Monday, 31 July 2023, 15:00 - 17:00
Conference Room A (Conference bldg.)
United Nations Headquarters, New York

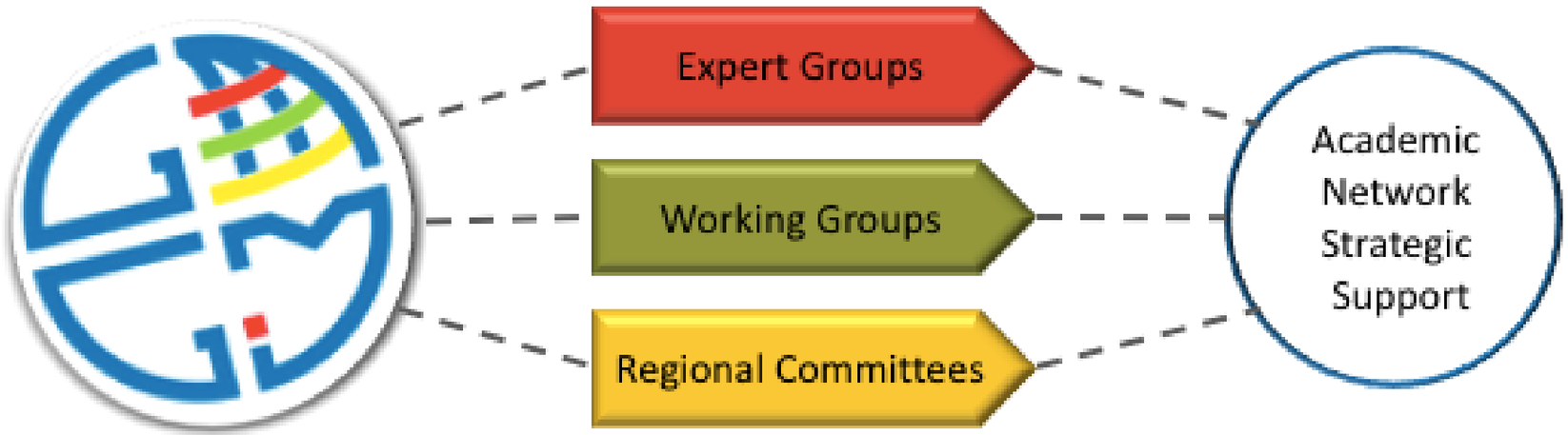
GEOAI: Opportunities and Challenges

The outcome of the two surveys of the UN GGIM AN

Prof. Maria Antonia Brovelli
Chair of the UN-GGIM Academic Network
Politecnico di Milano
on behalf of the UN GGIM AN Executive Board (Songnian Li, Ivana Ivanova)

UN-GGIM Academic Network

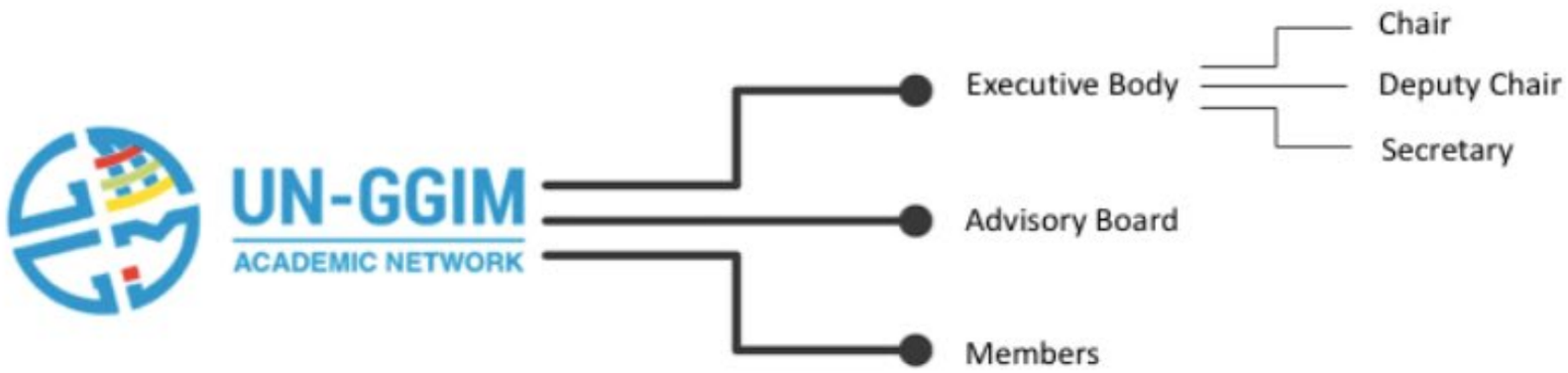
- Academic Network is a Strategic Knowledge, Research, and Training Arm of UN-GGIM.
- The Network is a coalition of recognized universities, research, and education centers or equivalent involved in the research, development, and training on geospatial and land information and related matters.



UN-GGIM Academic Network

- Promote and foster collaboration between universities and research groups.
- Encouraging members to undertake work that contributes to the Sustainable Development Goals of the UN.
- Forum of geospatial academics and researchers with the objective to advance competencies and qualifications needed for the UN-GGIM.
- Communication platform for member countries to bring to the Network's attention their key problems, needs, and areas of research.
- Capacity building and developing an inventory of international education programs open to and recommended for UN-GGIM actors.

UN-GGIM Academic Network Executive Committee



Executive Committee

Chair

Maria Antonia Brovelli
Politecnico di Milano
(Italy)

Deputy Chair

Songnian Li
Toronto Metropolitan University
(Canada)

Secretary

Ivana Ivánová
Curtin University
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UN-GGIM Academic Network Advisory Board

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Southwest Jiaotong University
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National Technical University of Athens
(Greece)

Michael Starek
Texas A&M University-Corpus Christi
(USA)

UN-GGIM Academic Network

- 66 members + 2 associate members
- 38 countries

Motivation for the GEOAI Surveys

- Geomatics and Earth Observation AI (GEOAI) refers to applying artificial intelligence (AI) methods, such as deep learning and machine learning, to process and analyze geospatial data. This allows us to better understand the physical world and our interactions with it at different levels, from individual to global. **AI can extract insights and patterns from geospatial data that traditional techniques may not be able to find**.
- Although the importance of integrating geospatial information and artificial intelligence is widely recognized, **there is currently no shared syllabus and body of knowledge (BoK) within the geospatial sector**. GEOAI and data science solutions often use ideas and models from multiple disciplines. While one can't be an expert in all relevant areas, a foundational understanding of different perspectives is really valuable for geospatial AI practitioners.
- Therefore, defining a syllabus is urgently needed to provide structure, clarify expectations, and help with planning courses related to GEOAI. **A syllabus also helps to highlight the importance of GEOAI and the relevance of geospatial data in this emerging field.**

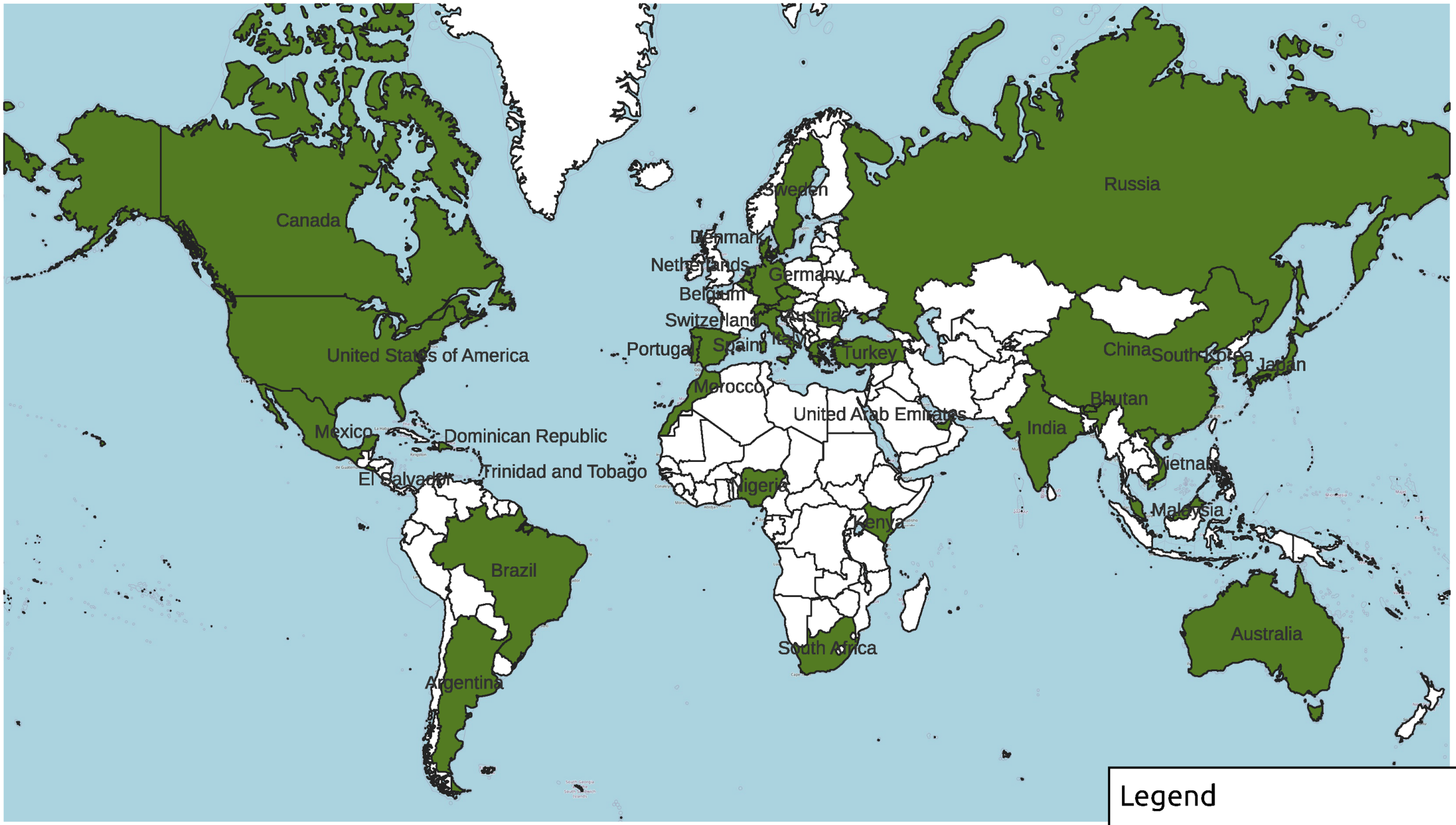
Motivation for the GeoAI Surveys

- On the other hand, providing a body of knowledge in GEOAI is crucial to **establishing a common language and understanding of key concepts, principles, and techniques**.
- This promotes **effective communication and collaboration** among researchers, practitioners, and stakeholders in this field.
- It also promotes **best practices** in the collection, analysis, and interpretation of geospatial data and their integration with AI techniques.
- The curriculum should be an integrative framework to prepare the next generation of students and GEOAI professionals to tackle complex challenges that can only be solved with a holistic and interdisciplinary approach like GEOAI.

