Horizon 2020 Grant Agreement No 809965
Contract start date: July 1st 2018, Duration: 30 months

LAMBDA Deliverable 6.1
Foresight Exercise

Due date of deliverable: 30/06/2020
Actual submission date: 30/06/2020

Revision: Version 1.0

Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme, H2020-WIDESPREAD-2016-2017 Spreading Excellence and Widening Participation under grant agreement No 809965.

Author(s)	Sahar Vahdati, Emanuel Sallinger, Valentina Janev (PUPIN)
Contributor(s)	All participants of the LAMBDA Panel on Big Data, 16.06.2020
Internal Reviewer(s)	Simon Scerri (Fraunhofer), Valentina Janev (PUPIN)
Approval Date	
Remarks	

Workpackage	WP 6 Monitoring, Evaluation and Impact Analysis
Responsible for WP	University of Oxford
Deliverable Lead	University of Oxford (Sahar Vahdati)
Related Tasks	Task 6.1 Foresight Exercise

Document History and Contributions

Version	Date	Author(s)	Description
0.1	May 2020	Sahar Vahdati, Emanuel Sallinger	Draft schedule of the Panel
0.2	16.06.2020	Sahar Vahdati, Emanuel Sallinger	Video material of the Panel
0.3	30.06.2020	Simon Scerri	Internal review
0.4	30.06.2020	Valentina Janev	Final version

Executive Summary

In this deliverable we report about the Foresight Exercise of the LAMBDA project. It brings together leading experts in the West Balkan region together with European and international experts. We report on the extensive preparations, the Foresight Exercise itself, and give a detailed discussion of its outcome.

Table of Contents

Abbreviations and Acronyms

BDA Big Data Analytics

WP Work Package

List of Figures

1. Introduction

1.1 Scope

The main objective of Work Package 6 is to bring together and monitor all components of the LAMBDA Twinning Action, especially in the Phase 3 of the project (see Figure 1) including

- monitoring the knowledge exchange among partners and collecting evidence for the IPR management (Task 6.2);
- monitoring the capacity and skill building, the structural changes in PUPIN, and identification of further training needs (Task 6.2);
- monitoring the outcomes of the Twinning Action Plan implementation and summarizing the progress beyond the state of the art (Task 6.2);
- promoting a vision of change and adoption of EU scientific trends (Task 6.1);
- developing a vision for the period 2021-2027 with references to the World's 2030 agenda for sustainable development (Task 6.1);
- developing guiding principles for the post-2020 research (Task 6.1);
- developing recommendations addressed to regional and the European institutions, national governments as well as to other stakeholders: companies, universities, research institutes, nongovernmental organisations and all others engaged in research and innovation within the EU and beyond (Task 6.1);
- development of the strategic partnership between the linked institutions (Task 6.2);

This report discusses the activities in Task 6.1 framework that started at month thirteen (M13).

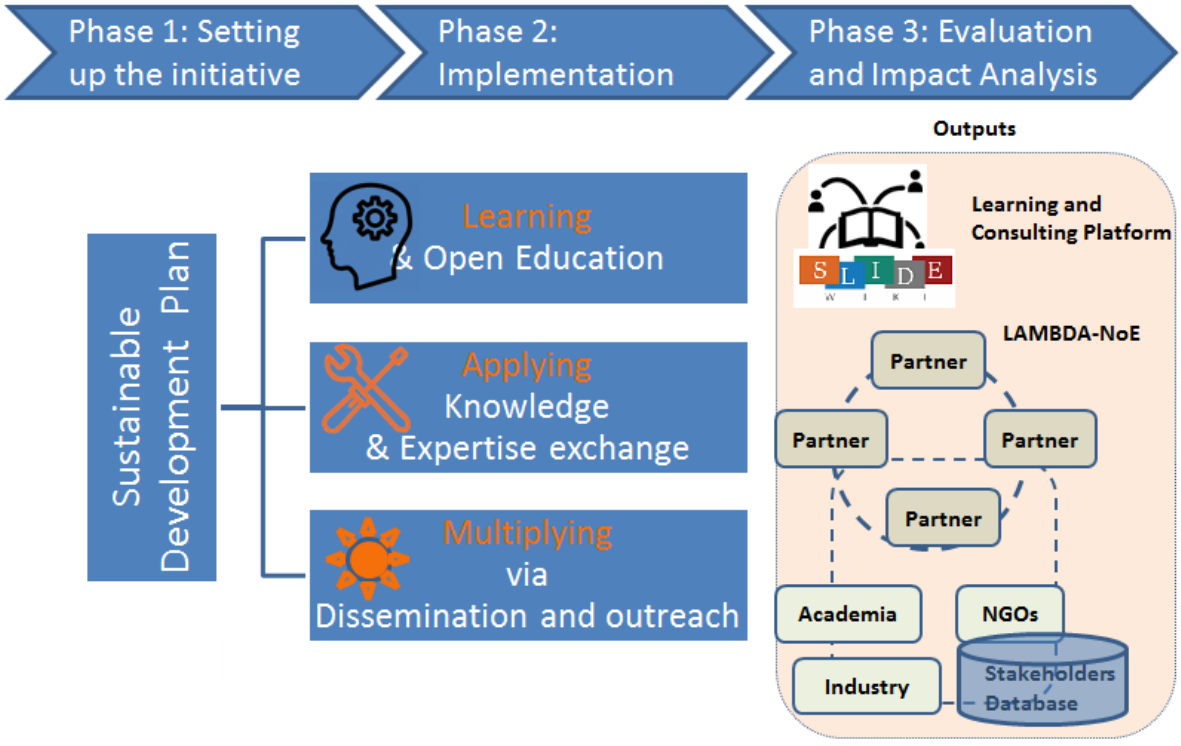


Figure 1. LAMBDA Methodology

1.2 Relation to Other Deliverables

This Deliverable is related to WP2

1. Deliverable 2.2 Education and RTD Needs that based on the identified education resources at partner organizations and the needs of PUPIN staff and the stakeholders from Serbia and the Region proposes a detailed Education and RTD Plan, as well as a draft programme for the Belgrade BDA Schools in 2019.
2. Deliverable 2.1 Big Data Challenges and Analysis of Scientific and Technological Landscape that gives an overview of the Big Data concepts, outlines some of the relevant challenges in Big Data domain and reviews and describes the current state of the art tools relevant to Big Data applications.
3. Deliverable 2.3 SWOT Analysis where the complementarities of the linked partners have been analysed and strategy for maximising the benefits from the LAMBDA project has been proposed in Deliverable 2.4.
4. Strategic Capacity Development Plan that presents the LAMBDA Action planfor scientific excellence and innovation capacity building of the PUPIN Institute in the Big Data domain for the following two years (2019-2020). The proposed action plan articulates how UOXF, UBO and Fraunhofer IAIS will transfer their institutional knowledge and expertise throughout the life time of LAMBDA, in particular the phase of the project from M07 until M24. This deliverable also serve as an input for the next foresight report D6.4 Strategic Action Plan for the next 5 years (period 2021-2025).

