Assessment of Workforce Demands to Shape GIS&T Education

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GI-N2K

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Outline

Motivation | High quality curriculum development

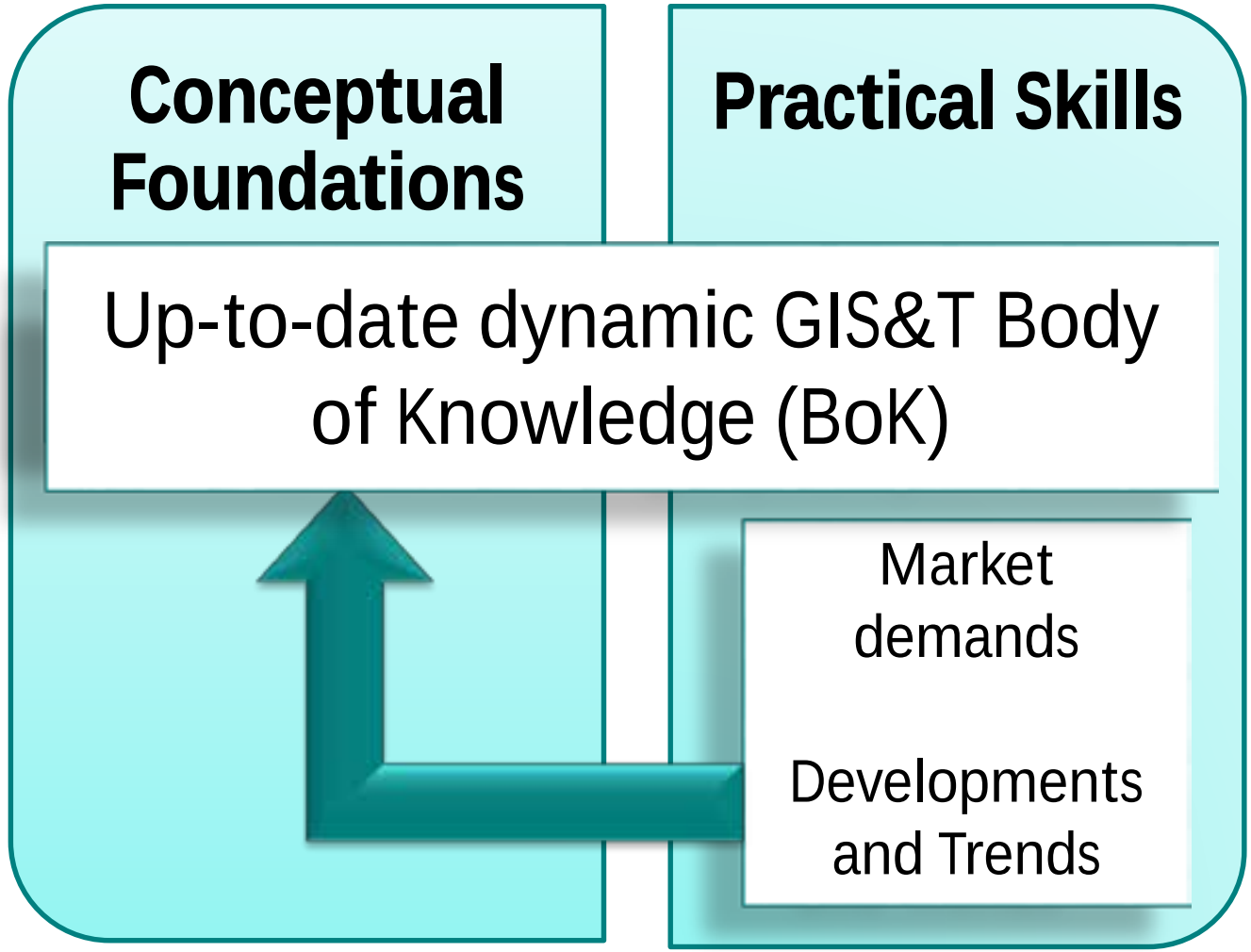
Background | Body of Knowledge

Survey | Rating of GIS&T competences

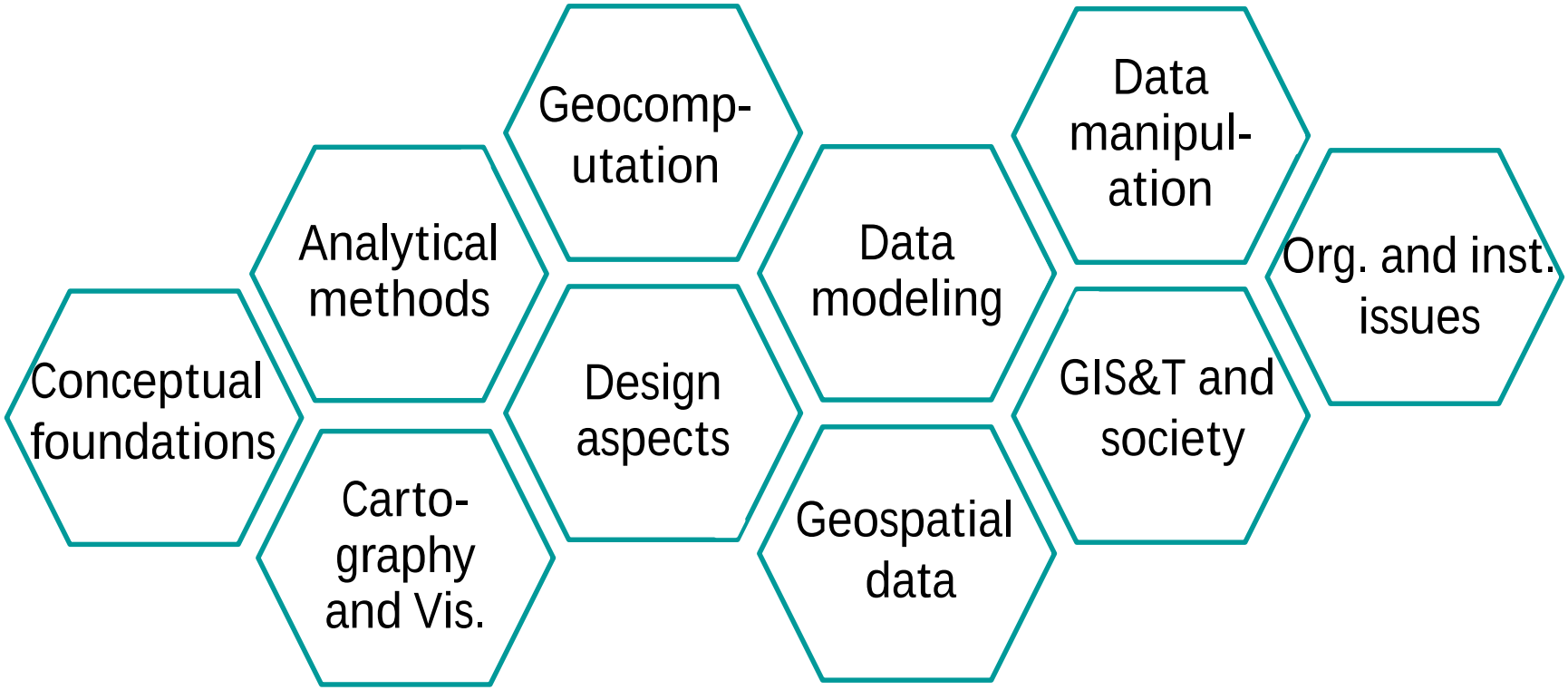
Results | Differentiation by organization type, EQF level