Motivation for the GeoAI Surveys

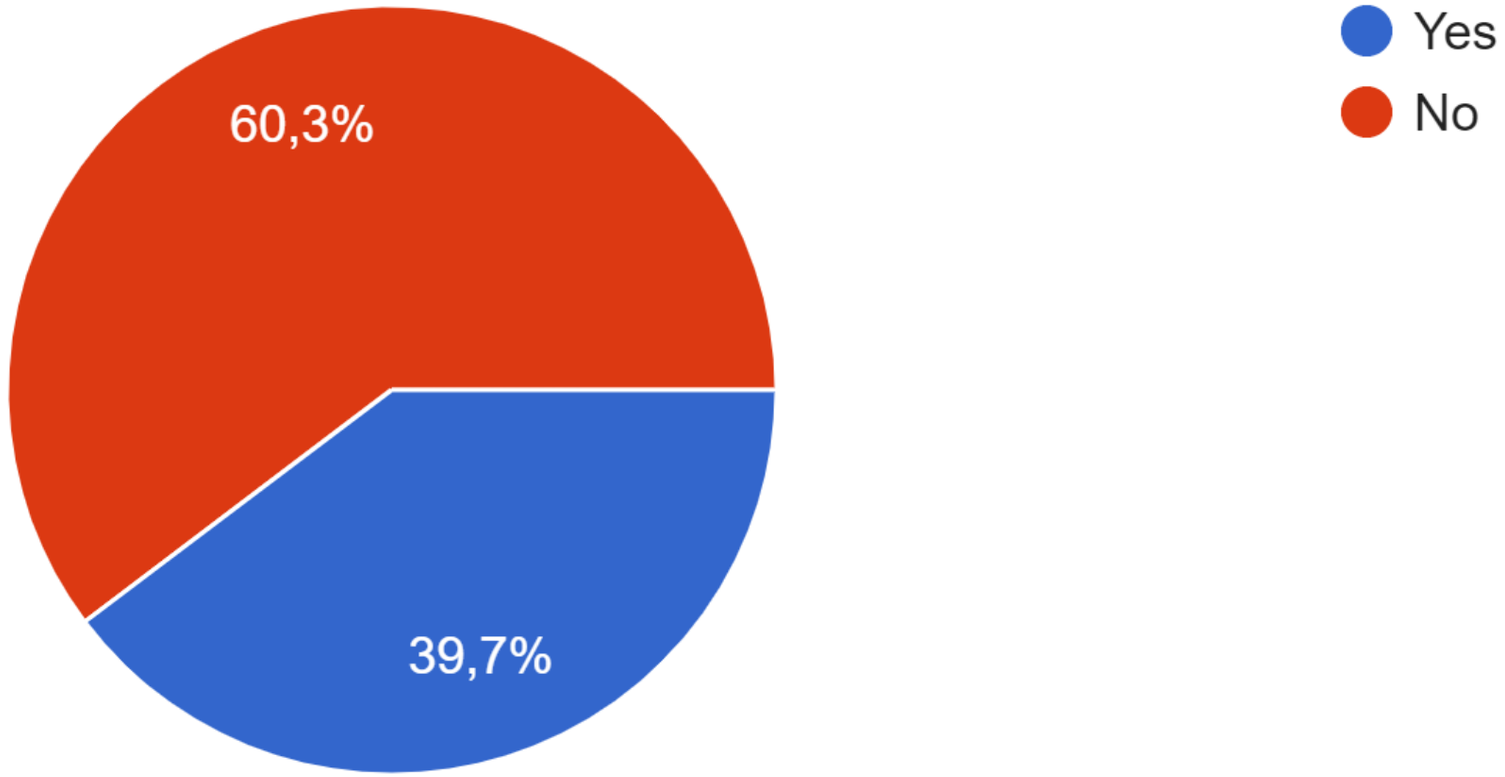
- Such a body of knowledge would **enable further innovation and creativity in the development of new techniques, tools, and applications,** leading to more breakthroughs in this field.
- Most importantly, **it supports education and training programs** by providing a framework for curriculum development and assessment.
- Finally, a body of knowledge **facilitates decision-making in policy, planning, and management**, allowing decision-makers to use geospatial data and AI techniques to address complex social, economic, and environmental challenges in a more effective and efficient manner.

The Survey to the Universities – 70 Participants



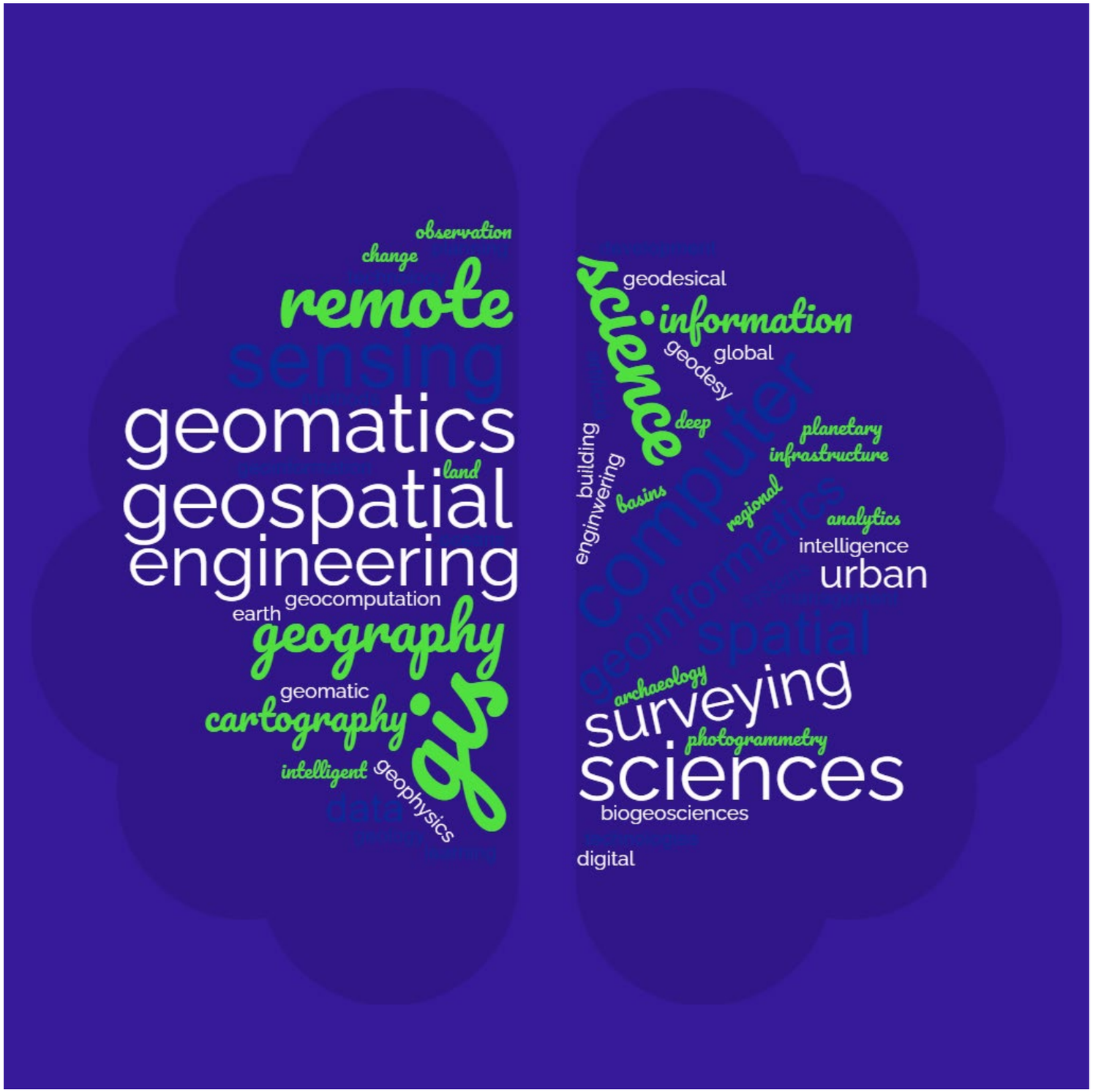
The Survey to the Universities

Is your University a member of the UN-GGIM Academic Network?



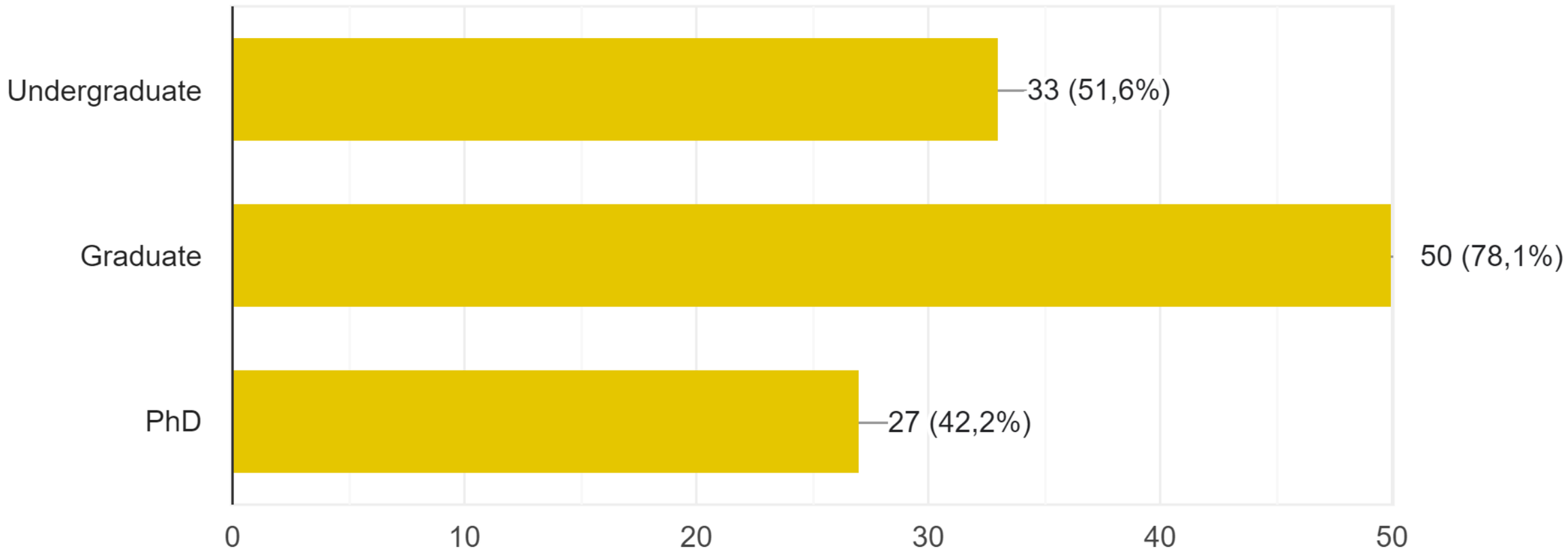
The Survey to the Universities

In which program(s) in your university the GEOAI courses are offered?