This Deliverable gives an input to Deliverable 6.2 Foresight Exercise and Policy Recommendations.

1.3 Structure of the Deliverable

This document is structured as follows.

In Section 2 we are going to report on preparatory activities, including extensive reporting on the questionnaire designed to prepare the Foresight Exercise. Section 3 reports on the Foresight Exercise panel itself. Section 4 reports on other foresight-related events in the region. Section 5 provides a conclusion.

2. Preparatory Activities

2.1 Target Participants

The starting point for the foresight exercise was to design a list of scientists, leaders, decision makers from the regions. Initially a list of target participants has been created by brainstorming internally and reviewing the online profile of the selected people. After several internal discussions, the names have been shortlisted and the invitation for participating in the LAMBDA Foresight exercise has been sent out.

We have received very positive replies from leading scientists of the region to contribute.

2.2 Questionnaire

In the context of LAMBDA Foresight exercise, one of the early steps was to contact and collect information in different level about:

- The connection of research and industrial activities of the participants to Big Data
- The opinion of participants about aspects of Big Data in the past, current, and future

Each of these directions have been divided into several sections.
The questionnaire is still available online[1] and we discuss the individual questions and their replies below and in the following subsections.

[1] https://docs.google.com/forms/d/e/1FAIpQLSfIadFkOS8Q8SZhhFukcVT5Un8vWPCNH2tVlPjd5VznwoKpcA/viewform

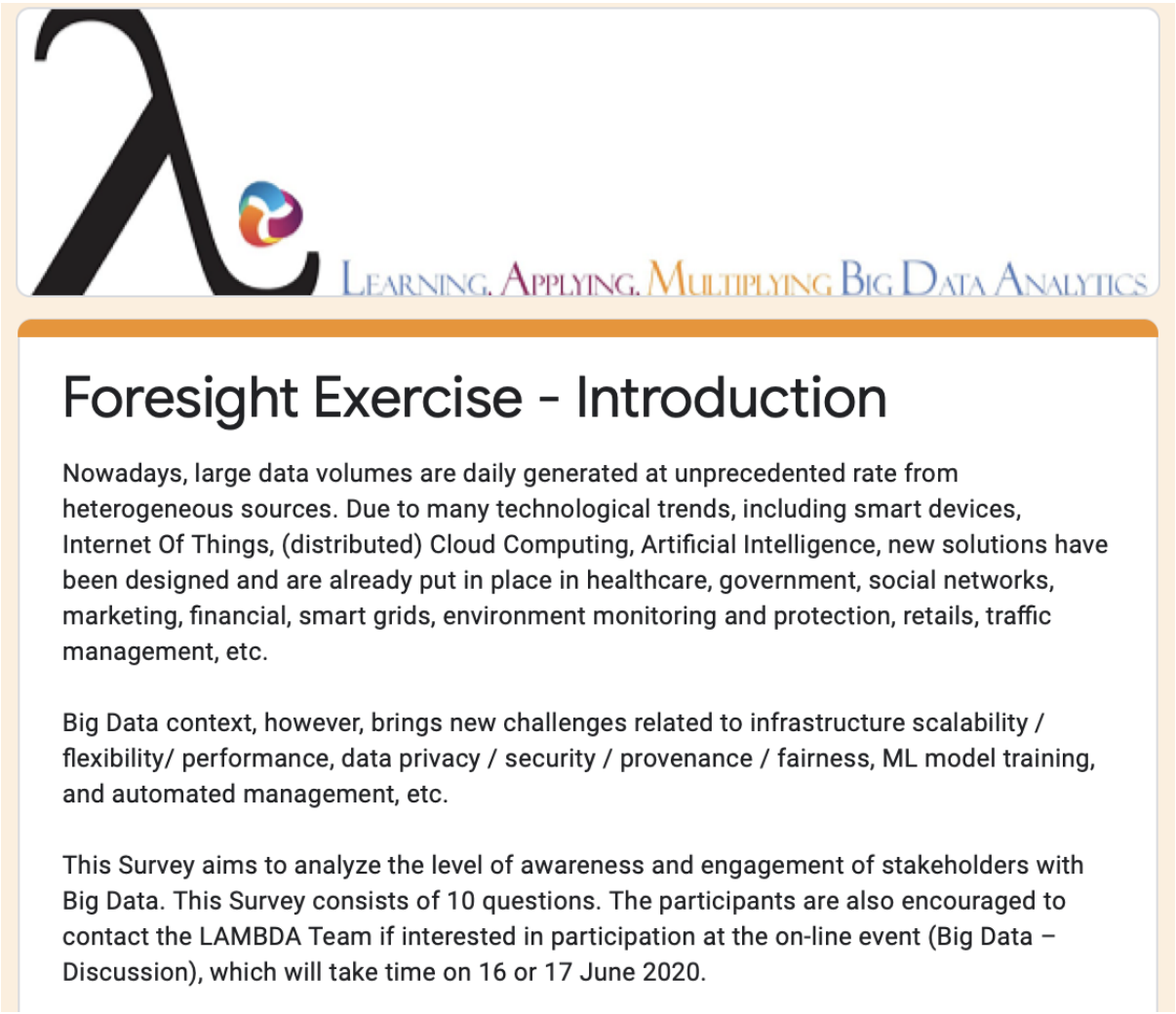


Figure 2. Foresight Questionnaire

2.3 Replies to the Questionnaire

Here we present the answers to the questionnaire from the domain experts. Overall, we had twelve replies and the results were collected and influenced the design of the foresight panel and future plans.