Open Issues | Technological trends vs. GI principles

BoK for Curriculum Development



GIS&T Body of Knowledge



Hierarchical structure: knowledge areas > units > topics

Assessment of Workforce Demand

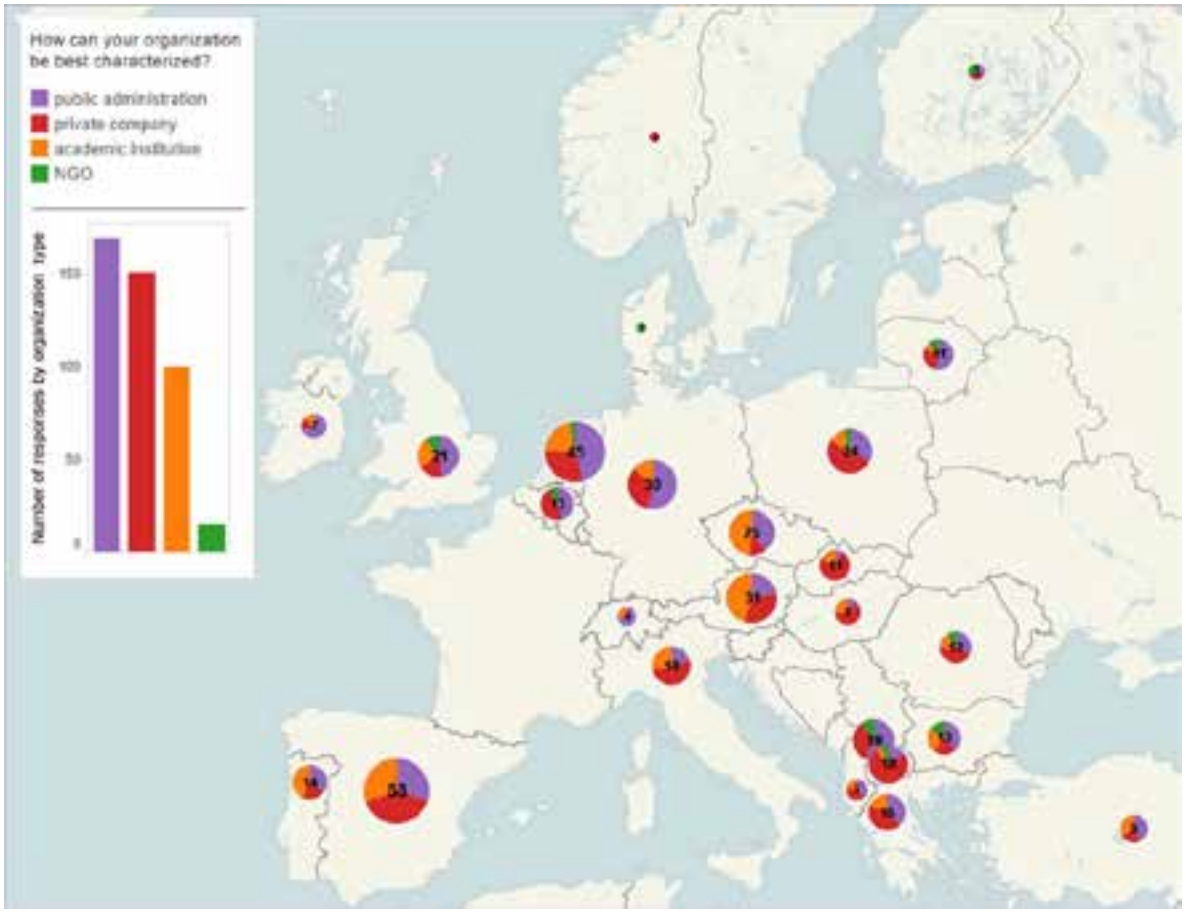
European-wide online survey on workforce demand

- Traget group: GIS&T professionals
  - Organizational type
  - Level of education (European qualification framework EQF)

Survey structure

- Frequently performed tasks (three keywords)
- **Rating of BoK knowledge areas** : How important have the following competences been in your professional work during the last 3 years?
- Competences important in future (three keywords)

