4%) (see the answers to the question “Q.I.5 Is the organization / company satisfied with its human resources in the field of GIT?”).

97.4% of IAOC respondents indicated that they use internal and/or external geo-information databases when making decisions (see the answers to the question “QI6 Do you use internal or/and geo data bases, spatial analysis, surveys or models during the decision-making procedure?”). Most of the respondents (61.5%) noted that data processing and analysis is carried out by their own organization/company, 30.8% of respondents noted that it is carried out with the involvement of other organizations/companies, 7.7% of respondents noted that only other organizations are invited for data processing and analysis (see the answers to the question “QI7 Is the geo data processing and analysis accomplished by your own organization/company or external organization is involved”).

To the question “Q.I.8 Do you currently use GIT in your organization?” the majority (84.2%) of the IAOC respondents answered positively. At the same time, the respondents indicated the following as the main areas of application of GIT:

- Creation of geodatabase and GIS (73,5%)
- Scanning and geo-referencing topographic and thematic maps (64,7%)
- Digitization of scanned maps (50%)
- UAV-based geospatial data acquisition and modelling (50%)
- Download satellite images for digitizing maps (50%)
- Geospatial data collection and storage based on surveying, geodetic observations (47,1%)
- Delivering courses on GIS and/or remote sensing (RS) (41,2%)
- Download satellite images for land use and land cover classification (41,2%)
- Location based services/navigation using digital maps (41,2%)
- Spatial analysis (44,1%)
- Photogrammetric data acquisition and modelling (26,5%)

15.8% of IAOC respondents indicated that their organization does not use GIT. Answering the question “Q.I.10 What is the reason that GIT has not been used in your company?”, respondents pointed to lack of experience as the main reason for not using GIT (59.3%). 81.8% of respondents indicated that they would like to use GIT / GIS software in their organization in the future (see the IAOC respondents answers to the question “Q.I.11 Would you like to apply GIT / GIS software in the future?”).

According to the survey results (see the IAOC respondents answers to the question Q.I.12 What type of surveying/ remote sensing/photogrammetric equipment do you use?”), organizations using GIT apply the following types of equipment:

- UAV (48,4%)
- Leveling (38,7%)
- Terrestrial (35,5%)
- GNSS (32,3%)
- Aerial optical cameras (29%)
- Mobile mapping (22,6%)
- Aerial LiDAR (6,5%)
- Laser scanners (6,5%)

Answers to the same question by the universities respondents (see the answers to the question “Q.U.6 What type of surveying/remote sensing/photogrammetric equipment do you use?”) show that the universities are using the following equipment:

Levels (85,7%)
GNSS (71,4%)
Total stations (42,9%)
Aerial optical cameras (35,7%)
Mobile mapping (21,4%)
Aerial LiDAR (14,3%)
Terrestrial laser scanners (14,3%)
UAV (21,4%)

As the IAOC respondents answers to the questions “Q.I.13” and “Q.I.14” and universities’ representatives answers to the questions “Q.U.7” and “Q.U.8” have shown, organizations and companies, as well as the universities are using a variety of software (see the Diagrams 1 and 2) and information data (see the Diagrams 3).

Diagram 1. The breakdown of answers to the question “Q.I.13”.

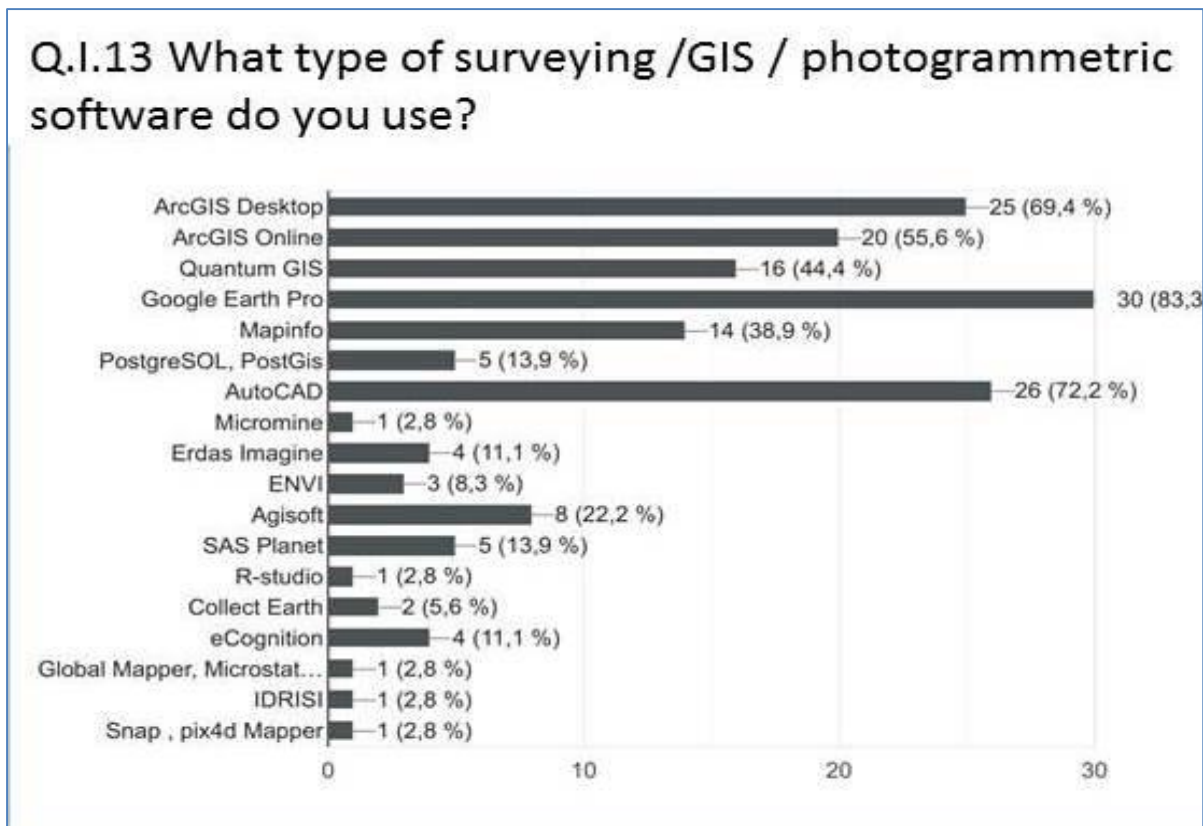


Diagram 2. The breakdown of answers to the question “Q.U.7”.