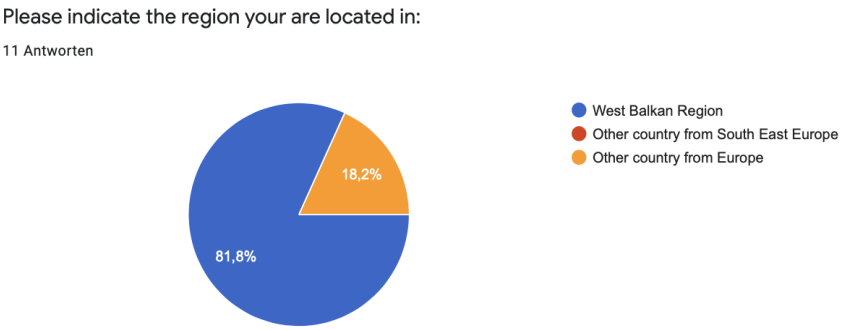


Figure 3. Structure and origin of participants

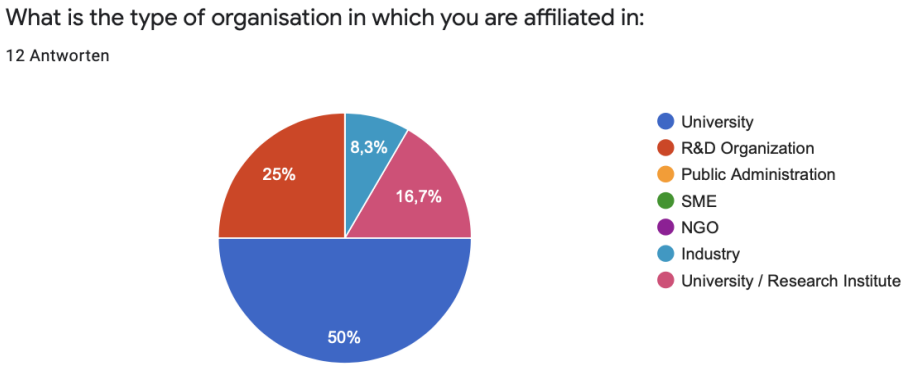


Figure 4. Results to Question - What is the type of organisation in which you are affiliated?

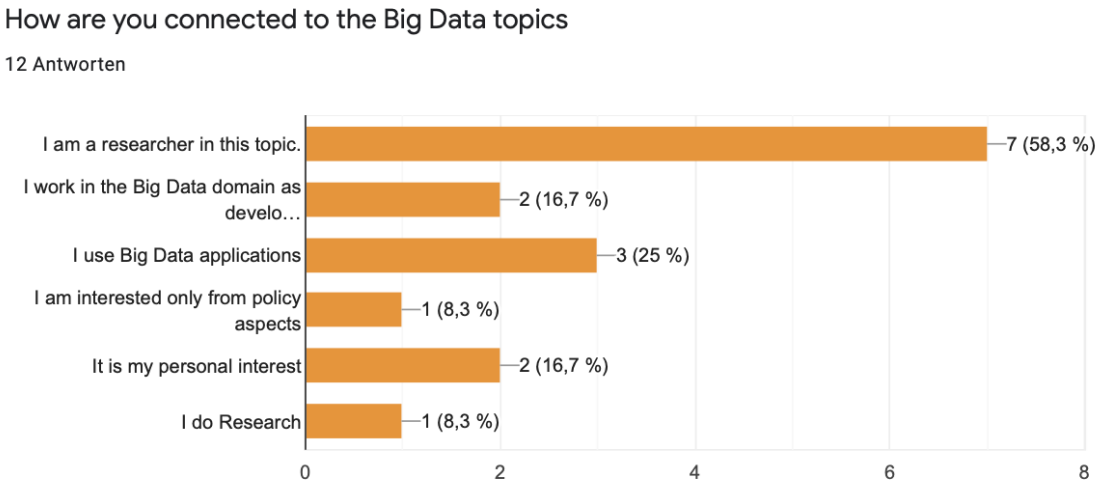


Figure 5. Results to Question - How are you connected to the Big Data topics?

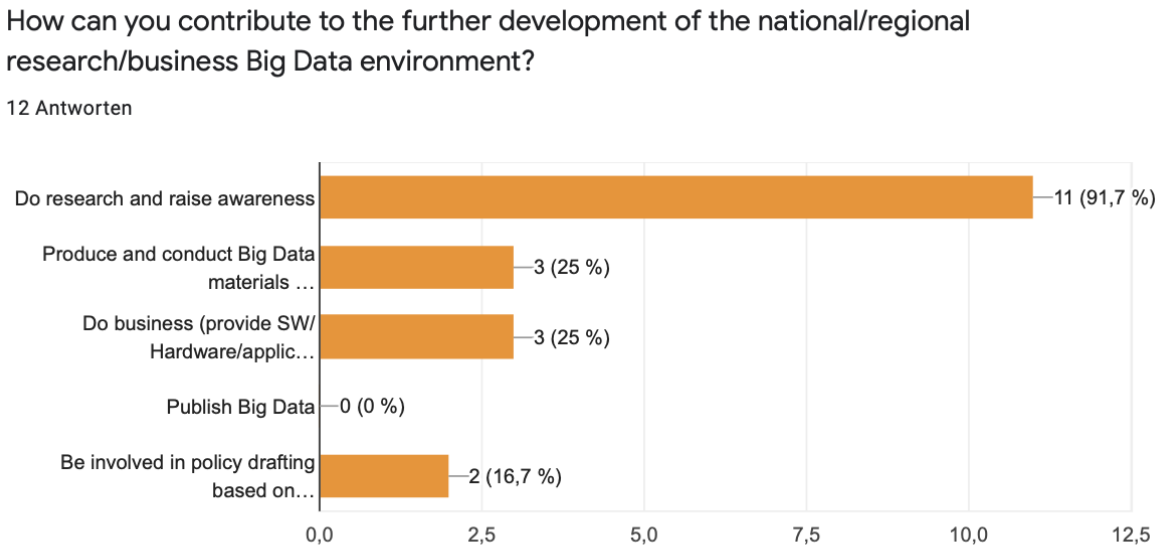


Figure 6. Results to Question - How can you contribute to the further development of the national/regional research/business Big Data environment?