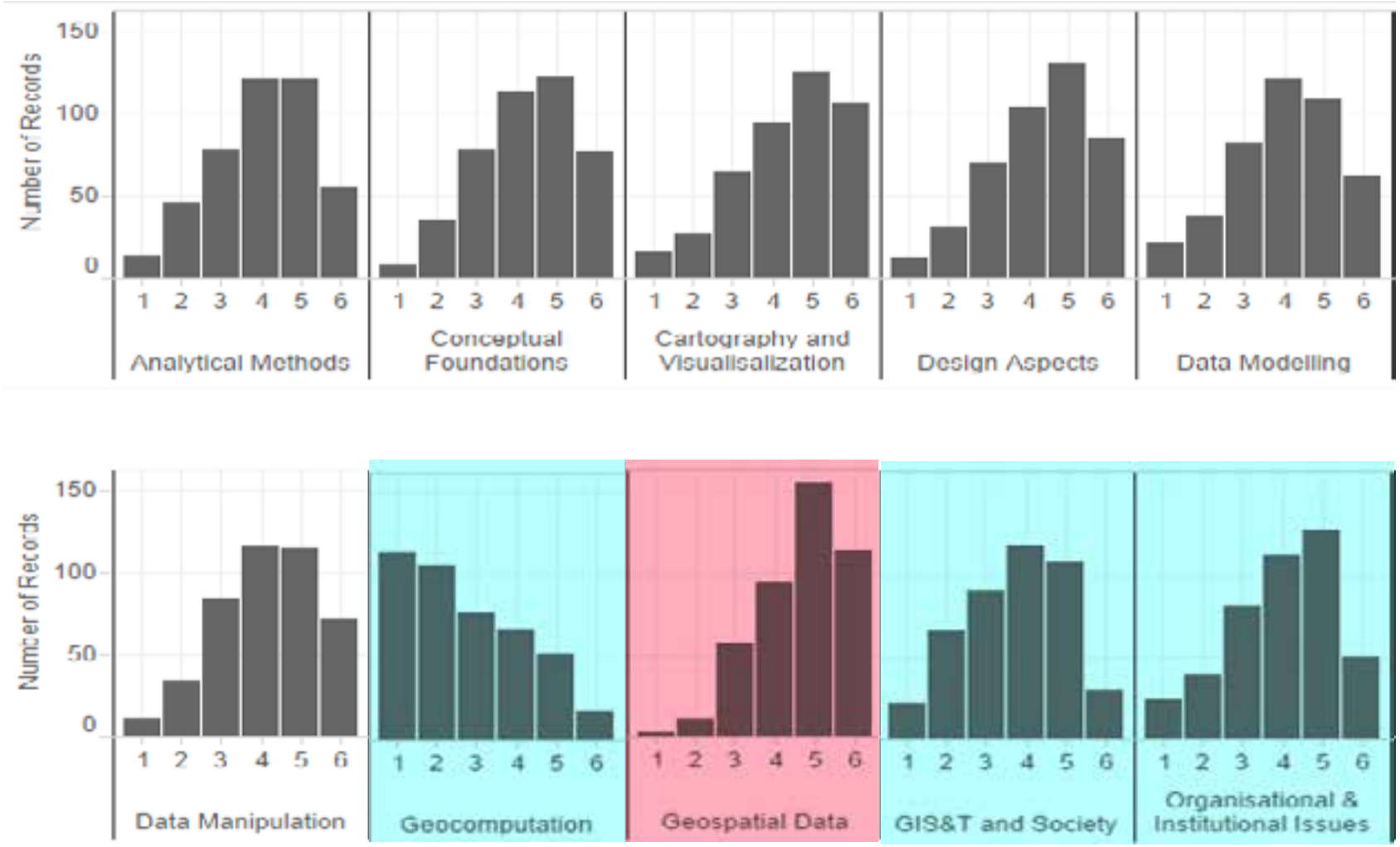
Survey Participation Throughout Europe