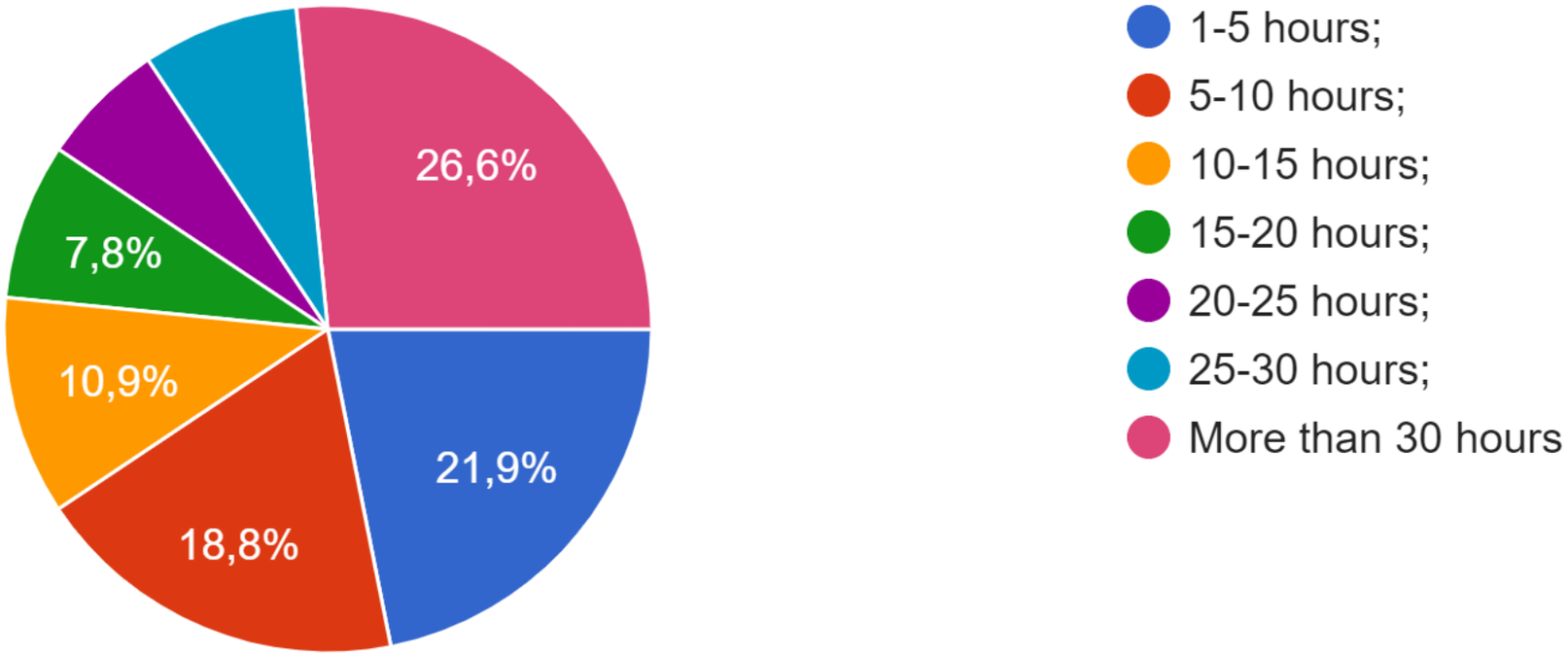
The Survey to the Universities

Which are the targeted students?



The Survey to the Universities

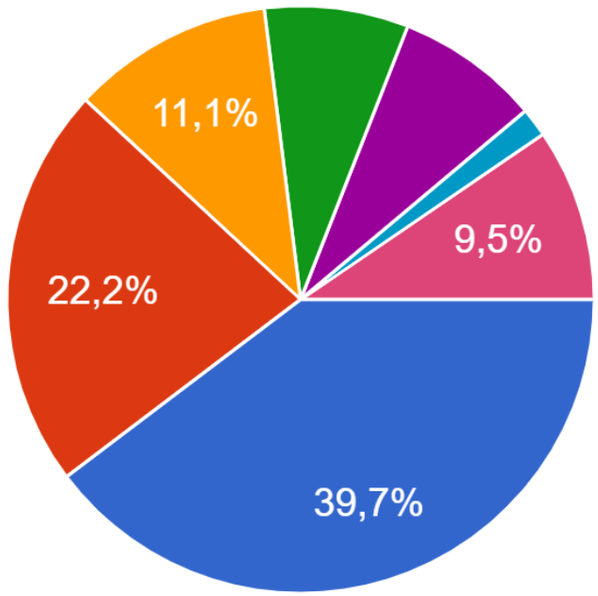
How many teaching hours are dedicated in your University to Geospatial AI (GEOAI = Geomatics and Earth Observation Artificial Intelligence)?



The Survey to the Universities

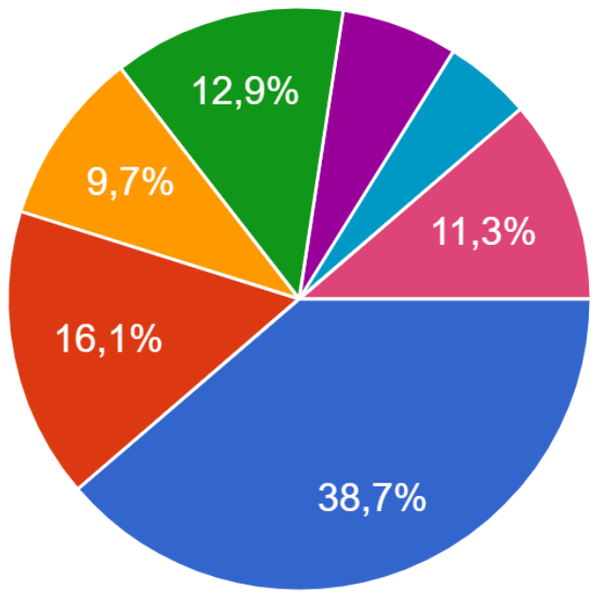
How many of them are theoretical lessons?

63 risposte



How many of them are practice/training/lab lessons?

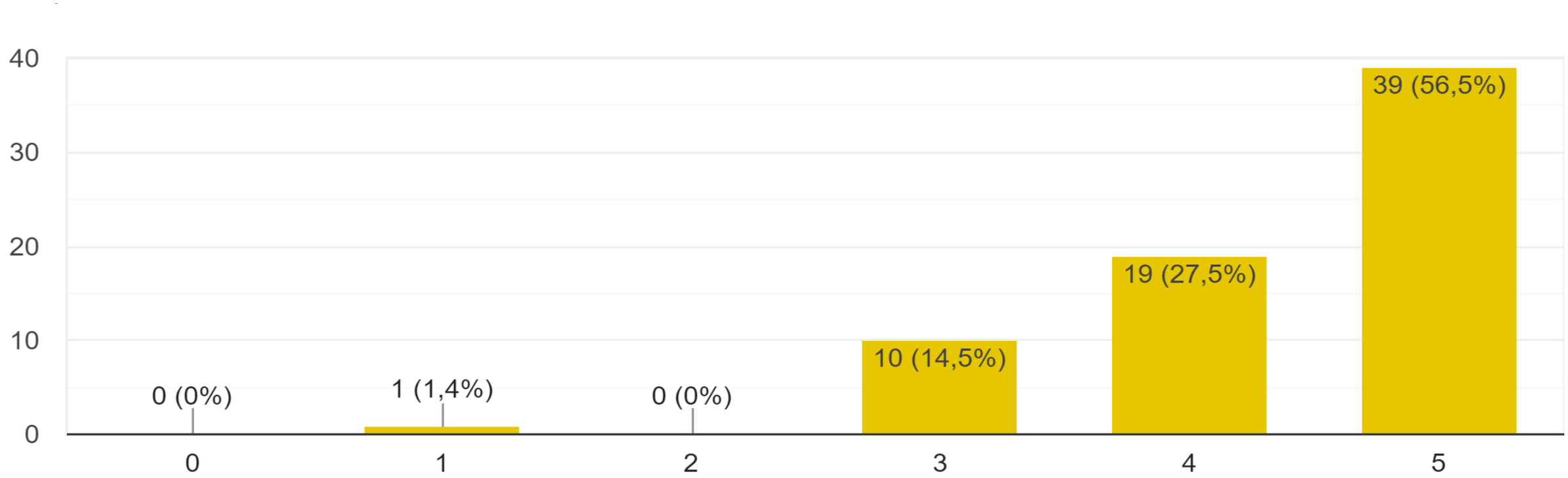
62 risposte



- 1-5 hours;
- 5-10 hours;
- 10-15 hours;
- 15-20 hours;
- 20-25 hours;
- 25-30 hours;
- More than 30 hours

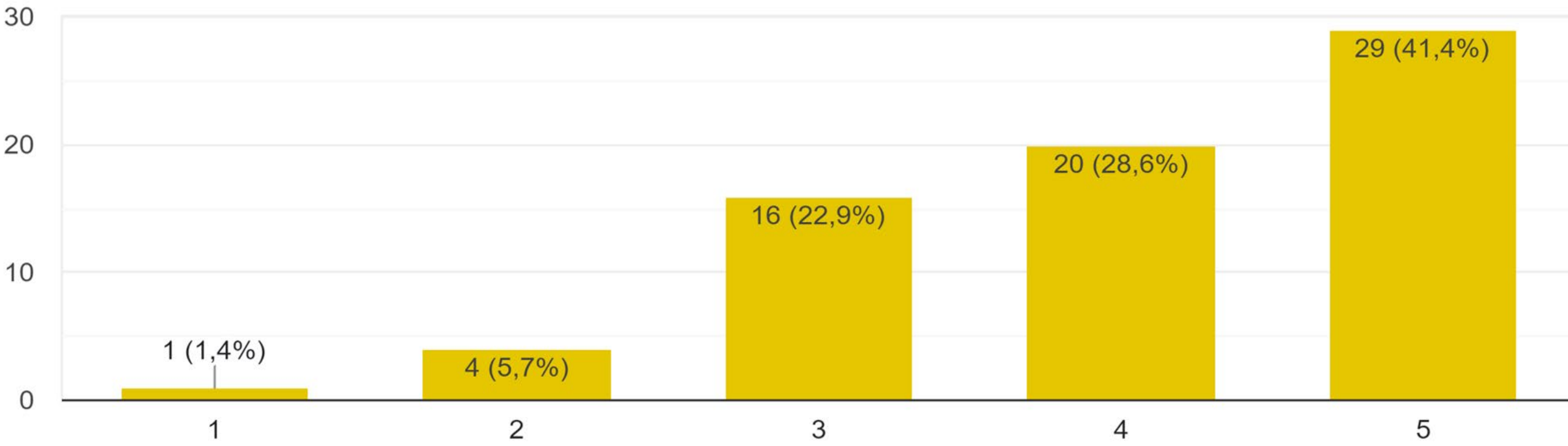
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how do you evaluate the introduction of GEOAI as a new subject in your University?



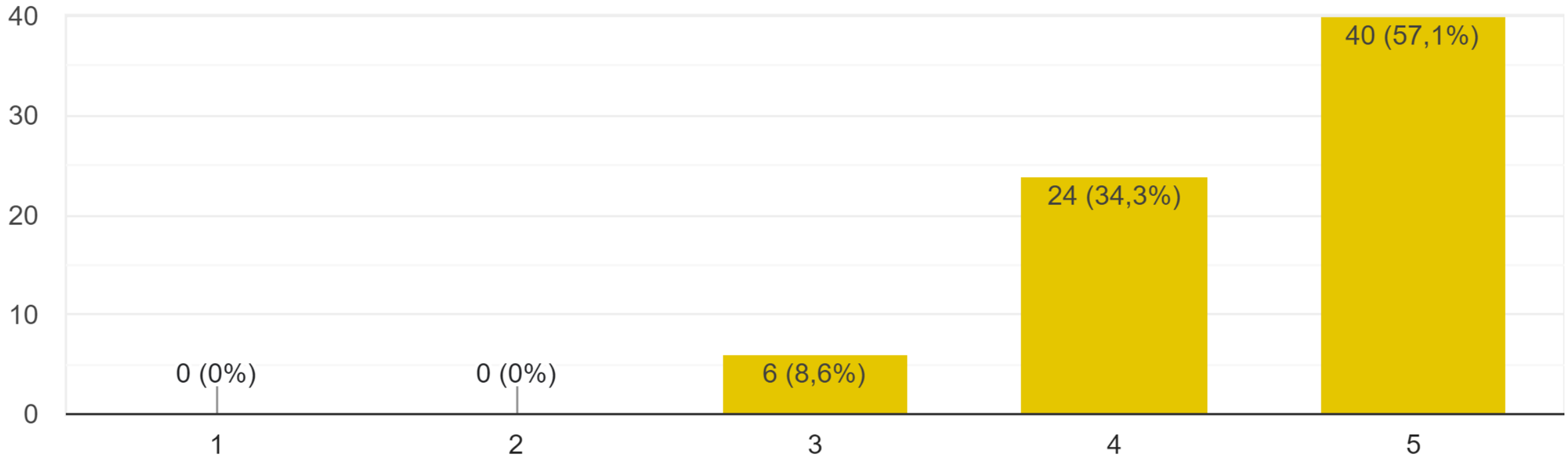
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to:
Ethics and GEOAI