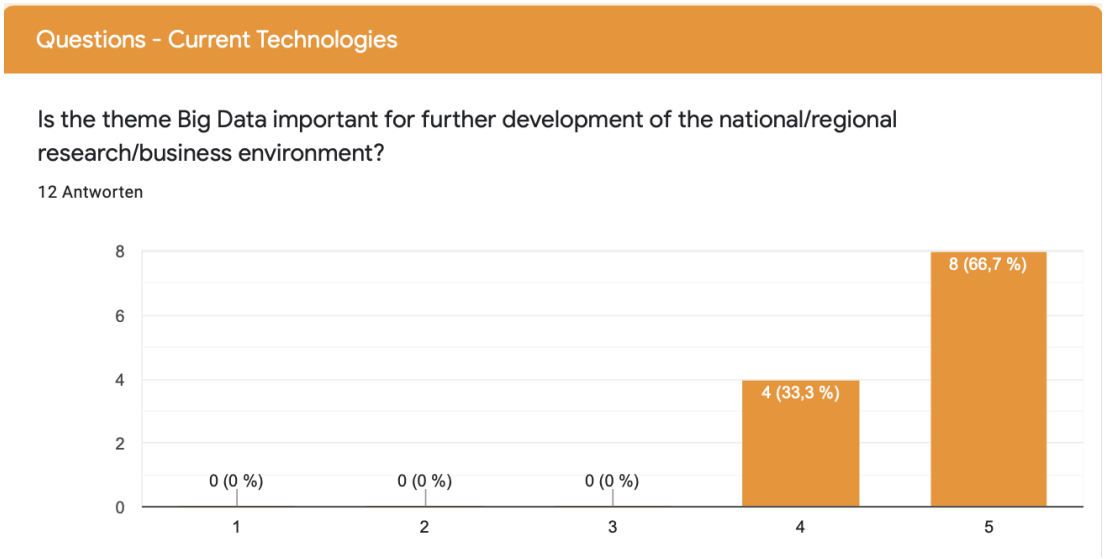


Figure 7. Results of inquiry - Further development of the national/regional research/development environment