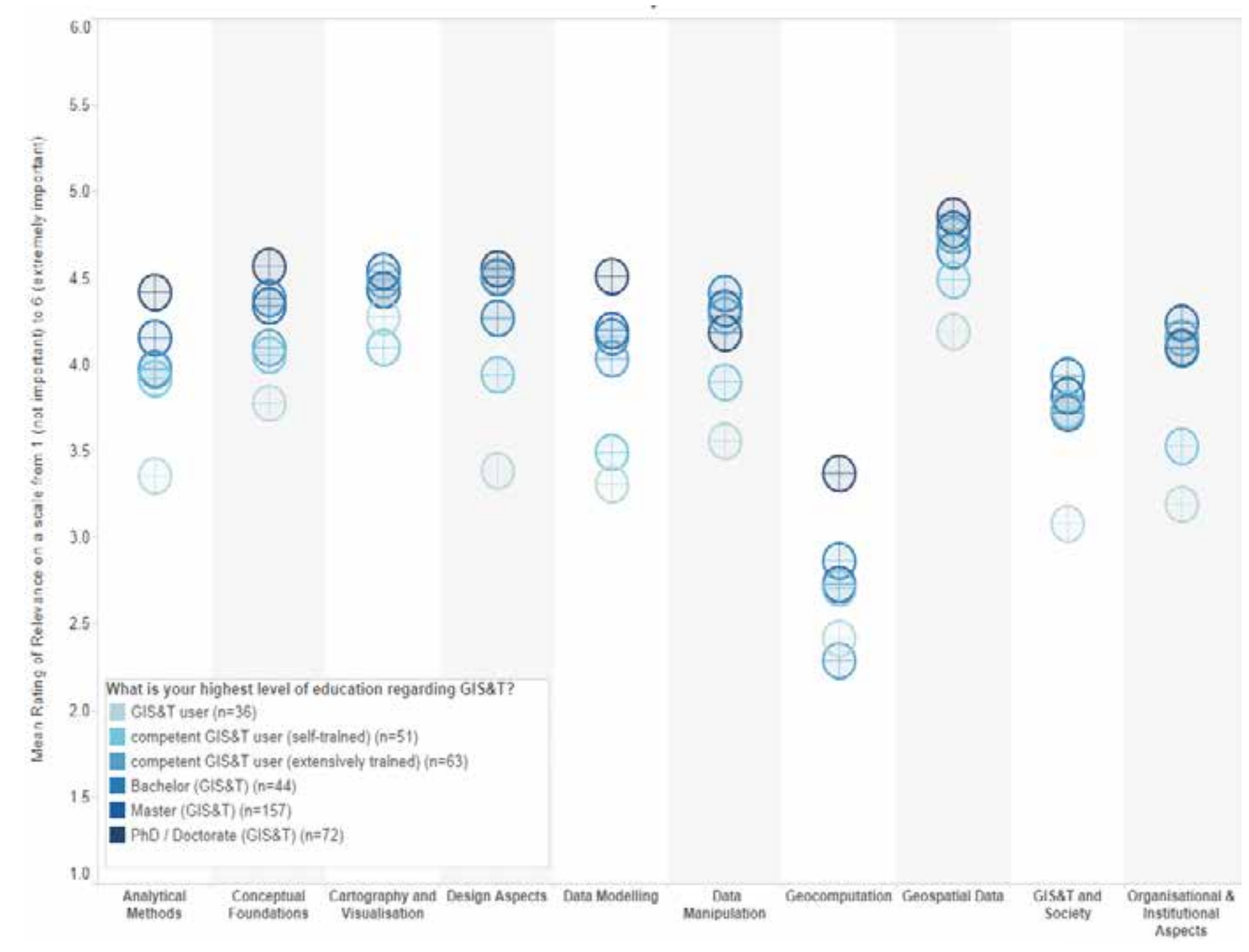


Survey participation:

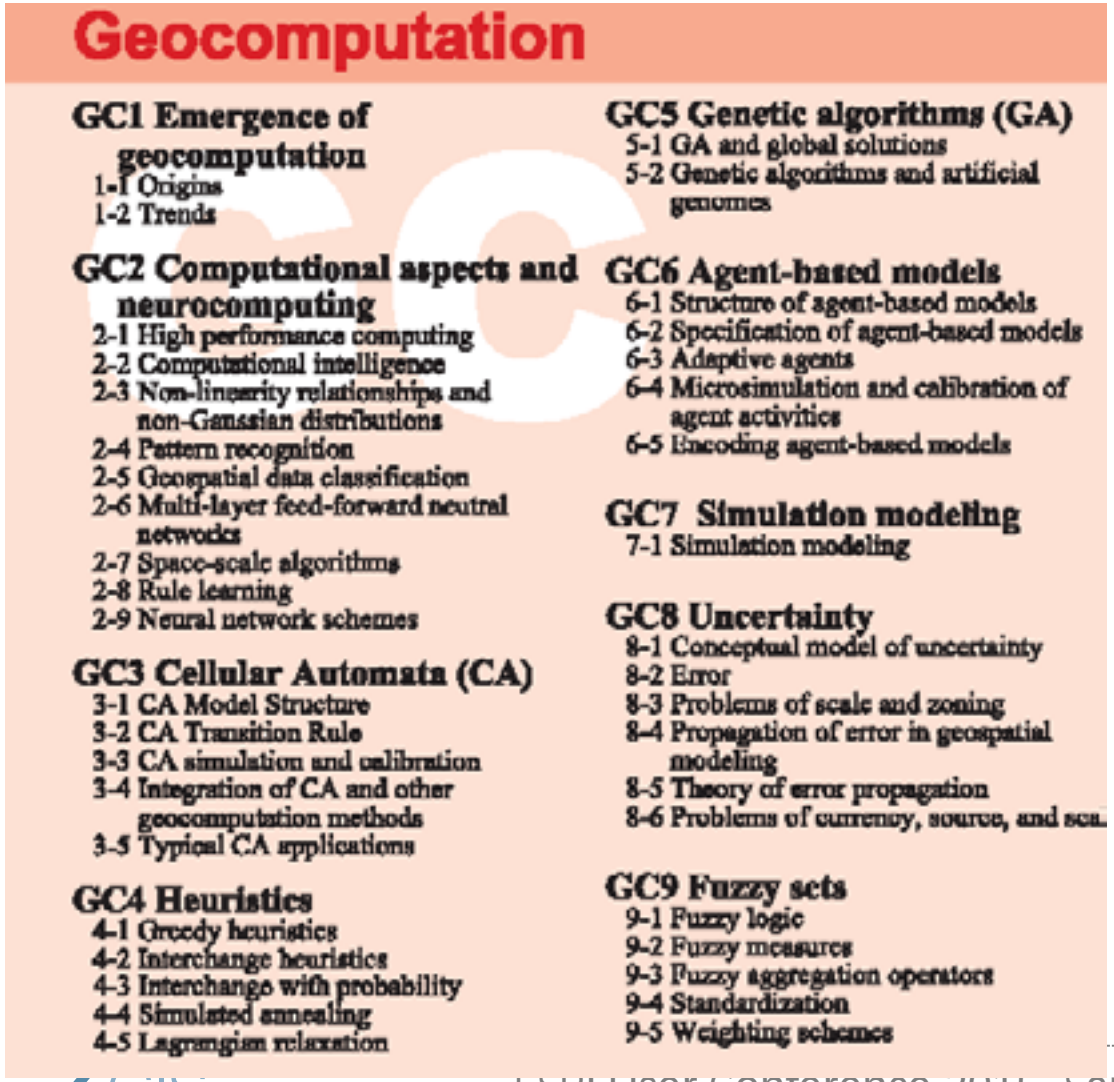
435 questionnaires
33 countries

Rating of Knowledge Areas




Mean Rating of Relevance on a scale from 1 (not important) to 6 (extremely important)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
What is your highest level of education regarding GIS&T?
GIS&T user (n=36)
competent GIS&T user (self-trained) (n=51)
competent GIS&T user (extensively trained) (n=63)
Bachelor (GIS&T) (n=44)
Master (GIS&T) (n=157)
PhD / Doctorate (GIS&T) (n=72)
Analytical Methods
Conceptual Foundations
Cartography and Visualisation
Design Aspects
Data Modelling
Data Manipulation
Geocomputation
Geospatial Data
GIS&T and Society
Organisational & Institutional Aspects