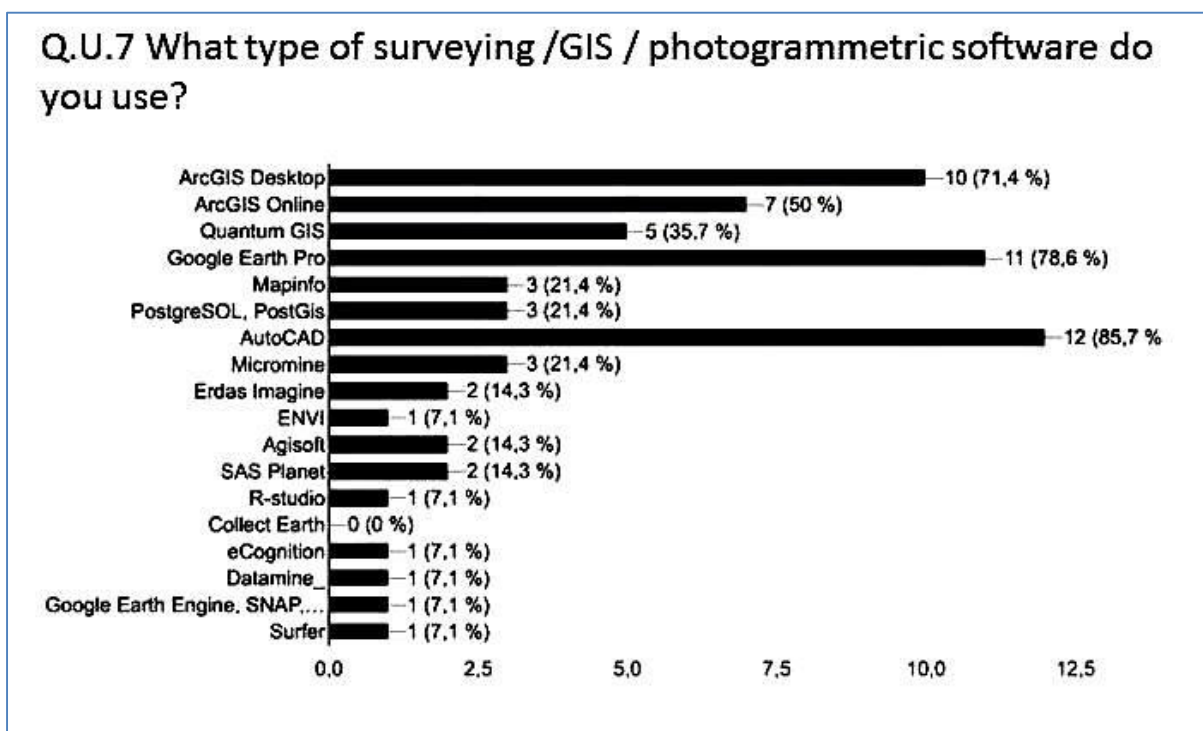
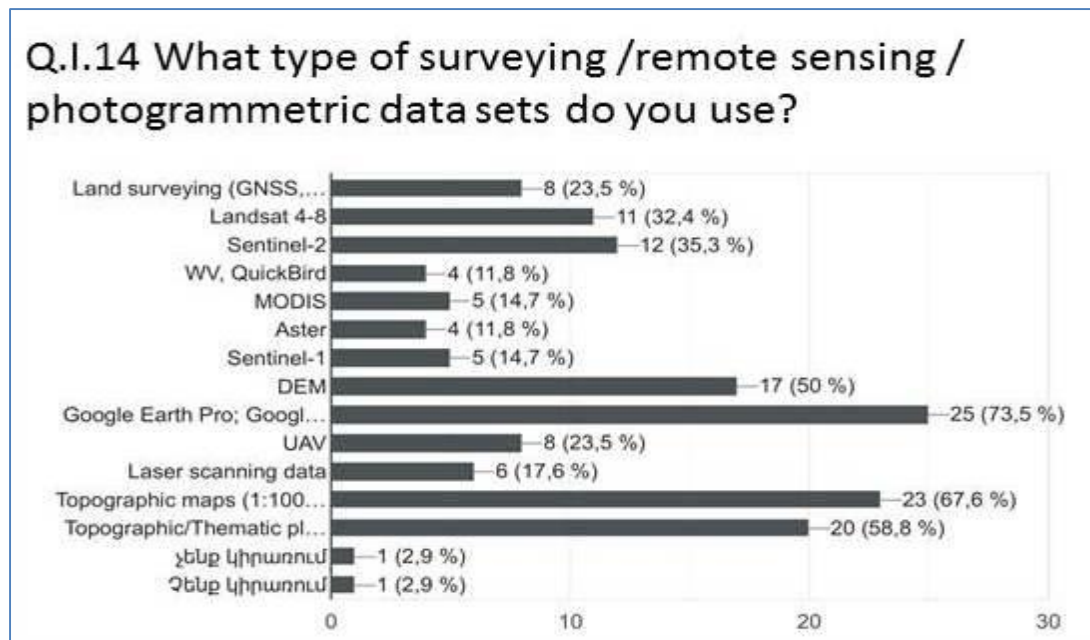


Diagram 3. The breakdown of answers to the question “Q.I.14”.



As barriers to using GIT in their organizations, 38.9% of IAOC respondents indicated the high cost of software and hardware, 27.8% - a shortage of specialists, 16.7% - a shortage of educated and professional specialists, and other reasons (see the answers to the question “Q.I.22”). The universities respondents found as barriers in the use of geospatial information the following: lack of GIT professionals (64,3%), lack of education/professional training (35,7%), expensive software/hardware (35,7%), geospatial datasets are not available (21,4%), all above mentioned options (7,1%), lack motivation (7,1%) (see the answers to the question “Q.U.14”).

4.2 Analysis of current situation in Kirgizstan

The current situation with Geospatial research and application is analyzed based on the survey results. Thirty-four respondents of industrial and administrative organizations/companies (hereinafter IAOC) took part in the survey, out of which 64% were government organizations, 26% - private companies, 2% - NGOs, 9%-other. The sample included large, medium and small organizations/companies. Thus, 47% of organizations and companies have more than 100 employees, 26% - 16 to 100 employees, and 28% - with 1 to 15 employees.

A significant part (60%) of IAOC respondents noted that their organization/company is strongly needed for improvement of its personnel in the field of GIT, 31% of respondents are expressed that GIT professional staff is sufficient, 10%-insufficient (see the answers to the question “Q.1.5 Is the organization / company satisfied with its human resources in the field of GIT?”).

94% of IAOC respondents indicated that they use internal and/or external geo-information databases when making decisions (see the answers to the question “QI6 Do you use internal or/and geo data bases, spatial analysis, surveys or models during the decision-making procedure?”). Most of the respondents (63%) noted that data processing and analysis is carried out by their own organization/company, 38% of

respondents noted that it is carried out with the involvement of other organizations/companies (see the answers to the question "Q.1.7 Is the geo data processing and analysis accomplished by your own organization/company or external organization is involved").