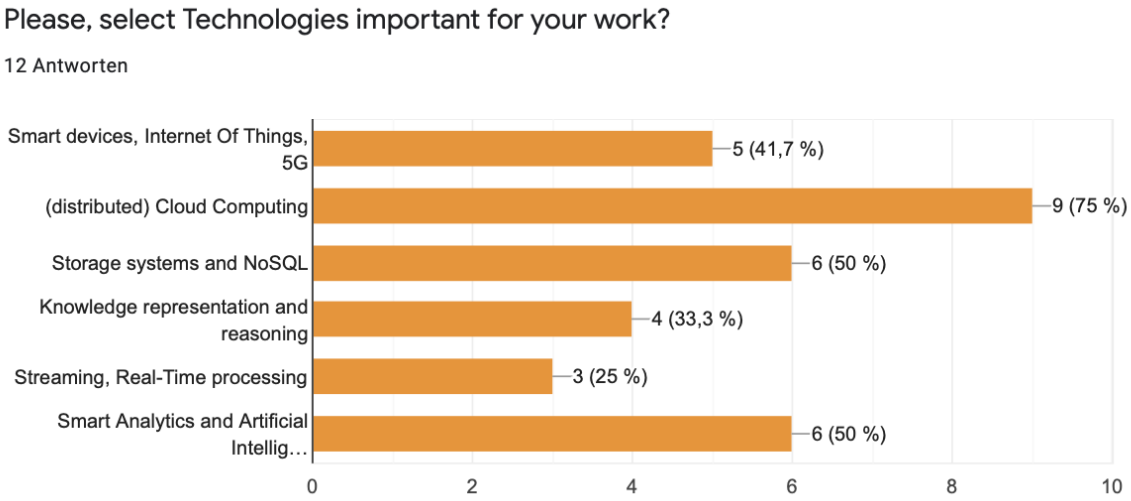


Figure 8. Results of inquiry - Technologies important for your work

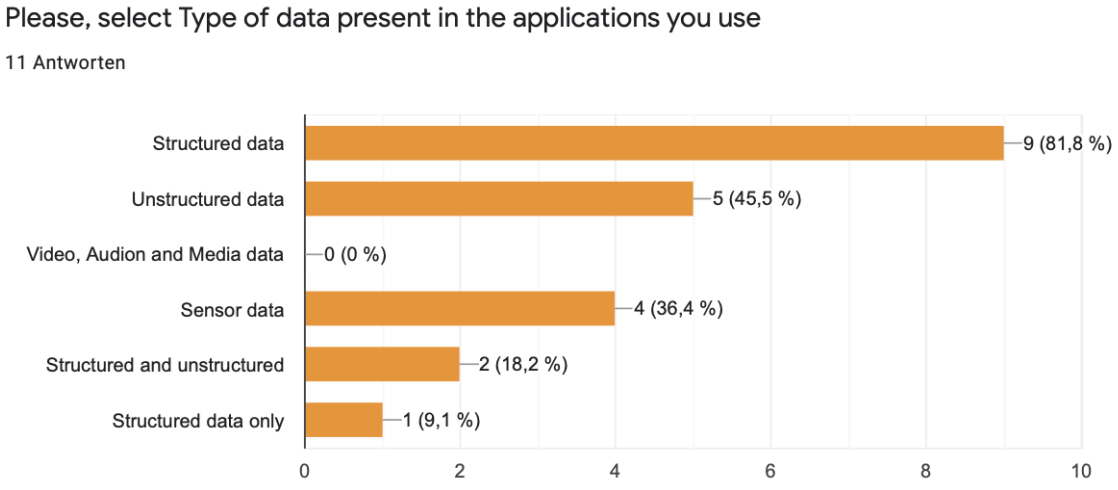


Figure 9. Results of inquiry - Type of data present in the applications you use

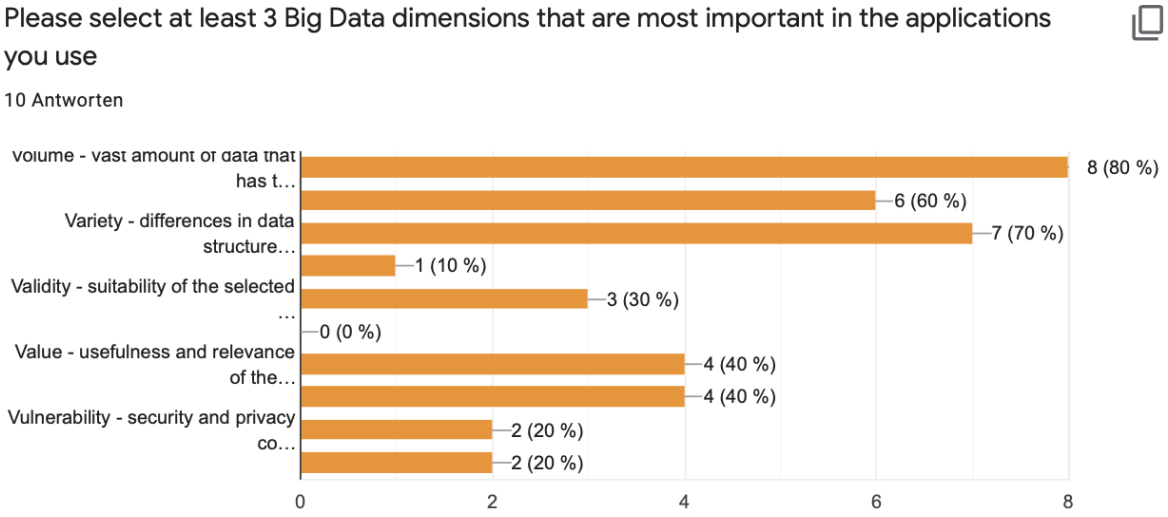


Figure 10. Results of inquiry - Big Data dimensions that are most important in the applications you use

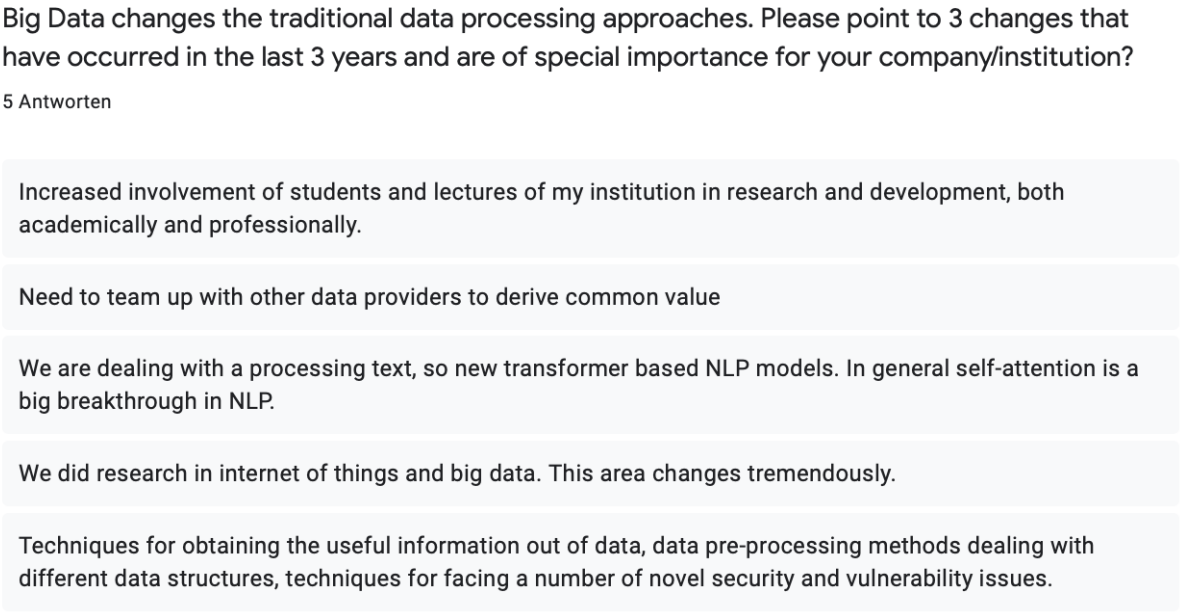


Figure 11. Results of inquiry - Changes that have occurred in the last 3 years

Questions - Emerging Technologies in your country

Please name at least 3 Big Data research trends that in your opinion will make the biggest breakthrough in the next 5 years

4 Antworten

Methods for improving veracity (provenance, blockchain, etc.); Methods to support distributed data processing (retaining data at source, security); Methods to support interoperability (easier visualisation and extension of common data models).

Big Data + AI

Research and development in the domains of: security and privacy protection, proper synchronization of the collected large data volumes, estimation of the data validity, the extraction of information that is most valuable for further analysis and processing of data in timely manner, solution customization for specific case needs, etc.

Machine learning and AI, Analytics, Visualization of data...

Figure 12. Results of inquiry - Big Data research trends that in your opinion will make the biggest breakthrough in the next 5 years

Please select 3 industry domains that in your opinion will have the biggest impact from emerging technologies in your country

5 Antworten

Energy, telecommunications and of course IT industry

Smart Manufacturing, Health, Transport

Robotics

Communication systems and network technologies (security, connection QoS, mobility, service availability); Energy and utility (smart meters, energy consumption control, active user involvement in service maintenance and enhancement) industry; Banking systems (Security - sophisticated intrusion detection and prevention systems, wide privacy concerns, advanced risk analysis and more accurate analytics techniques).

IT services in Healthcare, Energy sector, Marketing, Business ...

Figure 13. Results of inquiry - 3 industrial domains that will have the biggest impact from the emerging technologies

Please name at least 3 Big Data tools that you would like to examine in the next 3 years e.g. Hadoop, Spark, link, Storm, Kafka, Cassandra, Tableau, MongoDB, Apache Zookeeper, etc.