Geocomputation – The Subjects



Geocomputation

GC1 Emergence of geocomputation
1-1 Origins
1-2 Trends

GC2 Computational aspects and neurocomputing
2-1 High performance computing
2-2 Computational intelligence
2-3 Non-linearity relationships and non-Gaussian distributions
2-4 Pattern recognition
2-5 Geospatial data classification
2-6 Multi-layer feed-forward neutral networks
2-7 Space-scale algorithms
2-8 Rule learning
2-9 Neural network schemes

GC3 Cellular Automata (CA)
3-1 CA Model Structure
3-2 CA Transition Rule
3-3 CA simulation and calibration
3-4 Integration of CA and other geocomputation methods
3-5 Typical CA applications

GC4 Heuristics
4-1 Greedy heuristics
4-2 Interchange heuristics
4-3 Interchange with probability
4-4 Simulated annealing
4-5 Lagrangian relaxation

GC5 Genetic algorithms (GA)
5-1 GA and global solutions
5-2 Genetic algorithms and artificial genomes

GC6 Agent-based models
6-1 Structure of agent-based models
6-2 Specification of agent-based models
6-3 Adaptive agents
6-4 Microsimulation and calibration of agent activities
6-5 Encoding agent-based models

GC7 Simulation modeling
7-1 Simulation modeling

GC8 Uncertainty
8-1 Conceptual model of uncertainty
8-2 Error
8-3 Problems of scale and zoning
8-4 Propagation of error in geospatial modeling
8-5 Theory of error propagation
8-6 Problems of currency, source, and sca...

GC9 Fuzzy sets
9-1 Fuzzy logic
9-2 Fuzzy measures
9-3 Fuzzy aggregation operators
9-4 Standardization
9-5 Weighting schemes

- Advanced mathematical concepts
- Techniques from neighboring disciplines
- Use in practice apparently limited

Current and Future Tasks

Which competences would you like to obtain?

Which competences will gain importance in the future?

Word clouds exclude the terms GIS and data.

Future Trends Identified

Câmara et al. 2009 – Geographical Information Engineering in the 21st Century:

Technology side:

- Sensor networks
- Mobile devices
- Remote sensing

Concepts side:

- Semantics
- Time
- Cognition

- Technology side emphazised from survey participants
- Technology not all that needs advancement