To the question "Q.1.8 Do you currently use GIT in your organization?" the majority (98%) of the IAOC respondents answered positively. At the same time, the respondents indicated the following as the main areas of application of GIT:

- Scanning and geo-referencing topographic and thematic maps (14%)
- Creation of geodatabase and GIS (13%)
- Geospatial data collection and storage based on surveying, geodetic observations (13%)
- Digitization of scanned maps (12%)
- UAV-based geospatial data acquisition and modelling (10%)
- Spatial analysis (8%)
- Download satellite images for digitizing maps (8%)
- Location based services/navigation using digital maps (7%)
- Photogrammetric data acquisition and modelling (6%)
- Delivering courses on GIS and/or remote sensing (RS) (4%)
- Download satellite images for land use and land cover classification (4%)

“Q.1.10 What is the reason that GIT has not been used in your company?”, respondents pointed to lack of experience as the main reason for not using GIT (78%). 100% of respondents indicated that they would like to use GIT / GIS software in their organization in the future (see the IAOC respondents answers to the question “Q.1.11 Would you like to apply GIT / GIS software in the future?”).

According to the survey results (see the IAOC respondents answers to the question Q.1.12 What type of surveying/ remote sensing/photogrammetric equipment do you use?”), organizations using GIT apply the following types of equipment:

- GNSS (28%)
- Total stations (22%)
- UAV (18%)
- Leveling (15%)
- Mobile mapping (6%)
- Terrestrial Laser scanners (6%)
- Aerial optical cameras (6%)

Answers to the same question by the universities respondents (see the answers to the question “Q.2.6 What type of surveying/remote sensing/photogrammetric equipment do you use?”) show that the universities are using the following equipment:

- Leveling (25%)
- Total stations (19%)
- Mobile mapping (17%)
- UAV (17%)
- GNSS (12%)
- Aerial optical cameras (10%)

As the IAOC respondents answers to the questions “Q.1.13” (What type of surveying /GIS / photogrammetric software do you use?) and “Q.1.14” (What type of surveying /remote sensing / photogrammetric data sets do you use?) and universities’ representatives answers to the question “Q.2.7” (What type of surveying /GIS / photogrammetric software do you use?) have shown, organizations and companies, as well as the universities are using a variety of software (see the Diagrams 1 and 2) and information datasets (see the Diagrams 3).

Diagram 1. The breakdown of answers to the question “Q.1.13”

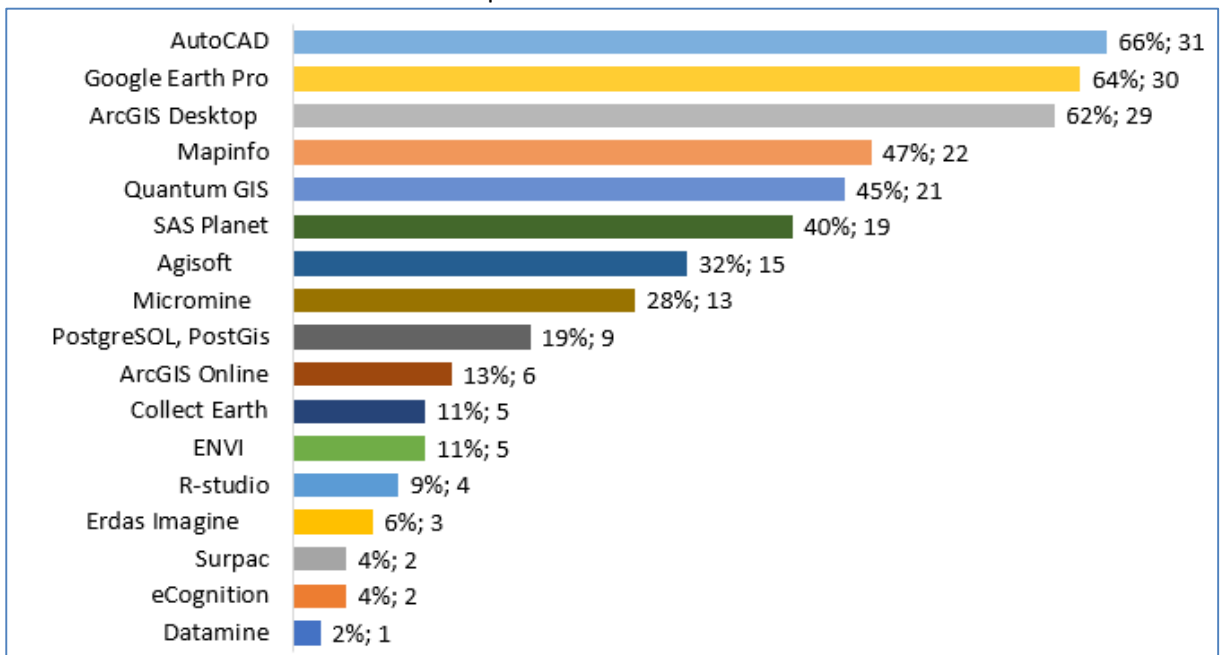


Diagram 2. The breakdown of answers to the question “Q.2.7”

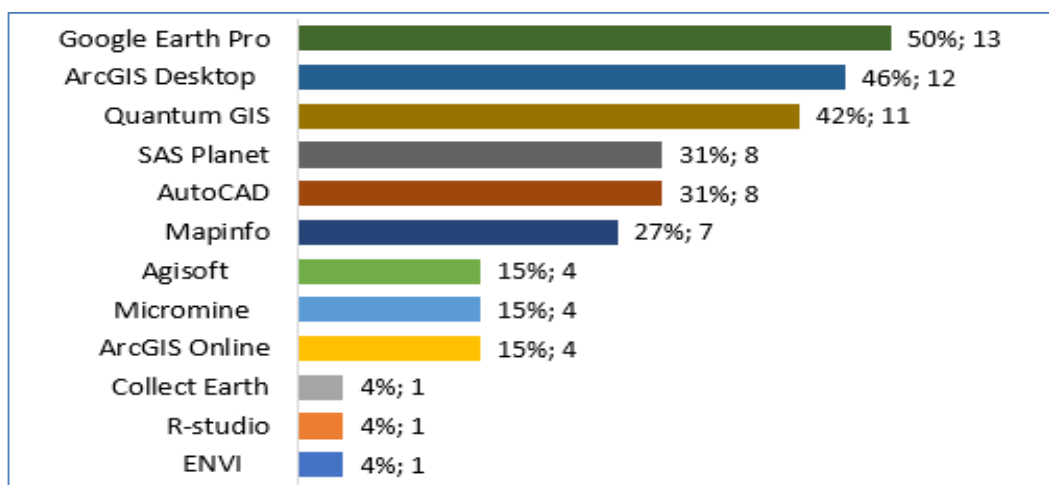
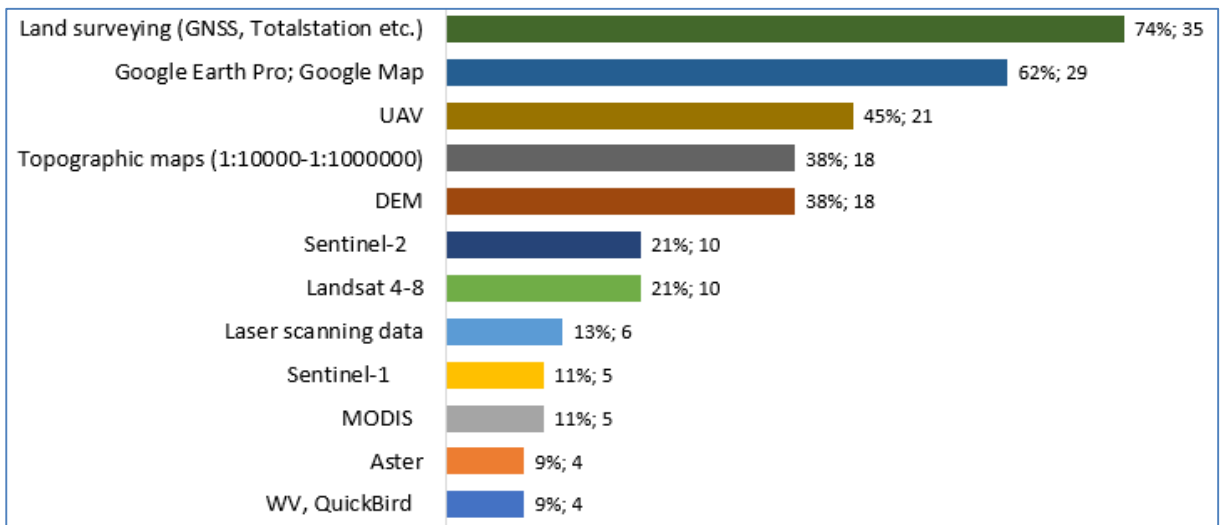