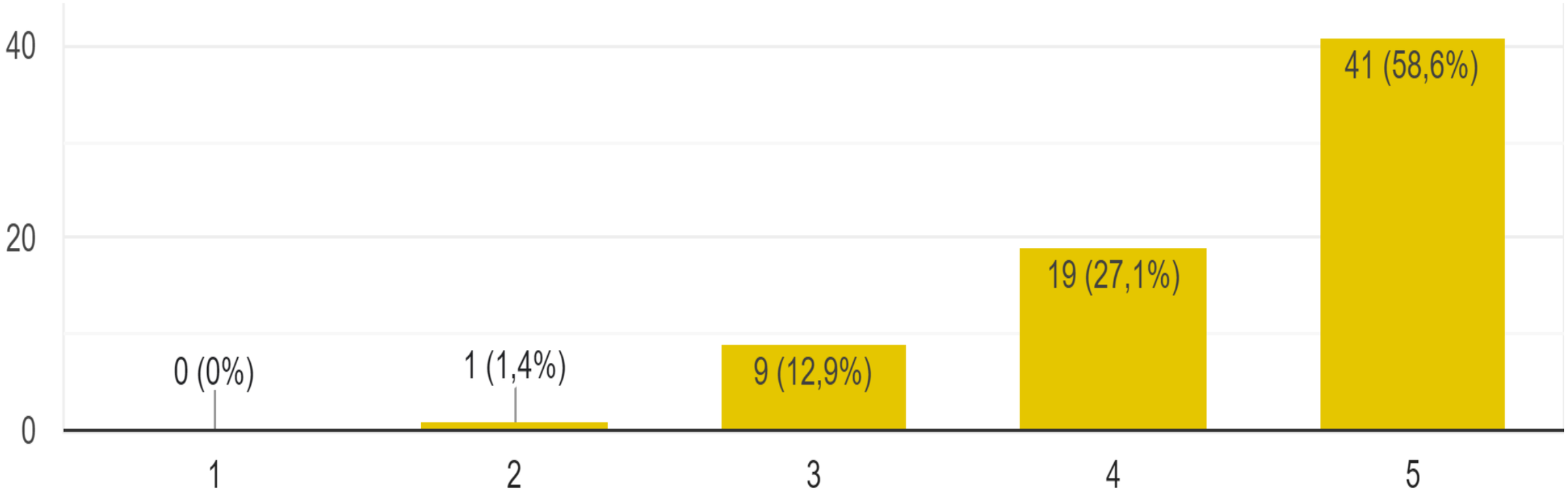
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **Open Geospatial Data for training the machines (data, metadata, quality of data)**



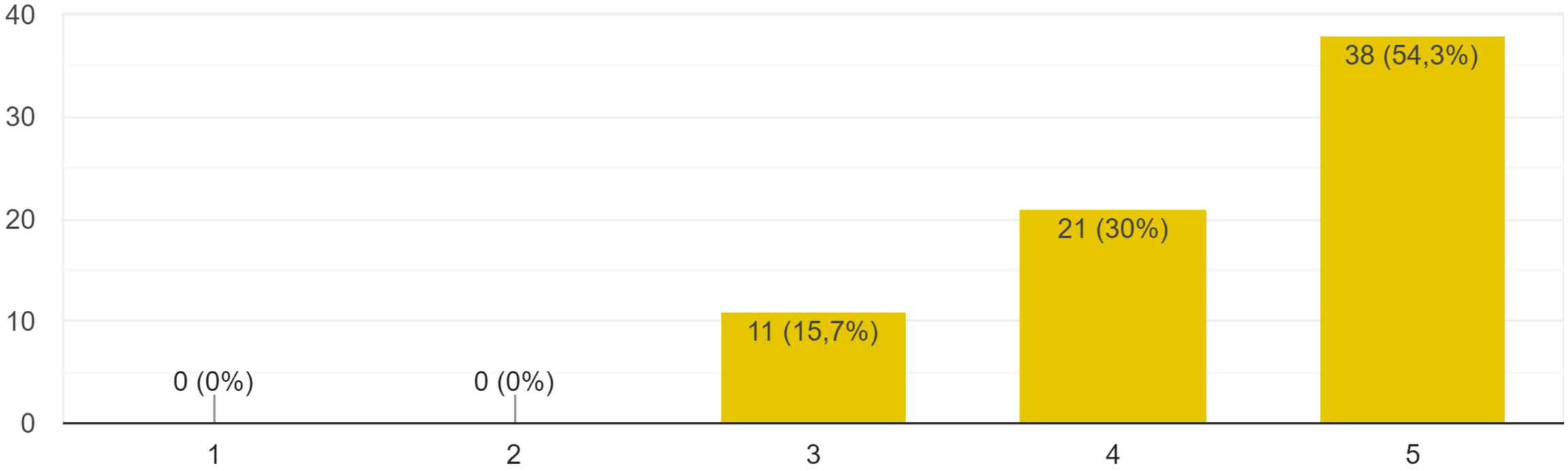
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **Machine Learning Algorithms (Unsupervised, Supervised, Reinforcement)**



The Survey to the Universities

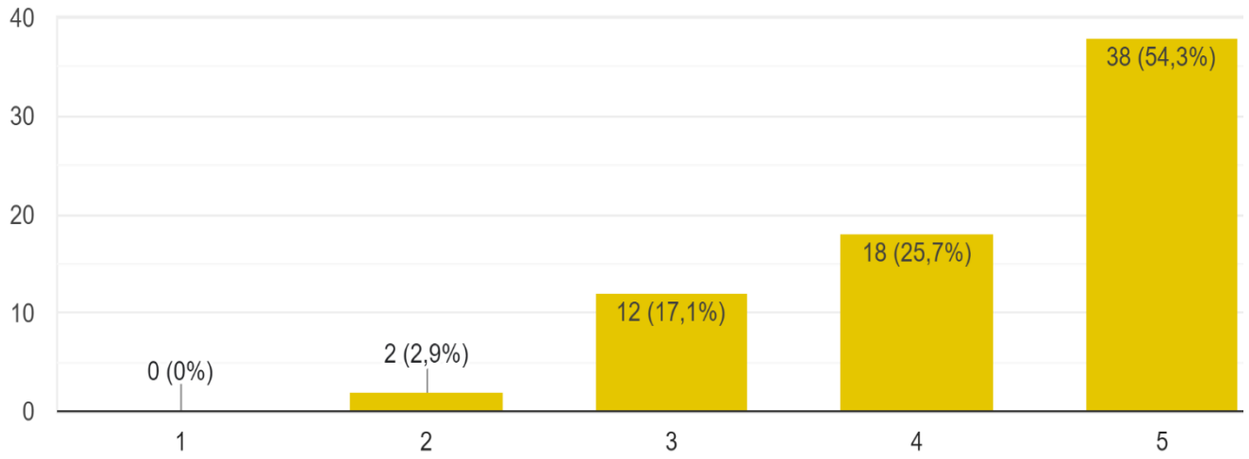
On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **Machine Learning Geospatial Applications**



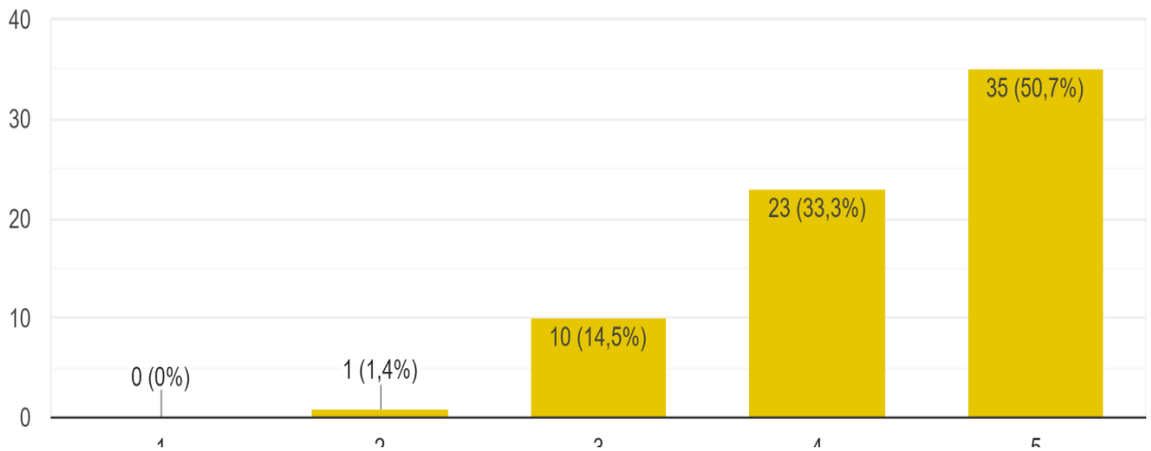
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to:

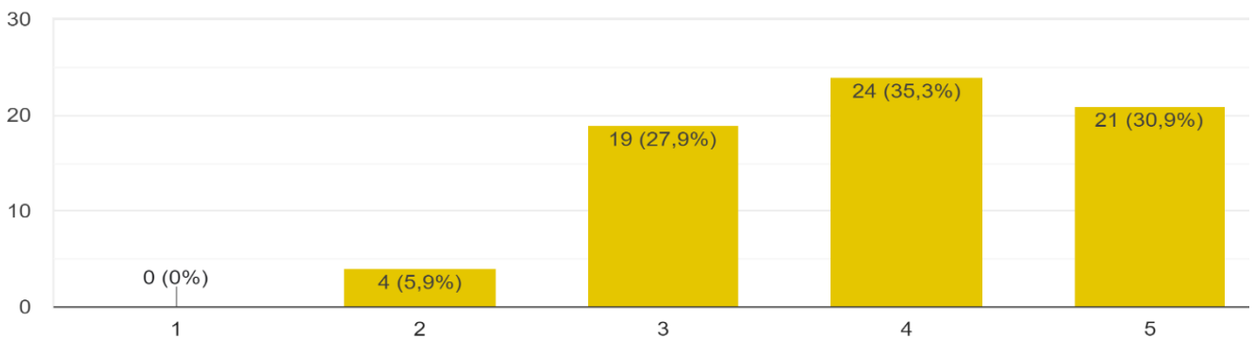
Deep Learning & ANN



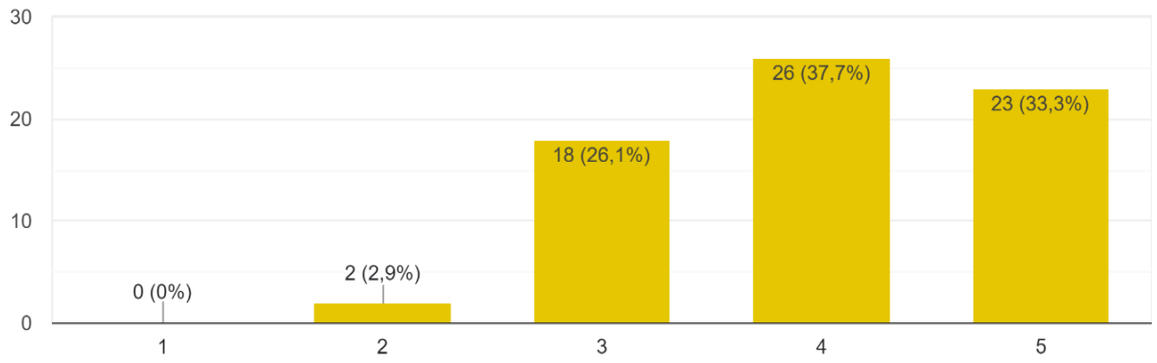
Deep Learning G Applications



Reinforcement Learning



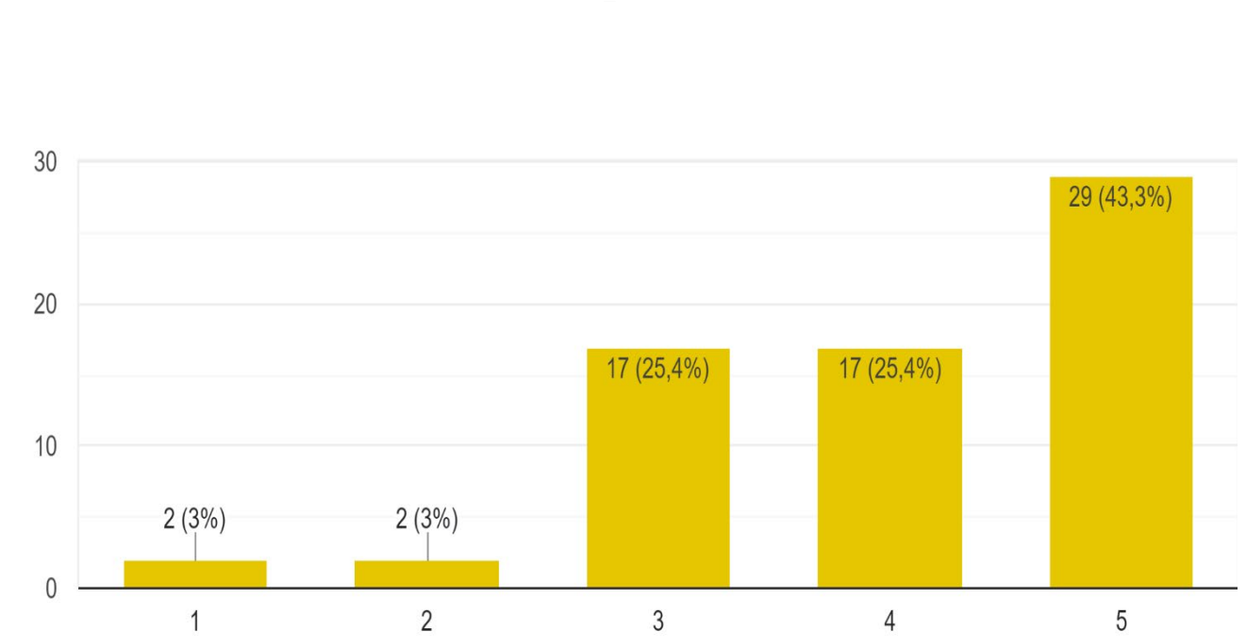
Reinforcement Learning G Applications



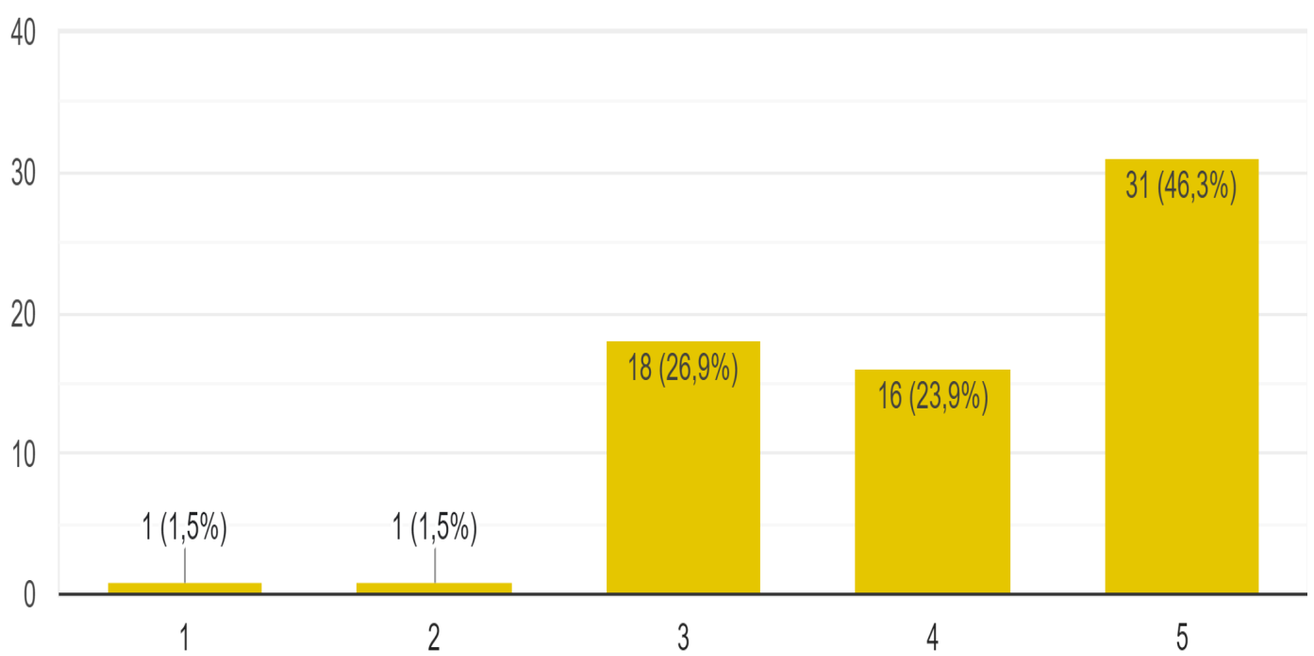
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to:

Programming languages for AI

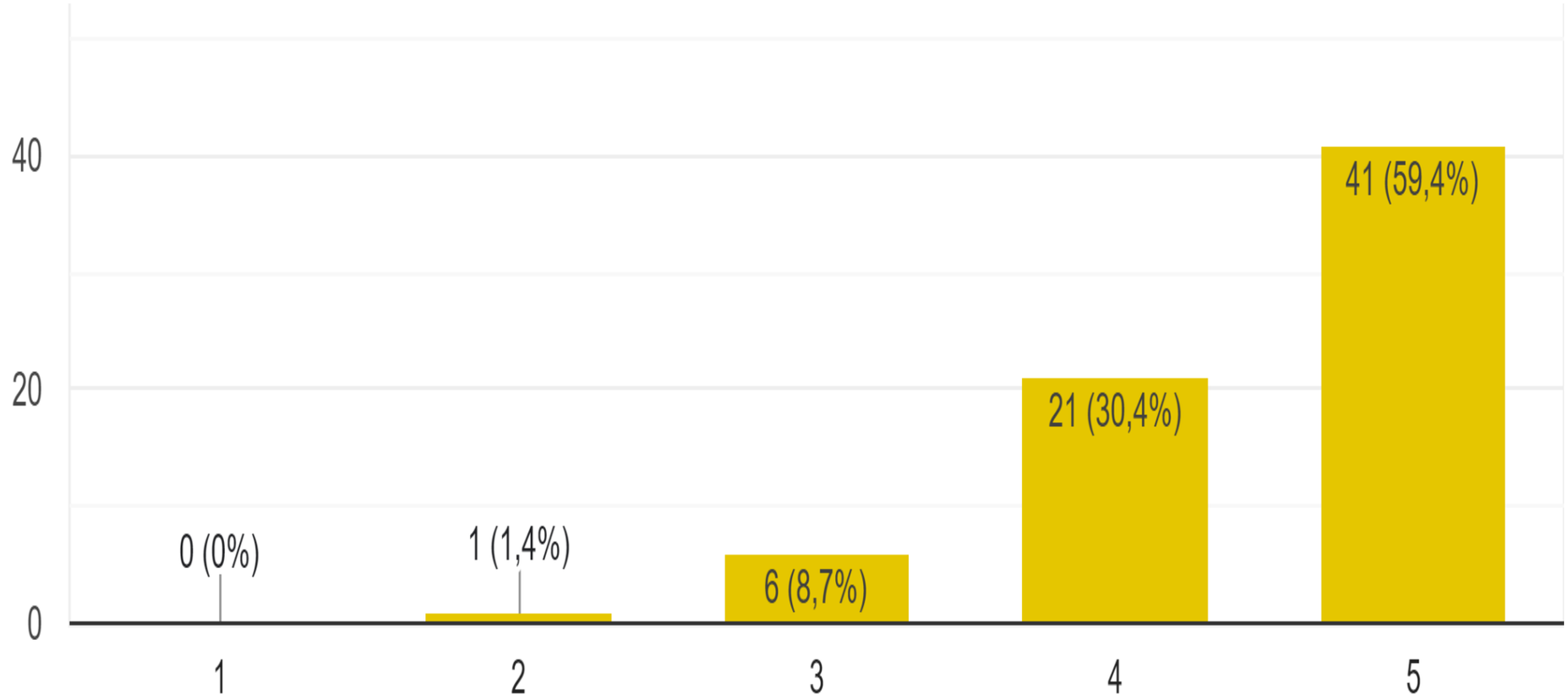


AI frameworks (e.g.: TensorFlow,Scikit-Learn, Pytorch)



The Survey to the Universities

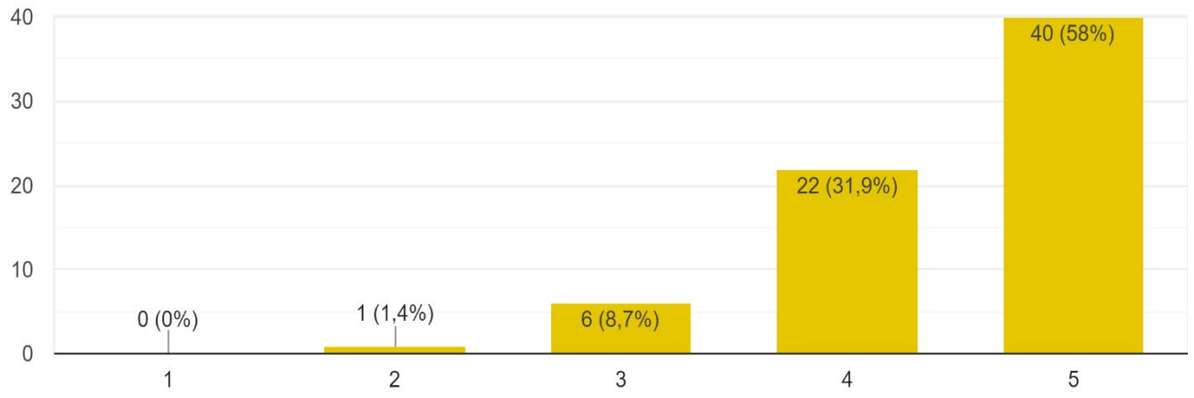
On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **Applications of AI in the various domain of Geomatics and Earth Observation**



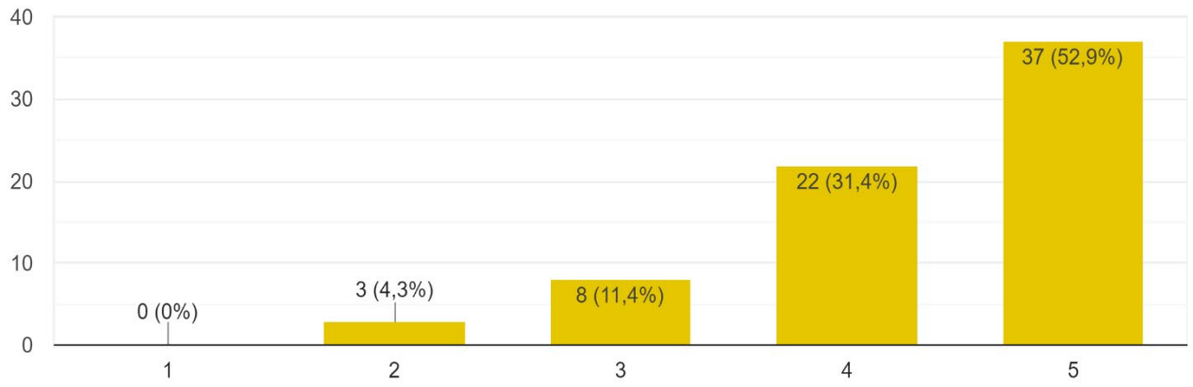
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to:

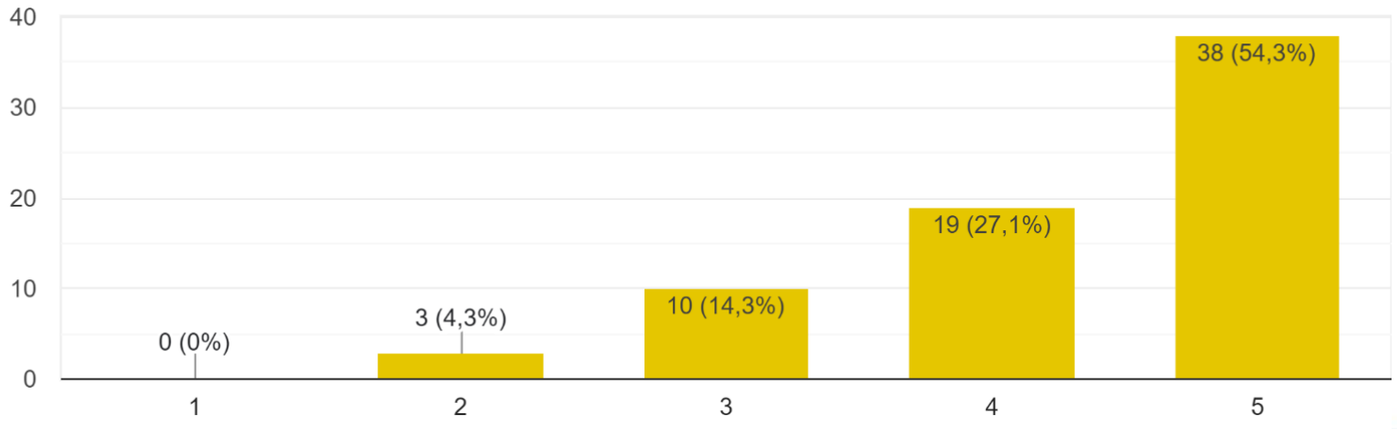
GEOAI Performance & Reliability



GEOAI Uncertainty Quantification



GEOAI trustworthiness

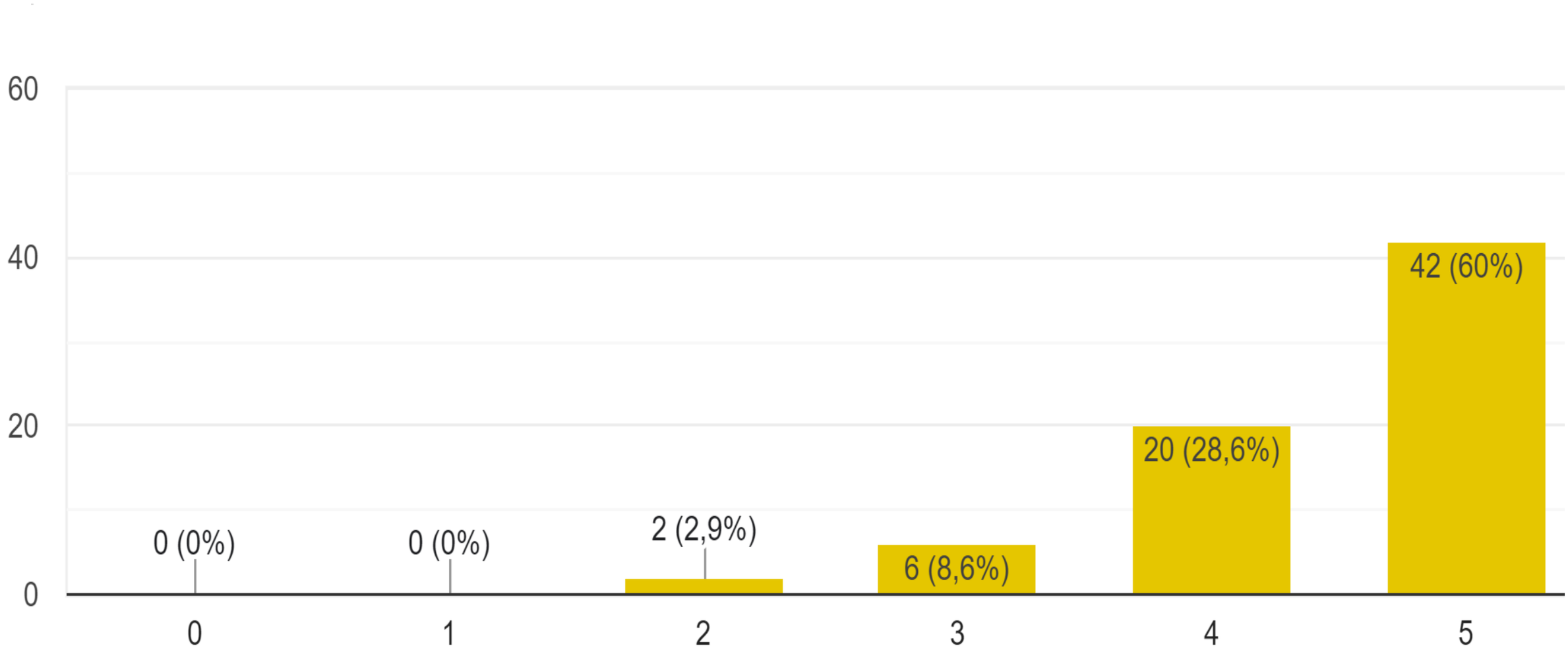


The Survey to the Universities: what was Missing?

- *“Use of cloud platforms available i.e. GEE”*
- *“How to choose the best ML methods for a particular task/problem.”*
- *“GIT”*
- *“I feel **Data Privacy and Licensing** of Geospatial Information”*
- *“GIS Applications in Urban Planning, our University teaches, we need to teach GeoAI in a different manner. Our answers are based on the experience of teaching and reception/reaction received by the students at large.”*
- *“AI in interrelationship mapping; AI in geospatial validation process”*
- *“Software Development”*
- *“providing proper metadata/documentation for GeoAI products (e.g. data, training data, products, algorithms, workflows)”*
- *“Ethics”*
- *“A **multi-disciplinary collaboration** is required”*

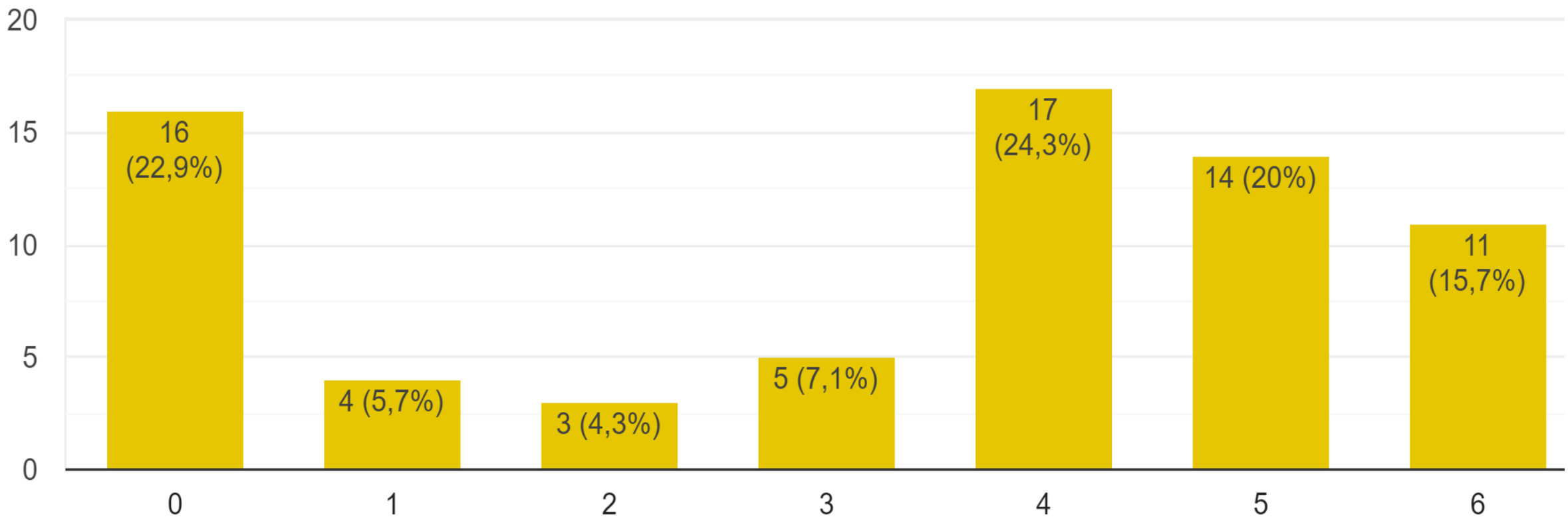
The Survey to the Universities

On a scale from 0 (not important) to 5 (extremely necessary and timely), how important is it to build a Foundation for Geospatial AI, i.e. defining a Syllabus and Body of Knowledge?

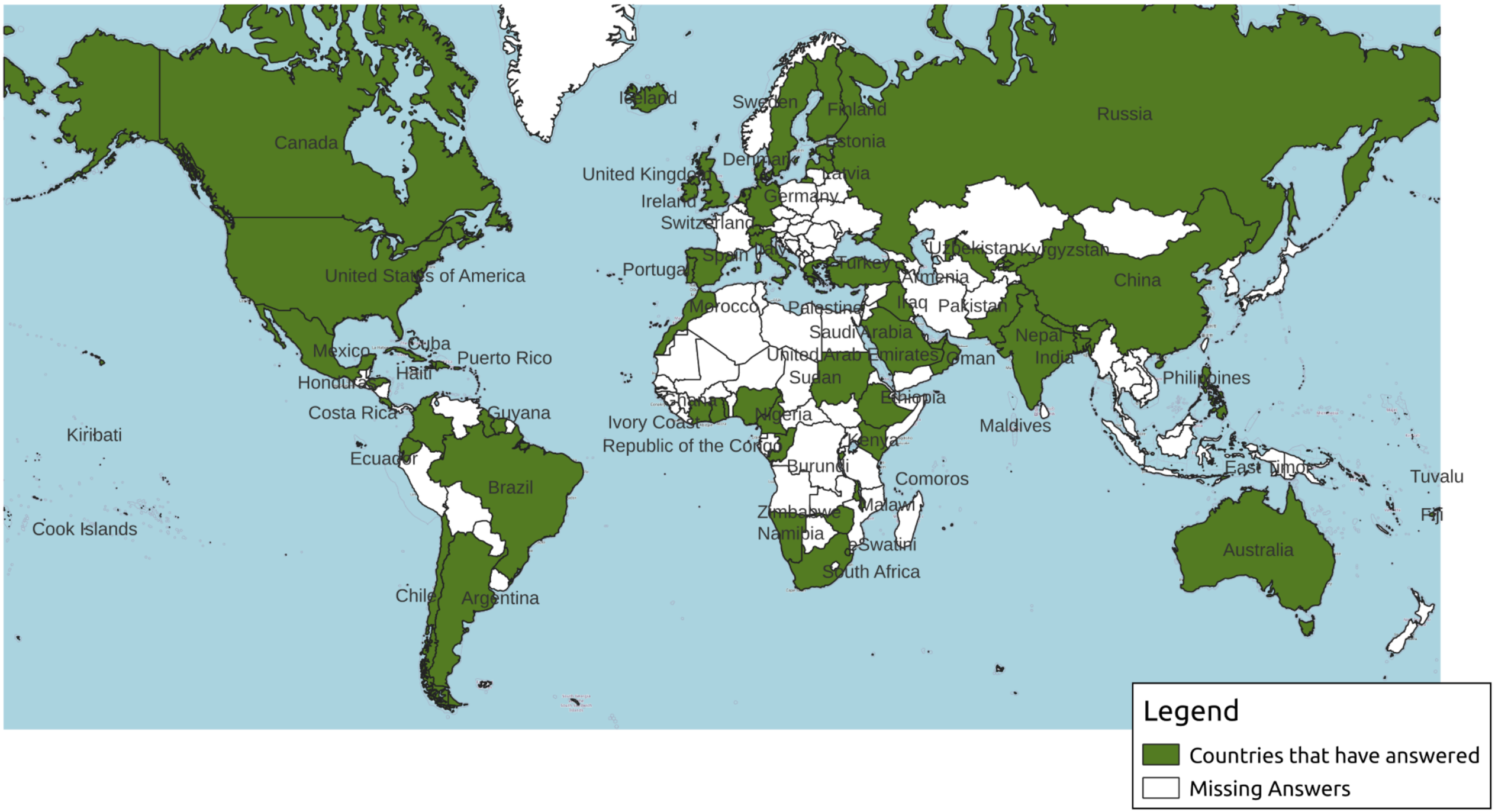


The Survey to the Universities

Is there an expectation of your students being taught GeoAI? (1 - no expectation; 6 - extremely strong expectation; If you have no clue about that, choose 0, which stands for “I don’t know”)