Complement: Qualitative Interviews

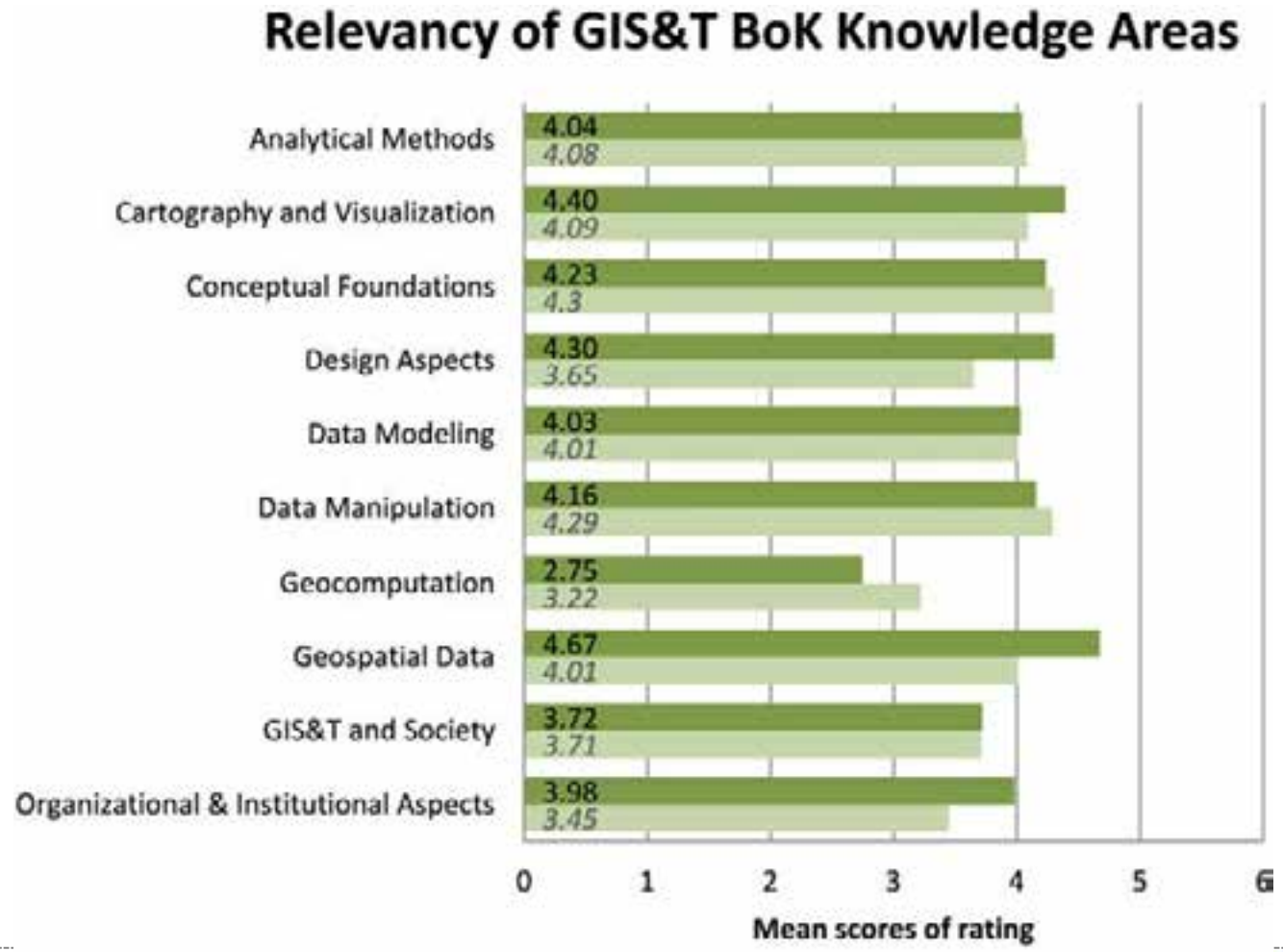
Variation in the GIS&T job market

- '*no problem to find employees*'
- '*slight oversupply features the market'*
- '*industry needs more good graduates*'
- '*it is difficult to find GIS&T experts*'

Three major deficits repeatedly mentioned:

- IT skills
- applying theoretical knowledge to real-world problems
- soft skills: (English) language and team working.

Is there a European GIS&T?



Questions Raised

- Technological skills are on the rise
  - Where are disciplinary limits of GIS&T?
  - Emphasis of spatial principles: GIS and data remain top-listed as future competences

- Impact of KA ratings on updated version of the BoK
  - Workforce demand as major steering wheel?

More to come from GI-N2K… http://www.gi-n2k.eu/

References

- D. DiBiase, M. DeMers, A. Johnson, K. Kemp, A. T. Luck, B. Plewe, and E. Wentz, "Geographic Information Science & Technology Body of Knowledge," ed. Washington, D.C: Association of American Geographers, 2006.

- G. Câmara, L. Vinhas, C. Davis, F. Fonseca, and T. Carneiro, "Geographical Information Engineering in the 21st Century," in Research Trends in Geographic Information Science, G. Navratil, Ed., ed: Springer Berlin Heidelberg, 2009, pp. 203-218.