Diagram 3. The breakdown of answers to the question “Q.1.14”



Some differences in the types of surveying / GIS / photogrammetric software used by IAOC and universities can be noticed. For instance, Erdas Imagine and eCognition are expensive commercial software are used by IAOC and universities not surprisingly do not use them in GIT teaching. But the open-source object-relational database system PostgreSQL with PostGIS extension can be applied in teaching and research work by university teachers.

As barriers to using GIT in their organizations, 37% of IAOC respondents indicated the high cost of software and hardware, 34% - a shortage of specialists, 17% - a shortage of educated and professional specialists, and 12% of respondents noted that geospatial datasets are not available (see the answers to the question “Q.1.22”). The universities respondents found as barriers in the use of geospatial information the following: expensive software/hardware (37%), lack of GIT professionals (23%), geospatial datasets are not available (23%), lack of education/professional training (17%) (see the answers to the question “Q.2.14”).

5 ANALYSIS OF NEEDS

5.1 Analysis of needs in Armenia

To find out what level specialists with GIT knowledge are needed by industrial and administrative organizations, the question “Q.I.15 What postgraduate level staff members with GIT competences does your organization need?” has been included in the questionnaire for IAOC respondents. Answering this question, 75.7% of the total number of IAOC respondents indicated that they need specialists with knowledge of GIT at the master's level, 16.2% indicated the need for specialists with knowledge of GIT with a doctoral degree, and only 8.1% indicated that in their organizations there is no need for specialists with knowledge of GIT.

A significant part (88.2%) of IAOC respondents answered positively to the question “Q.I.21 Would you employ a Geoinformatics MSc/PhD graduate in your company?”. 67.7% of organizations are ready to accept 1-2, 16.1% - 3-4, 16.1% - 6 or more specialists.

Answering the question “Q.I.17 Which GIT related knowledge areas/skills do you find important from the below proposed?”, IAOC respondents identified as the most important knowledge related to the GIT the following area:

- Spatial database management skills
- Advanced GNSS positioning
- Skills in remote sensing / photogrammetric software

As the next group according to their importance the following knowledge areas have been indicated:

- Spatial data infrastructure knowledge
- Geodetic measurements and survey using total stations
- Photogrammetric knowledge

As less significant in comparison with the two previous groups of knowledge the following knowledge areas were identified:

- Cadaster and land information knowledge
- UAV piloting, data acquisition and processing
- Remote sensing knowledge

Based on their work experience, IAOC and universities respondents identified the areas where GIT is urgently needed (see respectively responses to the question “Q.I.23” and “Q.U.15 Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions”). As such areas, the IAOC respondents noted the following: 66.7% of respondents indicated land survey and geodesy, 61.1% - land management and cadaster, 58.3% - disaster management and emergency response, 52.8% - agriculture, 52.8% - forestry, 47, 2% - environmental management, 41.7% - spatial and urban planning, 38.9% - location-based services and transportation, 38.9% tourism, 27.8% - cultural heritage. The universities respondents answer breakdown is such: 57,1% - disaster management, emergency response, 78.6 % - land survey and geodesy, 71,4% - land management and cadaster, 64.3% - spatial and urban planning, 78,6% - environmental management, 71,4% - agriculture, 42,9% - forestry, 71,4% - location-based services, transportation; 50% - tourism, 35,7% - cultural heritage, 7,1% - mining, 7,1% - water resources management.

Answering the question “Q.I.24 Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future”, based on their own work and experience as the main GIT directions, which, in their opinion, are the most promising in Armenia in terms of employment expectations in the near future, IAOC respondents noted the following directions:

- Agriculture (9 mentions)
- Sphere of emergency situations, disaster Management (6 mentions)
- Defense, emergency, traffic regulation (5 mentions)
- Land management (4 mentions)

81.1% of IAOC respondents and 78,8% of universities respondents noted that they are interested in creating a joint national GIT research network that will bring together universities, GIS researchers, national agencies, NGOs and companies (see respectively the answers to the question “Q.I.19 Would you be interested in joining National GIT Research Network which brings together universities , GIS scientists, national agencies, NGOs and Companies? ” and “Q.U.8 Is your university/institute interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies?”).

Answering the question "Q.I.20 In what way can your organization/company contribute into this GeoTAK project?" 41,2% of the IAOC respondents answered that they contribution could be done as a consultancy, 20,6% - in organization of practice, 17.5% - in the form of providing research data, 14.7% - as a Study visit.

The survey results showed that 82.9% of IAOC respondents and 78.8% of universities respondents are ready to be actively involved in the GeoTAK project (see the answers respectively to the questions “Q.I.25 and “Q.U.17 Do you like to be actively involved in the GeoTAK project”).

5.2 Analysis of needs in Kirgizstan

To find out what level specialists with GIT knowledge are needed by industrial and administrative organizations, the question “Q.1.15 What postgraduate level staff members with GIT competences does your organization need?” has been included in the questionnaire for IAOC respondents. Answering this question, 56% of the total number of IAOC respondents indicated that they need specialists with knowledge of GIT at the master's level, 27% indicated the need for specialists with knowledge of GIT with a doctoral degree, and only 17% indicated that in their organizations there is no need for specialists with knowledge of GIT.