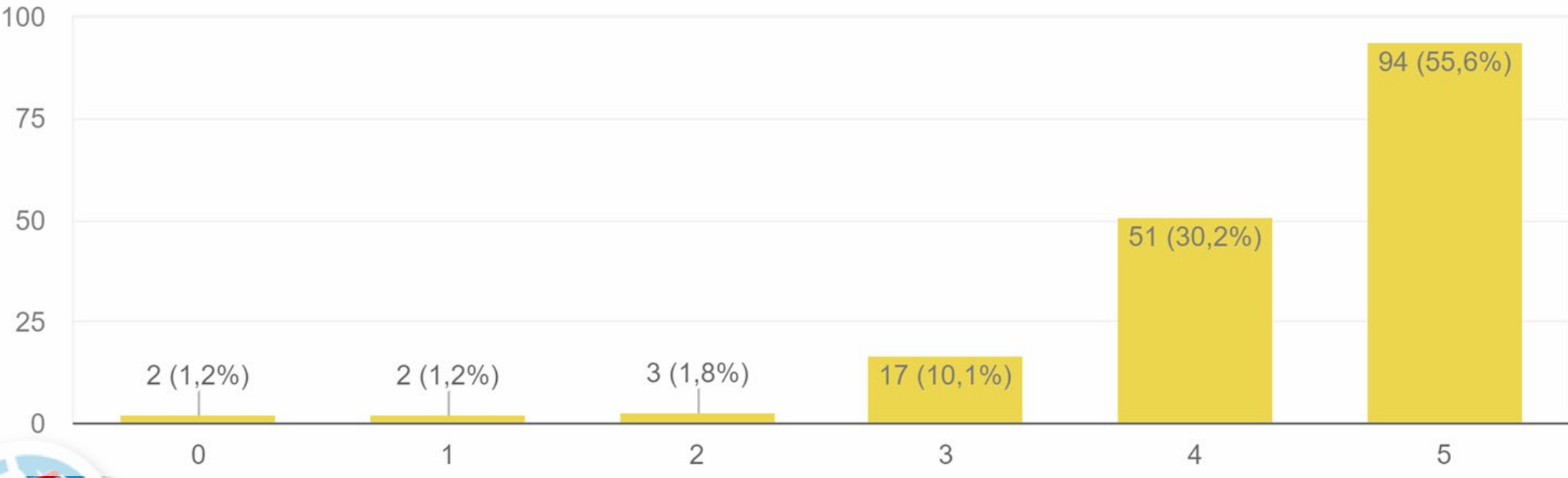


The Survey to the Member States – 169 Participants



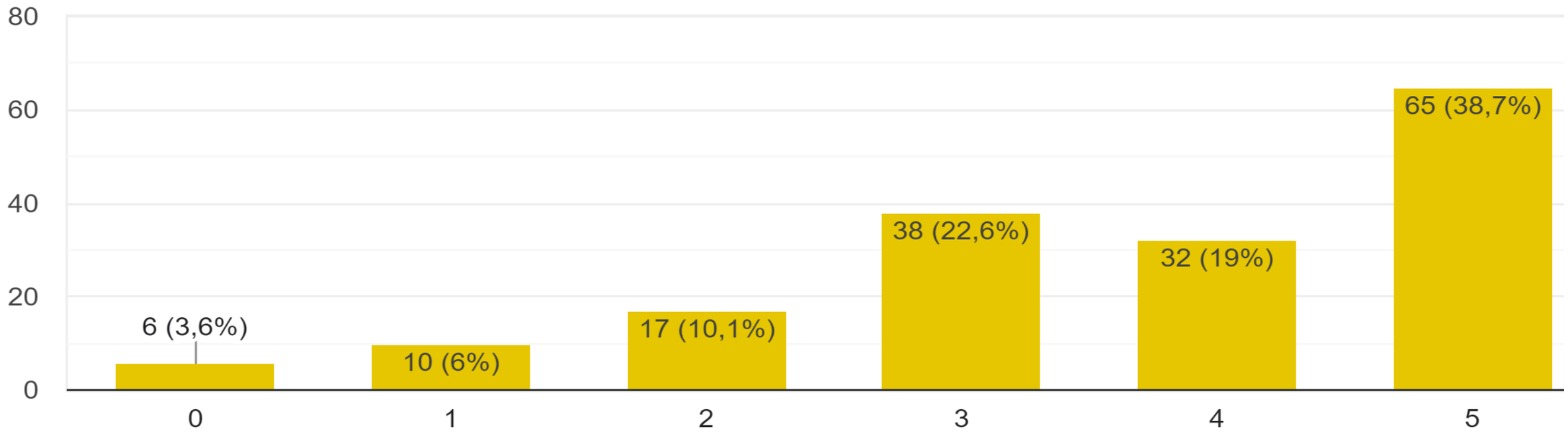
The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), do you believe that GEOspatial AI (or GEOAI, i. e. Artificial Intelligence applied in the Geospatial and Earth Observation domain and to Geospatial/Earth Observation data) can **improve** the **provision, effectiveness and value** of the existing geospatial procedures, products and services?



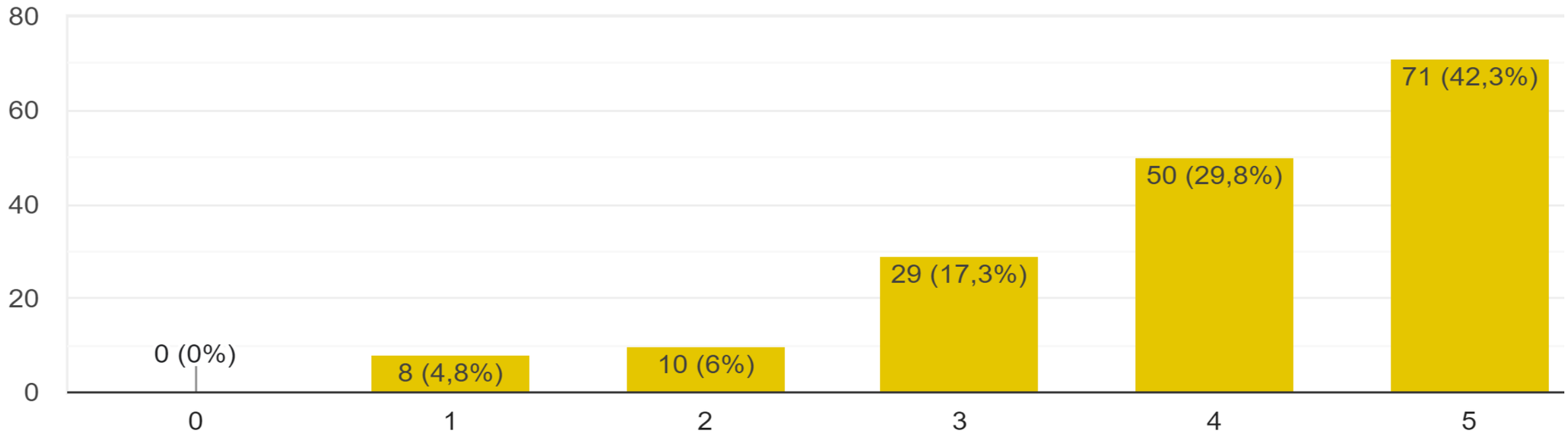
The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), how ready and prepared should the public sector of your country be in **managing and developing** GEOAI-related projects, products and services?



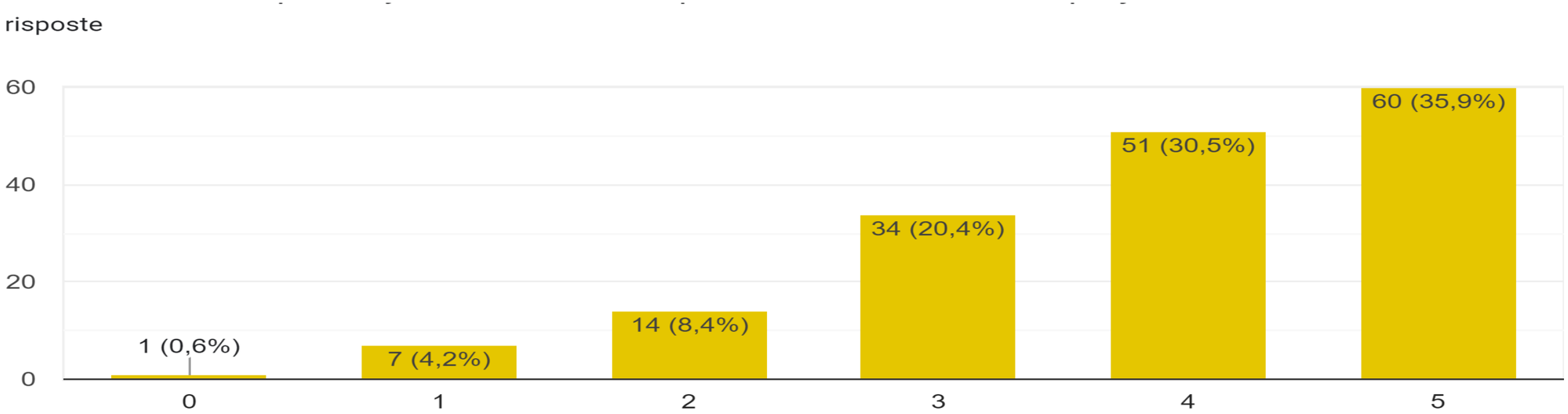
The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **understand the foundations and state of art of GEOAI technologies**



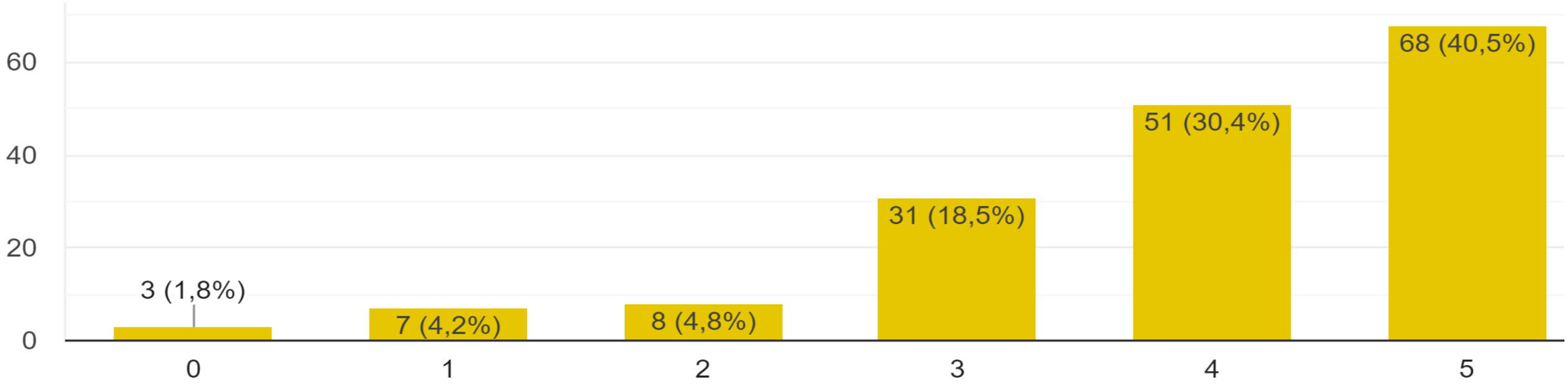
The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **understand the complete cycle for the development of GEOAI-related projects**