4 Antworten

TimeLion (Kibana), TensorFlow, Docker Swarm

Tableau, Apache Zookeeper

Storm, Spark, RapidMiner, R

Hadoop, Tableau, MongoDB...

Figure 14. Results of inquiry - Big Data tools worth testing

What is your opinion on required governmental actions for facilitating further development of Big Data research in your region?

5 Antworten

Bringing legislation that will enable educational and research institutions to have a much higher level of collaboration and synergy with industry.

Support datamarket setups to promote safe data exchange and sharing, incentivizing both research and industry to improve technology further

Opening more data

The necessary governmental action would be to provide more funds for the purchase of best possible hardware and software for the research and development in this area.

Government need to attract development using traditional and big data for our countries, but some of initiatives are only on paper.

Figure 15. Results of question - What is your opinion on required governmental actions for facilitating further development of Big Data research in your region?

Would you like to participate in the online LAMBDA Event that will be organized by the LAMBDA consortium on June 16 2020?

11 Antworten

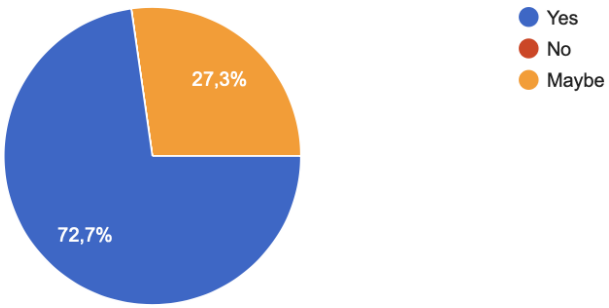


Figure 16. Results of inquiry about willingness to participate in the BDA School

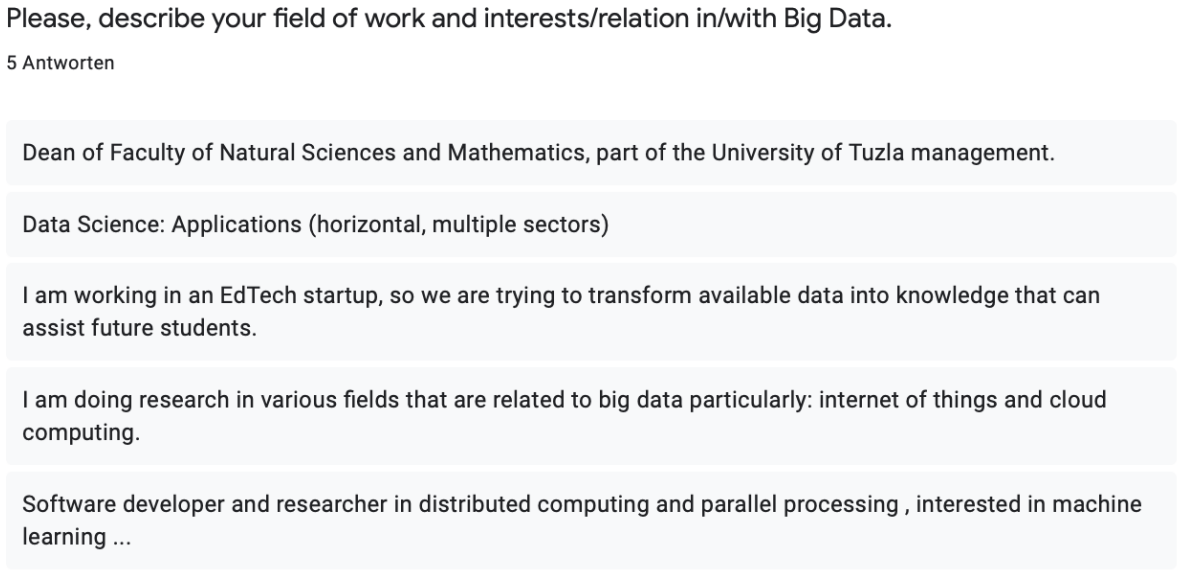


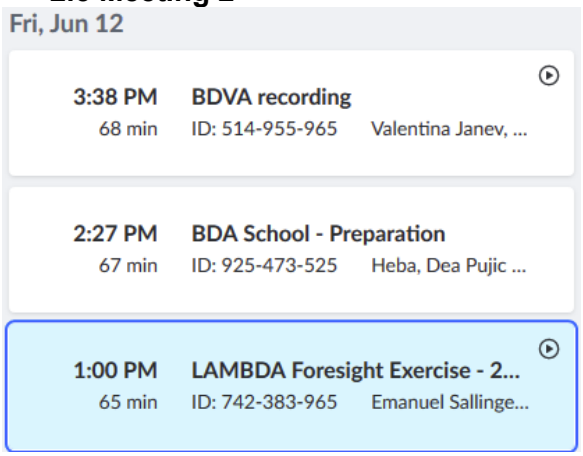
Figure 17. Results of inquiry about field of work

2.4 Meeting 1

In order to get to know the panel participants in person and to have an initial introduction on the ultimate objective of the foresight exercise, the Oxford team has organized a meeting on 7 May 2020. Everyone with a great potential to participate in the foresight exercise has been invited.

In this meeting, we discussed the current status of Big Data in the Balkan area in general and the required needs for future developments. Then, we discussed the questionnaire and asked for feedback on that. Each of the participants were asked to prepare presentation slides including content to present themselves in the foresight exercise session and explain their connection to Big Data topics.

2.5 Meeting 2



In order to coordinate for the main foreseíght session, a second meeting has been organized on 12 June 2020. All the panel participants were present in this meeting and the Oxford team explained and simulated the foresight exercise with them.

The provided presentation slides have been discussed. The Oxford team made a unification for the presentation content and everyone exercised how the actual foresight session will be.

3. Foresight Forum

3.1 Target Participants

The foresight exercise has been organized by the University of Oxford, and moderated by Prof. Emanuel Sallinger and Dr. Sahar Vahdati.