A significant part (83%) of IAOC respondents answered positively to the question "Q.1.21 Would you employ a Geoinformatics MSc/PhD graduate in your company?". 59% of organizations are ready to accept 1-2, 36% - 3-5, 5% - 6 or more specialists.

Answering the question “Q.1.17 Which GIT related knowledge areas/skills do you find important from the below proposed?”, IAOC respondents identified as the most important knowledge related to the GIT the following area (more than 7%):

- Skills in remote sensing / photogrammetric software
- Spatial database management skills
- GIS knowledge and skills
- Knowledge on the geodetic reference systems



- UAV piloting, data acquisition and processing

As the second group according to their importance the following knowledge areas have been indicated:

- Advanced GNSS positioning
- Spatial analysis knowledge
- Remote sensing knowledge
- Geodetic measurements and survey using total stations
- International experience

As less significant in comparison with the two previous groups of knowledge the following knowledge areas were identified:

- Spatial data infrastructure knowledge
- Cadastre and land information knowledge
- Management skills
- Interdisciplinary skills
- Photogrammetric knowledge

Based on their work experience, IAOC and universities respondents identified the areas where GIT is urgently needed (see respectively responses to the question “Q.1.23” and “Q.2.15” (Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions). As such areas, the IAOC respondents noted the following: 57% of respondents indicated “land management and cadaster” and “land survey and geodesy”, 55% - environmental management, 49% - disaster management and emergency response, 47% - agriculture, 43% - forestry, 43% - spatial and urban planning, 40% - location-based services and transportation, 28% tourism and 19% - cultural heritage. The universities respondents answer breakdown is such: 69% - environmental management, 62% - land survey and geodesy, 50% - tourism, 50% - spatial and urban planning, 50% - disaster management, emergency response, 46% - agriculture, 38% - cultural heritage, 38% - land management and cadaster, 31% - location-based services, transportation and 31% - forestry.

Answering the question “Q.1.24” (Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future), based on their own work and experience as the main GIT directions, which, in their opinion, are the most promising in Kyrgyzstan in terms of employment expectations in the near future, IAOC respondents noted the following directions:

- Land management (6 mentions)
- Agriculture (4 mentions)
- Location-based services, transportation (3 mentions)
- Spatial and urban planning (3 mentions)
- Environmental management (3 mentions), etc.

94% of IAOC respondents and all university respondents noted that they are interested in creating a joint national GIT research network that will bring together universities, GIS researchers, national agencies, NGOs and companies (see respectively the answers to the question “Q.1.19” (Would you be interested in joining National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and Companies?) and “Q.2.8” (Is your university/institute interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies?).



Answering the question "Q.1.20" (In what way can your organization/company contribute into this GeoTAK project?) 36% of the IAOC respondents answered that they contribution could be done as internsips for students, 25% - advising, 19% - in the form of study visits, 18% - by providing research data and 1% is interested in exchange or experiences.

The survey results showed that 94% of IAOC respondents and 100% of universities respondents are ready to be actively involved in the GeoTAK project (see the answers respectively to the questions "Q.1.25" and "Q.2.17" (Do you like to be actively involved in the GeoTAK project).

6 CONCLUSIONS

6.1 Armenia

As a result of the study, the following conclusions were made:

- The organizations/companies that took part in the survey have a significant need for specialists in the field of GIT. Moreover, as shown by the results of the survey, industrial and administrative organizations are interested in specialists of the master's degree (this was indicated by 75.5% of the respondents) and the PhD (this was indicated by 16.2% of the respondents) levels. However, as can be seen from the survey of respondents representing universities, in all areas related to GIT, the number of interested master's staff is not very large, it falls within the range from 0 to 5 (see the results of answers to the question “QU9.1 The number of MSc staff interested in GIT”). The same picture is observed in the field of postgraduate and doctoral contingent of universities (see the results of answers to the question “Q.U.9.2 The number of PhD (aspirantura) staff interested in GIT” and “Q.U.9.3 The number Doctor of Sc. Staff interested in GIT”). This situation dictates the need to develop appropriate mechanisms in universities to promote increased interest in study programs in the field of GIT at the graduate, postgraduate and doctoral levels.
- As the data of the table below shows, the same surveying/remote sensing/photogrammetric equipment is used to varying degrees in industrial/administrative organizations/companies and universities. So, if with regard to the use of UAV, Terrestrial laser scanner, Mobile mapping, we can say that the number of respondents of IAOC who indicated the use of these exceeded the number of universities respondents who indicated the use of the same equipment, then the situation with the use of Leveling, GNSS, Aerial optical cameras and Aerial LiDAR is just the opposite. This circumstance suggests that combining the efforts of both parties in the creation of training programs at the universities will expand the opportunities for both parties to use the listed equipment on a wider scale.

##	Type of Equipment	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
1.	UAV	48,4	21,4
2.	Leveling	38,7	85,7
3.	Terrestrial laser scanner	35,5	14,3
4.	GNSS	32,3	71,4
5.	Aerial optical cameras	29	35,7
6.	Mobile mapping	22,6	21,4
7.	Aerial LiDAR	6,5	14,3

- Respondents of industrial/administrative organizations/companies, as well as universities, cited the same reasons for not using GIT. The data in the table below allows a quantitative comparison.

##	Barriers to use GIT	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
1.	Expensive software/ hardware	38,9	35,7
2.	Lack of GIT specialists/ professionals	27,8	64,3
3.	Lack of education/ training	16,7	35,7

- Based on their work experience, IAOC and universities respondents identified the areas where GIT is urgently needed. The table below shows the results:

##	The areas where GIT is urgently needed	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
1.	Land survey and geodesy	66,7	78,6
2.	Land management and cadaster	61,1	71,4
3.	Disaster management and emergency response	58,3	57,1
4.	Agriculture	52,8	71,4
5.	Forestry	52,8	42,9
6.	Environmental management	47,2	78,6
7.	Spatial and urban planning	41,7	64,3
8.	Location-based services and transportation	38,9	71,4
9.	Tourism	38,9	50,0
10.	Cultural heritage	27,8	35,7
11.	Mining	-	7,1
12.	Water resources management	-	7,1

- 81.1% of IAOC respondents and 78,8% of universities respondents noted that they are interested in creating a joint national GIT research network that will bring together universities, GIS researchers, national agencies, NGOs and companies.
- Respondents of industrial/administrative organizations/companies, as well as universities are ready to be actively involved in the GeoTAK project. 82.9% of IAOC respondents and 78.8% of universities respondents answered positively on the question “Do you like to be actively involved in the GeoTAK project?”.