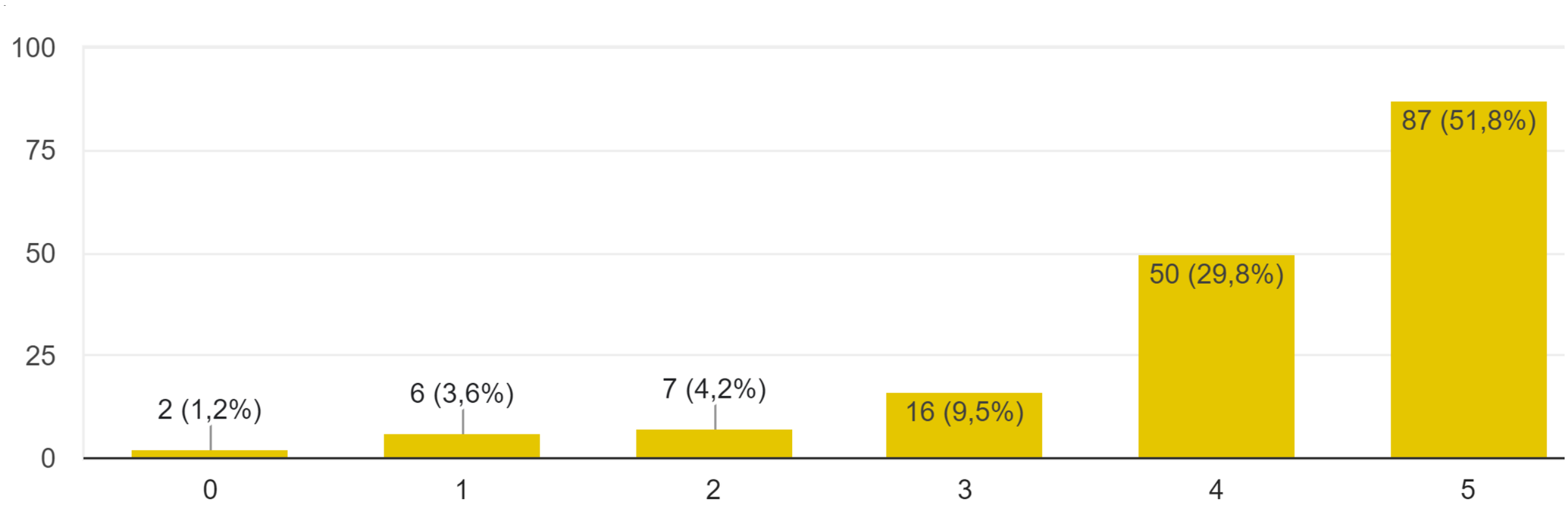
The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), how much is the need for **capacity building** related to: **understand the complete cycle for the delivery of GEOAI-related public services**



The Survey to the Member States

On a scale from 0 (not important) to 5 (extremely necessary and timely), how do you evaluate the **introduction of GEOAI as a new subject in universities**?



AI For Good

What it will take for AI to work with geospatial data?

Speaker(s)

Nadine Alameh
Open Geospatial Consortium (OGC)

Maria Antonia Brovelli
Politecnico di Milano

Barbara Ryan
World Geospatial Industry Council (WGIC)

Moderator(s):

Andrea Manara
International Telecommunication Union (ITU)

AI For Good

5 July 2023

In person and Online

Building a foundation for geospatial AI: defining a syllabus and body of knowledge - *updated on June 15th*

14:00 - 17:30

Maria Antonia Brovelli (Politecnico di Milano), **Andrea Manara** (ITU), **Andrew Zolli** (Planet)...

Workshop

https://www.youtube.com/watch?v=acHUM7vb8o4

5 July 2023

In person and Online

The role of AI in tackling climate change and its impacts: from science to early warning - *updated on June 25th*

09:00 - 17:30

Markus Reichstein (Max Planck Institute for Biogeochemistry), **Gustau Camps-Valls** (Universitat de València), **Philip Stier** (University of Oxford)...

Workshop

14 June 2023

GeoAI Education

15:30 - 17:00

Lokendra Chauhan (Qen Labs Inc), **Ali Mansourian** (Lund University), **Ming-Hsiang Tsou** (SDSU)...

Discovery - GeoAI

GeoAI Education - YouTube

20 April 2023

Synergy between geography and mapping with the nation's energy mission

16:00 - 17:30

Budhu L Bhaduri (ORNL), **Maria Antonia Brovelli** (Politecnico di Milano)

Discovery - GeoAI

16 December 2022

2022 ITU GeoAI Cropland Mapping Challenge Finale

16:00 - 17:00

Kyoung-Soo Eom (United Nations), **Zhongxin Chen** (FAO), **Maria Antonia Brovelli** (Politecnico di Milano)...

12 December 2022

2022 ITU GeoAI Location Mention Recognition Challenge Finale

16:30 - 17:40

Reem Ali Suwaileh (Qatar University), **Andrea Manara** (ITU), **Reinhard Scholl** (ITU)...

Discovery - GeoAI

30 November 2022

Harnessing AI to manage climate risk

17:00 - 17:30

Aditya Khosla (IBM), **Andrew Thut** (IBM), **Campbell Watson** (IBM)...

Perspectives

28 September 2022

AI in Earth observation

17:00 - 18:30

Laurent Durieux (GEO), **Philip Stier** (University of Oxford), **Xiao Xiang Zhu** (Technical University of Munich)...

Discovery - AI and Climate Science

21 September 2022

GeoAI and the digital transformation of agriculture, water and food systems

16:00 - 17:30

Andrea Manara (ITU), **Maria Antonia Brovelli** (Politecnico di Milano), **Zhongxin Chen** (FAO)...

Discovery - GeoAI

AI For Good

28 June 2022

Launch of the ITU GeoAI Challenge

15:30 - 17:30

Andrea Manara (ITU), **Zhongxin Chen** (FAO), **Do-Hyung Kim** (UNICEF)...

Discovery - GeoAI

27 June 2022

GeoAI and Health

16:00 - 17:30

Andrea Manara (ITU), **Nadine Alameh** (OGC), **Ajay K Gupta** (HSR.health)...

Discovery - AI and Health, Discovery - GeoAI

23 June 2022

The future of GeoAI for Good with Google Earth Engine

17:00 - 18:00

Barbara Ryan (WGIC), **Rebecca Moore** (Google), **Maria Antonia Brovelli** (Politecnico di Milano)...

Discovery - GeoAI

7 June 2022

Spatial Digital Twins and AI: Racing into the Future

16:00 - 18:00

Peter Atalla (VoxelMaps, Inc), **Nicolaus Hanowski** (ESA), **Omar Maher** (ESRI)...

Discovery - GeoAI

26 April 2022

Climate action and GeoAI: Innovative applications for climate change mitigation and adaptation

16:00 - 18:00

Barbara Ryan (WGIC), **Andrea Manara** (ITU), **Adina Gillespie** (GHGSat)...

Discovery - GeoAI

30 - 31 March 2022

Meeting of the Focus Group on "Artificial Intelligence (AI) and Internet of Things (IoT) for Digital Agriculture" (FG-AI4A)

13:00 - 16:00

Ramy Ahmed Fathy (National Telecom Regulatory Authority, Egypt), **Sebastian Bosse** (HHI)

ITU Focus Group

29 March 2022

Analyzing the Amazon Deforestation with Machine Learning and the Google Earth Engine – Part 2

15:00 - 17:30

Maria Antonia Brovelli (Politecnico di Milano), **Vasil Yordanov** ('Vasil Levski' National Military University)

Discovery - GeoAI

15 March 2022

Analyzing the Amazon Deforestation with Machine Learning and the Google Earth Engine – Part 1

15:00 - 17:30

Maria Antonia Brovelli (Politecnico di Milano), **Vasil Yordanov** ('Vasil Levski' National Military University)

Discovery - GeoAI

22 February 2022

Where ethics and geospatial AI meet

16:00 - 17:30

Barbara Ryan (WGIC), **Caroline Gevaert** (University of Twente), **Amina Al Sherif** (Anno.ai)...

Discovery - GeoAI

AI For Good

1 February 2022

What it will take for AI to work with geospatial data?

16:00 - 17:30

Barbara Ryan (WGIC), **Lokendra Chauhan** (Qen Labs Inc), **Maria Antonia Brovelli** (Politecnico di Milano)...

Discovery - GeoAI

27 October 2021

AI and digital technologies for the future of climate

17:00 - 18:30

Hendrik Hamann (IBM), **Solomon Assefa** (IBM), **Philip Stier** (University of Oxford)...

Discovery - AI and Climate Science

11 May 2021

Workshop: Satellite data analysis and machine learning classification with QGIS – Part 2

14:00 - 16:00

Gorica Bratic (Politecnico di Milano), **Maria Antonia Brovelli** (Politecnico di Milano)

Discovery - GeoAI, Webinar

27 April 2021

Workshop: Satellite data analysis and machine learning classification with QGIS – Part 1

14:00 - 16:00

Gorica Bratic (Politecnico di Milano), **Maria Antonia Brovelli** (Politecnico di Milano)

Discovery - GeoAI, Webinar

13 April 2021

Geospatial AI/ML applications and policies – A global perspective

16:00 - 17:30

Arnout Desmet (TomTom), **Barbara Ryan** (WGIC), **Jim Van Rens** (Riegl International)...

Discovery - GeoAI, Webinar

13 October 2020

How can artificial intelligence reduce disaster risks in countries?

11:00 - 12:30

Adam Fysh (UNDRR), **Bilel Jamoussi** (ITU), **Muralee Thummarukudy** (UNEP)...

Webinar

AI For Good: Open Challenges

GEOAI Challenge 2023

Compute platform

ITU provides a state-of-the-art, free-of-charge compute platform to participants of the Challenge who do not have adequate access to compute in their respective institutions. The compute platform will provide participants with access to:

- Free GPUs and CPUs
- Hosted Jupyter notebook server
- Python kernel
- Pre-installed machine learning packages, e.g. PyTorch and Tensorflow

GeoAI Challenge Timeline

7 July 2023
Start

31 October 2023
Deadline Project

30 November
Evaluation

December
Challenge Finale

The GeoAI Challenge features five problem statements

Landslide Susceptibility Mapping

Develop ML algorithms that can analyze large dataset to identify patterns indicating high probability of landslide occurrence and create a landslide susceptibility map.

Curated by **GEOlab at Polytechnic di Milano**

LEARN MORE

Cropland Mapping

Develop accurate, cost-effective classification model for cropland extent mapping with ML techniques in three test regions.

Curated by **UNODC** (United Nations Office on Drugs and Crime) and **FAO** (Food and Agriculture Organization of the United Nations)

LEARN MORE

Air Pollution Susceptibility Mapping

Implement a machine learning method which can accurately estimate the pollution levels (AQI) of the metropolitan city of Milan

Curated by **GEOlab at Polytechnic di Milano**

COMING SOON

The Hyperview Challenge

Estimating soil parameters from hyperspectral images.

Curated by **ESA** (European Space Agency)

COMING SOON

Location Mention Recognition (LMR)

This challenge aims at automatically extracting toponyms (places or location names) from the given text.

Curated by **QCRI** (Qatar Computing Research Institute), **QU** (Qatar University), and **Qen Labs Inc.**

COMING SOON

[GeoAI Challenge - AI for Good (itu.int)]

Thank you!

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