Figure 18. Foresight panel – Opening

3.2 Panel Participants

Here we briefly introduce the panel participants:

- **Prof. Dr.sc. Neven Vrček** is a professor at University of Zagreb Faculty of Organization and Informatics (FOI). He is also the president of the Sectoral council for information sciences at Ministry of Science and Education, Croatia. He servers as a member of the Supervisory Board at the Ruđer Bošković Institute and is the former dean of FOI and Head of Department of IS Development. In his research profile, he co-authored more than 100 journal and conference papers and several books. He is also the experienced manager and member of supervisory board with a demonstrated history of working in the high education sector, information technology, project management and services industry. His research interests include: Smart Industry, Digital transformation, Open Data, Internet of Things, e-business, Entrepreneurship, Technology.

- **Prof. Dr. Dimitar Trajanov** is the Head of Information systems and network technologies Department at the faculty of Computer Science and Engineering, Cyril and Methodius University –Skopje. He is the leader of Social Innovation Hub and the CEO of MindTRON Technologies. He has been co-authoring more than 150 journal and conference papers and he is the author of seven books. Involved in more than 60 research and industry projects. His research interests include Data Science, Machine Learning, NLP, FinTech, Semantic Web, Open Data, Sharing Economy, Social Innovation, e-commerce, Entrepreneurship, Technology for Development, Mobile Development, and Climate Change.

- **Dr. Luka Filipović** is a scientist at the IT center of the University of Montenegro, Software department. His main activities are at the faculty of electrical engineering, and he has several projects such as FP6/FP7/H2020 projects. His main topics are around Distributed and parallel computing.

- **Prof. Dr. Vedad Pašic** is a professor in the field of pure mathematics at the University of Tuzla since 2016. He teaches a variety of courses at the Department of Mathematics at the University of Tuzla. He is the Dean of the Faculty of Natural Sciences and Mathematics.
His main areas of research are operator theory and theories of gravity, but he has also published work in functional analysis and numerical analysis.

- **Dr. Nikola Tomasevic** is currently a project manager at Mihajlo Pupin Institute where he works since 2007. He received a Dipl. Ing. Degree in July 2007 at the School of Electrical Engineering, University of Belgrade, Serbia. In December 2013, he defended his PhD thesis at the Department of Communications and Information Technologies of the School of Electrical Engineering, University of Belgrade. He is involved in technical management and research activities of R&D projects in various domains. Currently, under the H2020 Work Programme, he is managing two H2020 projects (REACT and RESPOND) and taking active role in several other H2020 projects (such as InBetween, IDEAS and LAMBDA). So far, he took part in a number of EU H2020, FP7 and FP6 projects (H2020 SlideWiki, FP7 EPIC-HUB, CASCADE, EMILI, Reflect, and FP6 Web4Web) and also was actively involved in R&D projects financed by the Ministry of Science and Technological Development of Serbia (SOFIA and AMICA). In his scientific career, his research activities were focused on energy efficiency, emergency management, recommendation and support systems, semantic web technologies, mobile communication systems, learning analytics and natural language processing. He (co-)authored more than 40 scientific and technical papers as journal, conference and workshop contributions. He also serves as a reviewer for respectable journals (Applied Energy (Elsevier), Transactions on Wireless Communications (IEEE), International Journal of Neural Systems (World Scientific), Artificial Intelligence Review (Springer), etc.), as a PC member and session chair of international conferences (such as TELFOR and ICTERI).