6.2 Kirgizstan

The questionnaire survey was realized and its results are analysed to design the proper strategy and methods for the development of new postgraduate programs and course syllabuses. Only 30,8% of respondents are satisfied with its human resources in the field of GIT and other 69.2% of respondents needed for capacity improvement or with insufficient staff with GIT competencies (Q.1.8). At the same time 98% of respondents IAOCs currently use GIT in their business and operation.

The needs analysis shows that many organizations/companies that took part in the survey have a significant need for specialists in the field of GIT with MSc (this was indicated by 56% of the respondents) and PhD

degrees (this was indicated by 27% of the respondents) levels. The survey results of respondents representing universities indicates the most demanded specialists with GIT competencies should have MSc degrees. There are a number of related MSc Programs at the responded Kyrgyz universities (Table 6) with 105 students and such a lack of specialists with MSc degrees can be explained with other obstacles as non-competitive salary, etc.

33 or 27% of IAO respondents declare that they need PhD level specialists, while only 5 Cand.Sc. (Candidate of Sciences or Aspirantura programs) students are studying at the GIT related programs of respondent universities. It can be highlighted that there are neither Candidate of Sciences or PhD programs in Geodesy, Surveying, Remote sensing or Cartography and Geoinformatics programs in the country. It shows the urgent need in development and implementation of the Geodesy and GIT program in the Kyrgyz Republic.

The type of surveying/remote sensing/photogrammetric equipment used by industrial/administrative organizations/companies and universities differs. GNSS technology is used by most of IAOs (36%) following total stations (28%) and UAV (23%). But the universities mostly use leveling (50%), total stations (38%), UAV and mobile mapping (35%), which shows the existing unbalance on the surveying/remote sensing/photogrammetric equipment by industry and academy. Such situation can be explained by the existing financial weakness of the universities on available surveying/remote sensing/photogrammetric equipment. Terrestrial laser scanning is applied by IAOs, but not used for teaching by universities because of the high cost of such advanced survey equipment:

##	Type of Equipment	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
8.	GNSS	36	23
9.	Total stations	28	38
10.	UAV	23	35
11.	Leveling	19	50
12.	Terrestrial laser scanner	8	-
13.	Aerial optical cameras	8	19
14.	Mobile mapping	8	35

The main barriers in the use of geospatial information identified by respondents of industrial/administrative organizations/companies, as well as universities, are quite similar except the availability of geospatial datasets. The next table shows that 46% of universities are experiencing the lack of geospatial datasets, which can be explained by weakness of the data sharing between industry and academy. Another surveying equipment not available at universities are terrestrial laser scanners already used by industry, which can be explained by the high cost of such advanced instruments:

##	Barriers to use GIT	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
4.	Expensive software/ hardware	74	73
5.	Lack of GIT specialists/ professionals	68	46
6.	Lack of education/ training	34	35
7.	Geospatial datasets are not available	23	46

Based on their work experience, IAOC and universities respondents identified the areas where GIT is urgently needed. According to the table below shows the land management, cadaster and surveying fields need GIT urgently. The universities declare that Environmental management and Land survey are mostly GIT needed fields. The respondents from universities have highly ranked the Cultural heritage as one of the GIT needed fields (38%), which has the minimum share within responded IAOC (19%), which can be explained by absence of Industrial, administrative organizations and companies working in the cultural heritage protection and conservation:

##	The areas where GIT is urgently needed	Percentage of Answers, %	
		Industrial/administrative organizations/companies	Universities
13.	Land management and cadaster	57	38
14.	Land survey and geodesy	57	62
15.	Environmental management	55	69
16.	Disaster management and emergency response	49	50
17.	Agriculture	47	46
18.	Forestry	43	31
19.	Spatial and urban planning	43	50
20.	Location-based services and transportation	40	31
21.	Tourism	28	50
22.	Cultural heritage	19	38

94% of IAOC respondents and all Kyrgyz university respondents confirmed that they are interested in creating a joint national GIT research network that will bring together universities, GIS researchers, national agencies, NGOs and companies.

Respondents of industrial/administrative organizations/companies, as well as universities are ready to be actively involved in the GeoTAK project. 82.9% of IAOC respondents and 78.8% of universities respondents answered positively on the question “Do you like to be actively involved in the GeoTAK project?”.



Annex 1

Questionnaire for administration and industry (in English language)

Dear Participant of the Questionnaire Survey!

This questionnaire is part of the GeoTAK project, which is an Erasmus+ project aiming to develop postgraduate Higher Education programmes in Geo-Information Technologies (GIT) and strengthen the links in research and innovation between Higher Education Institutions (HEI), industry and administration in Armenia and Kyrgyzstan. The questionnaire forms the foundation for identifying the market needs and significant development trends in the geospatial domain in the countries.

We believe that you are an important expert and/or stakeholder in the spatial data & geo-informatics domain. We would really appreciate if you could invest your time in completing this questionnaire, as only with your help we will be able to collect data and information relevant for our further planning and implementation of advanced postgraduate Higher Education programmes in Geo-information Technologies (GIT) and strengthen the research and innovation activities in the domain.

Your participation in this survey is voluntary. If you decide to answer the questionnaire, we will consider this as your consent to participate in the survey. You can withdraw your participation at any time. We will take all possible measures to keep your personal information confidential. All the data collected will be aggregated and used exclusively for the purpose of the GeoTAK project.

We request you to answer questions by writing, typing or marking the specific checkbox .

We would greatly appreciate if you could complete the questionnaire as soon as possible and return it to GeoTAK staff or by e-mail: geotak.kg@gmail.com

If you have any questions, remarks, or comments about this questionnaire or any other issues regarding data collection and privacy protection, do not hesitate to contact us by email: geotak.kg@gmail.com.

Kind regards,

GeoTAK project team

QUESTIONNAIRE FOR ADMINISTRATION AND COMPANIES

1. Name of your organisation/company (not required): _____
2. Your name and telephone/email (not required): _____
3. What is the ownership status of your organisation/company?
 State Private NGO Other _____
4. What is the total number of employees? 1-15 15-100 more than 100
5. Is the organisation/company satisfied with its human resources in the field of GIT?
 Sufficient Strong need for improvement Insufficient
6. Do you use internal or/and external geodatabases, spatial analysis, surveys or models during the decision-making procedure? Yes No
7. Is the geo data processing and analysis accomplished by your own organisation/company or external organisation is involved? Our organisation/company External Mixed
8. Do you currently use GIT in your organisation? If not, go to question 11.
9. For what purpose do you use GIT?
Choose all the relevant option(s) (more than one option is possible).
 Scanning and geo-referencing topographic and thematic maps
 Digitization of scanned maps
 Creation of geodatabase and GIS
 Geospatial data collection and storage based on surveying, geodetic observations
 UAV-based geospatial data data acquisition and modelling
 Photogrammetric data acquisition and modelling
 Delivering courses on GIS and/or remote sensing (RS)
 Download satellite images for digitizing maps
 Download satellite images for land use and land cover classification
 Spatial analysis
 Location based services/navigation using digital maps
 Others _____
10. What is the reason that GIT has not been used in your company?
 Lack of expertise Lack of interest Other _____
11. Would you like to apply GIT / GIS software in the future? Yes May be No
12. What type of surveying /remote sensing / photogrammetric equipment do you use?
Choose all the relevant option(s) (more than one option is possible).
 Leveling Total stations GNSS Terrestrial Laser scanners UAV
 Aerial LiDAR Aerial optical cameras Mobile mapping
 Other _____

13. What type of surveying /GIS / photogrammetric software do you use?

Choose all the relevant option(s) (more than one option is possible).

- | | | |
|-------------------------------------------|-----------------------------------------------|----------------------------------------|
| <input type="checkbox"/> ArcGIS Desktop | <input type="checkbox"/> PostgreSQL, PostGis | <input type="checkbox"/> Agisoft |
| <input type="checkbox"/> ArcGIS Online | <input type="checkbox"/> AutoCAD | <input type="checkbox"/> SAS Planet |
| <input type="checkbox"/> Quantum GIS | <input checked="" type="checkbox"/> Micromine | <input type="checkbox"/> R-studio |
| <input type="checkbox"/> Google Earth Pro | <input type="checkbox"/> Erdas Imagine | <input type="checkbox"/> Collect Earth |
| <input type="checkbox"/> Mapinfo | <input type="checkbox"/> ENVI | <input type="checkbox"/> eCognition |
| <input type="checkbox"/> Other _____ | | |

14. What type of surveying /remote sensing / photogrammetric data sets do you use?

Choose all the relevant option(s) (more than one option is possible).

- | | |
|-------------------------------------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> Land surveying (GNSS, Totalstation etc.) | <input type="checkbox"/> DEM |
| <input type="checkbox"/> Landsat 4-8 | <input type="checkbox"/> Google Earth Pro; Google Map |
| <input type="checkbox"/> Sentinel-2 | <input type="checkbox"/> UAV |
| <input type="checkbox"/> WV, QuickBird | <input type="checkbox"/> Laser scanning data |
| <input type="checkbox"/> MODIS | <input type="checkbox"/> Topographic maps (1:10000-1:1000000) |
| <input type="checkbox"/> Aster | <input type="checkbox"/> Topographic/Thematic plans (1:500-1:5000) |
| <input type="checkbox"/> Sentinel-1 | <input type="checkbox"/> Other _____ |

15. What postgraduate level staff members with GIT competencies does your organisation need?

- MSc PhD (Candidate of Scs) Does not need

16. Did your company had GIT related project in the last 5 years? Yes No

If yes, in which application areas?

Choose all the relevant option(s) (more than one option is possible).

- Cadastre, land management
- Geodesy, cartography
- GIS
- Environmental studies, Earth observation
- Spatial decision making
- Deformation monitoring, Engineering geodesy
- Mining
- Disaster management, Emergency response
- Tourism
- Cultural heritage
- Location-based services, navigation, transportation
- Other _____

17. Which GIT related knowledge areas / skills do you find important from the below proposed?

Please indicate the importance with a mark on a 1-5 scale (5= means very important, not important at all=1)

<i>No</i>	<i>knowledge areas / skills</i>	<i>Importance</i>
1	Programming skills	
2	Data acquisition and data integration skills	
3	Cadastre and land information knowledge	
4	Spatial data infrastructure knowledge	
5	Spatial database management skills	



6	GIS knowledge and skills	
7	Spatial analysis knowledge	
8	UAV piloting, data acquisition and processing	
9	Geodetic measurements and survey using total stations	
10	Advanced GNSS positioning	
11	Knowledge on the geodetic reference systems	
12	Remote sensing knowledge	
13	Photogrammetric knowledge	
14	Skills in remote sensing/photogrammetric software	
15	Management skills	
16	Interdisciplinary skills	
17	International experience	
	Other, please specify	

18. Do you have relevant ongoing GIT projects / partnerships / activities at your organisation/company?

- a.
- b.
- c.

19. Would you be interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies? Yes No

20. In what way can your organisation/company contribute into this GeoTAK project?

- Advises Study visits Research data Internship Other _____

21. Would you employ a Geoinformatics MSc/PhD graduate in your company? Yes No
If yes, how many? 1-2 3-5 6 and more

22. Please, identify the main barriers in the use of geospatial information?

- Lack of GIT professionals Lack of education/professional training
 Expensive software/hardware Geospatial datasets are not available

Other: _____

23. Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions:

- Disaster management, emergency response Land survey, geodesy
 Land management and cadastre Spatial and urban planning
 Environmental management Agriculture
 Forestry Location-based services, transportation
 Tourism Cultural heritage
 Other: _____

24. Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future



25. Do you like to be actively involved in the GeoTAK project? Yes No
If „Yes”, please, write your email adress: _____

*Your feedback is very important for the further development of GeoTAK project!
The questionnaire is evaluated anonymously. Thank you for participating in our survey!*
Please, fill the questionnaire and return it to GeoTAK staff or by email: geotak.kg@gmail.com



Annex 2

Questionnaire for universities (in English language)

Dear Participant of the Questionnaire Survey!

This questionnaire is part of the GeoTAK project, which is an Erasmus+ project aiming to develop postgraduate Higher Education programmes in Geoinformation Technologies (GIT) and strengthen the links in research and innovation between Higher Education Institutions (HEI), industry and administration in Armenia and Kyrgyzstan. The questionnaire forms the foundation for identifying the market needs and significant development trends in the geospatial domain in the countries.

We believe that you are an important expert and/or stakeholder in the spatial data & geoinformatics domain. We would really appreciate if you could invest your time in completing this questionnaire, as only with your help we will be able to collect data and information relevant for our further planning and implementation of advanced postgraduate Higher Education programmes in Geoinformation Technologies (GIT) and strengthen the research and innovation activities in the domain.

Your participation in this survey is voluntary. If you decide to answer the questionnaire, we will consider this as your consent to participate in the survey. You can withdraw your participation at any time. We will take all possible measures to keep your personal information confidential. All the data collected will be aggregated and used exclusively for the purpose of the GeoTAK project.

We request you to answer questions by writing, typing or marking the specific checkbox .

We would greatly appreciate if you could complete the questionnaire as soon as possible and return it to GeoTAK staff or by e-mail: geotak.kg@gmail.com

If you have any questions, remarks, or comments about this questionnaire or any other issues regarding data collection and privacy protection, do not hesitate to contact us by email: geotak.kg@gmail.com.

Kind regards,

GeoTAK project team

QUESTIONNAIRE FOR UNIVERSITIES

1. Name of your university/institute: _____

2. Contact person (not required) Name: _____
E-mail: _____
Mobile phone: _____

3. Main academic and research activities at your university/institute:

Please, write the names of your BSc/MSc/PhD programmes on GIT related sciences

No	Level/Degree	Name of the programme
1	BSc	
2	MSc	
3	Aspirantura (Cand.Sc.)	
4	PhD	
5		
6		

4. Name 3 most important research areas at your institution with GIT used:

- a.
- b.
- c.

5. What kind of relevant ongoing GIT projects / partnerships / activities do you have at your university/institute?

- a.
- b.
- c.

6. What type of surveying /remote sensing / photogrammetric equipment do you use?

Choose all the relevant option(s) (more than one option is possible).

- Levels
 Total stations
 GNSS
 Terrestrial laser scanners
 UAV
 Aerial LiDAR
 Aerial optical cameras
 Mobile mapping
 Other _____

7. What type of surveying /GIS / photogrammetric software do you use?

Choose all the relevant option(s) (more than one option is possible).

- | | | |
|-------------------------------------------|----------------------------------------------|----------------------------------------|
| <input type="checkbox"/> ArcGIS Desktop | <input type="checkbox"/> PostgreSQL, PostGis | <input type="checkbox"/> Agisoft |
| <input type="checkbox"/> ArcGIS Online | <input type="checkbox"/> AutoCAD | <input type="checkbox"/> SAS Planet |
| <input type="checkbox"/> Quantum GIS | <input type="checkbox"/> Micromine | <input type="checkbox"/> R-studio |
| <input type="checkbox"/> Google Earth Pro | <input type="checkbox"/> Erdas Imagine | <input type="checkbox"/> Collect Earth |
| <input type="checkbox"/> Mapinfo | <input type="checkbox"/> ENVI | <input type="checkbox"/> eCognition |
| <input type="checkbox"/> Other _____ | | |

8. Is your university/institute interested in joining a National GIT Research Network which brings together universities, GIS scientists, national agencies, NGOs and companies??

Yes No I don't know

9. Number and qualification of the academic and research staff of your institution interested in GIT

<i>GIT related sciences</i>	<i>MSc</i>	<i>Cand.Sc. / PhD</i>	<i>Doctor of Sc.</i>
a. Geodesy, Surveying			
b. Cartography and Geoinformatics			
c. Land management and cadaster			
d. Remote sensing			
e. Geology and mining			
f. Environmental studies			
g. Other application areas			

10. Number of related study programs in your institution

<i>GIT related sciences</i>	<i>BSc</i>	<i>MSc</i>	<i>Cand.Sc. / PhD</i>
a. Geodesy, Surveying			
b. Cartography and Geoinformatics			
c. Land management and cadaster			
d. Remote sensing			
e. Geology and mining			
f. Environmental studies			
g. Other application areas			

11. What are the main difficulties/hinders for GIT Master/Doctoral (PhD) studies in the country?

Choose all the relevant option(s) (more than one option is possible).

- Lack of committed teachers and academic supervisors
- Lack of interested students or students with sufficient background knowledge
- Lack of knowledge on current Geoinformation Technologies
- Inadequate research funding
- Lack of research facilities and research centers
- Insufficient English language skills
- Lack of link/cooperation between university, research and industry
- Incompatible degree system
- PhD diplomas are not recognized by the National labor legislation
- Others: _____

12. Competences: Evaluate the importance of the following competences and skills, and the competence level presently at your institution (*grading from 1 to 5, where 5 corresponds to most important or very high level*)

<i>12 .1. Professional competences</i>	<i>Importance</i>	<i>Competence level</i>
1. Advanced skills in analyzing, integrating and managing spatial data		
2. Skills to design Geoinformation systems and services		
3. Ability for innovations in designing, managing and implementing GIT projects		
4. Ability to solve complex spatial problems in a global context		

5. Knowledge and skills to address challenges in defining and maintaining geodetic reference systems		
6. Ability to use, investigate limitations and possibilities of high accuracy GNSS positioning and navigation		
7. Deep insight on Earth's gravity field and the geoid and their applications in geodesy and earth sciences		
8. Knowledge and professional skills on the Remote sensing data collection and processing		
9. Others: _____		

<i>12.2. Research competences</i>	<i>Importance</i>	<i>Competence level</i>
1. Insight on current research activities in Geo-Information science and technology		
2. Ability to critically evaluate existing theories and technologies and identify the needs of further research for the improvement		
3. Ability for innovations in designing, managing and implementing GIT projects		
4. Ability to design scientific experiments, interpret experiment results and seek solutions based on sound scientific methods		
5. Ability to apply multi-disciplinary approaches to solve scientific problems		
6. Others: _____		

<i>12.3. Generic competences (soft skills)</i>	<i>Importance</i>	<i>Competence level</i>
1. Ability to communicate effectively in oral or written form to both specialist and non-specialist audiences		
2. Ability to choose and use the right social media for publishing and communicating		
3. Leadership skills and ability to work in a project team and in a multi-disciplinary environment		
4. Innovation and entrepreneurial skills to widely use research results and innovation ideas		
5. Ability to engage in life-long learning		
6. Awareness of ethical, economic and professional issues, as well as sustainable development issues		
7. Others: _____		

13. How important are the following courses which could support potential MSc/PhD students?
(grading from 1 to 5, where 5 corresponds to most important)



Course title	Importance
1. Spatial data science	
2. Scientific research methodology and methods	
3. Research paper writing and communication	
4. Introduction to geospatial programming	
5. Applied mathematics and statistics	
6. Coordinate systems in geodesy	
7. Advanced geoinformation technologies	
8. Integrated positioning and navigation	
9. Physical geodesy	
10. Remote sensing applications in land and environmental management	
11. Spatial data infrastructures	
12. Image processing methods for geospatial analysis	
13. Selected chapters in advanced geodesy	
14. Geospatial data quality (with theory of errors)	
15. Advances of geospatial data modeling	
16. Contemporary methods and technology of remote sensing in geology	
21. Others: _____	

14. Please, identify the main barriers in the use of geospatial information?

- Lack of GIT professionals Lack of education/professional training
 Expensive software/hardware Geospatial datasets are not available

Other: _____

15. Please, select the application fields that, based on your work and experience, GIT is currently urgently needed in your country and require advanced solutions:

- Disaster management, emergency response Land survey, geodesy
 Land management and cadaster Spatial and urban planning
 Environmental management Agriculture
 Forestry Location-based services, transportation
 Tourism Cultural heritage
 Other: _____

16. Please, describe the GIT areas that, based on your work and experience, you consider the most promising in your country in terms of employment expectation in the near future

17. Do you like to be actively involved in the GeoTAK project? Yes No

If „Yes”, please, write your email address: _____

*Your feedback is very important for the further development of GeoTAK project!
The questionnaire is evaluated anonymously. Thank you for participating in our survey!
Please, fill the questionnaire and return it to GeoTAK staff or by email: geotak.kg@gmail.com*