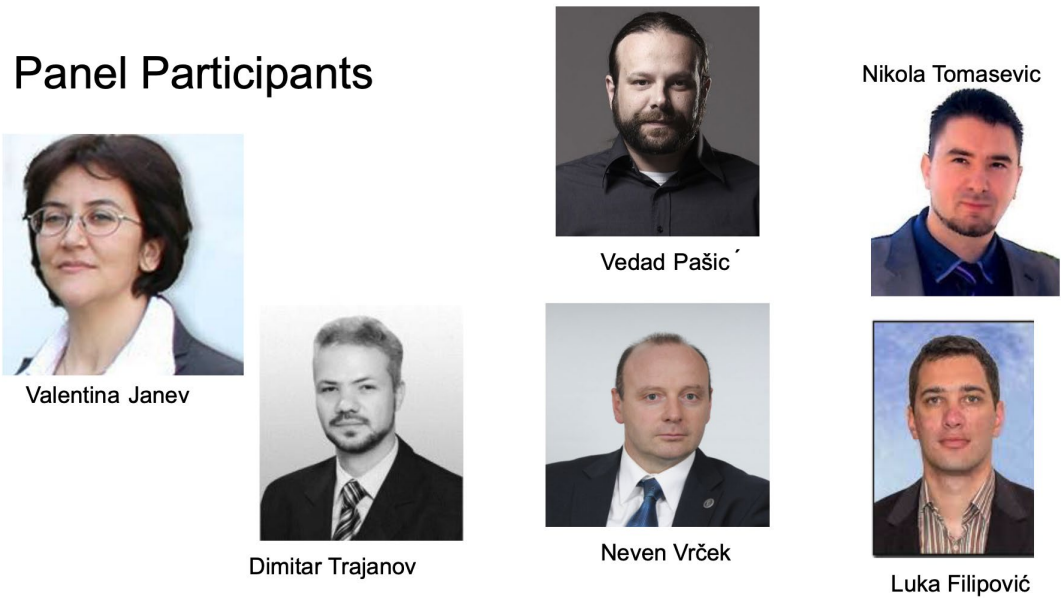


Figure 19. Foresight panel – Participants

Figure 20. Foresight panel – Dr. Luka Filipović

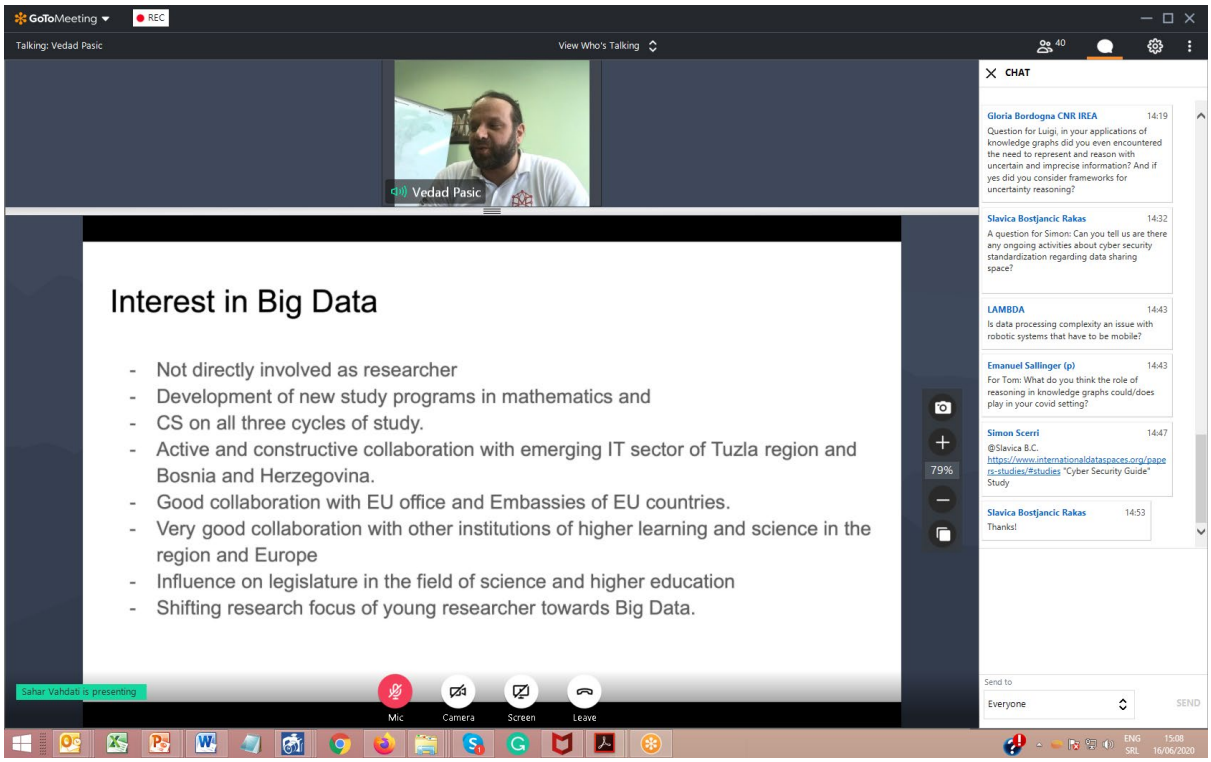


Figure 21. Foresight panel – Prof. Dr. Vedad Pašic

3.2 Panel Discussion

In preparation of the panel discussion, the Oxford team had designed a series of initial questions which could be asked to the participants. These questions have been discussed together with the other members of the consortium and finalized. A set of three main questions has been selected to be asked in three rounds and two back-up questions have been reserved for the case the discussion goes fast and time remains.

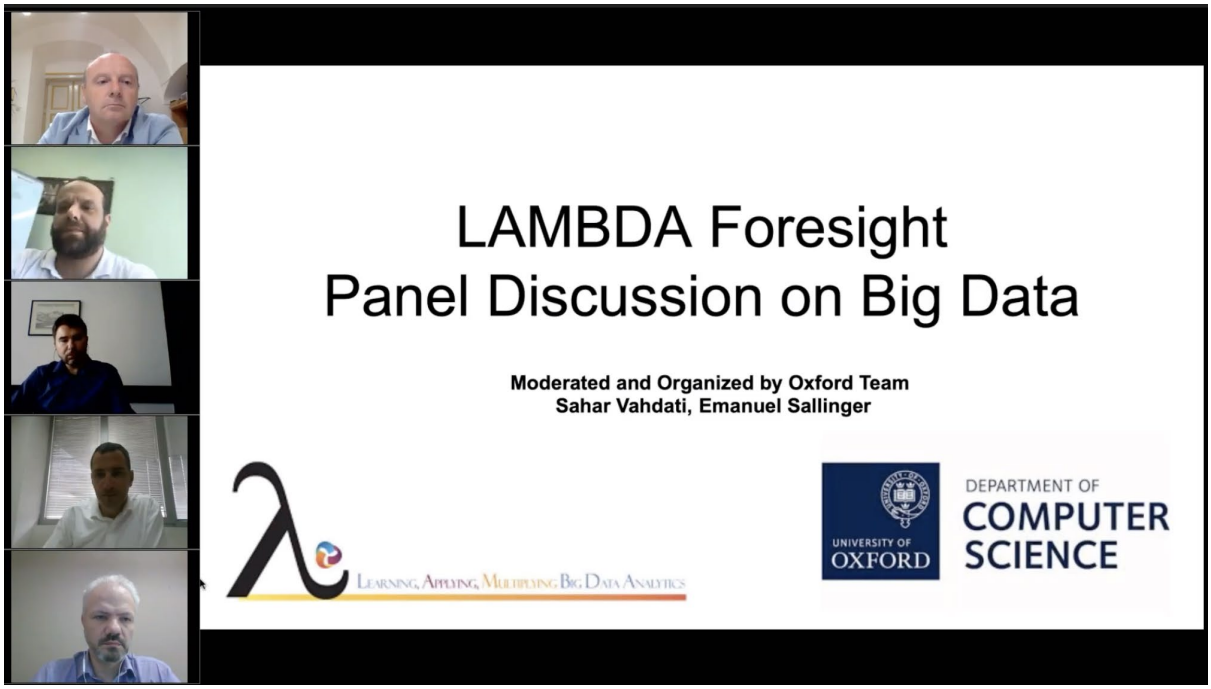


Figure 22. Foresight panel – Opening

Question 1. The first question had a focus on industry domains. From the panel participants, the ones who are very close to the industry and have strong network have been selected to be addressed. The discussion started by posing the question to the participants.

- **Dimitar Trajanov:** Everyday, there is more and more data around us. Taking finances as an example, one can see how it influences our daily life from investment to risk assessments. Big data and NLP and ML are making a lot of changes and everyday there are new products that are closer and closer to the needs of the users. There are lots of chatbots for example that are replacing lots of human-based conversations and the ethical implications of that. Much more automated services are accessible by deep analysis of Big data.

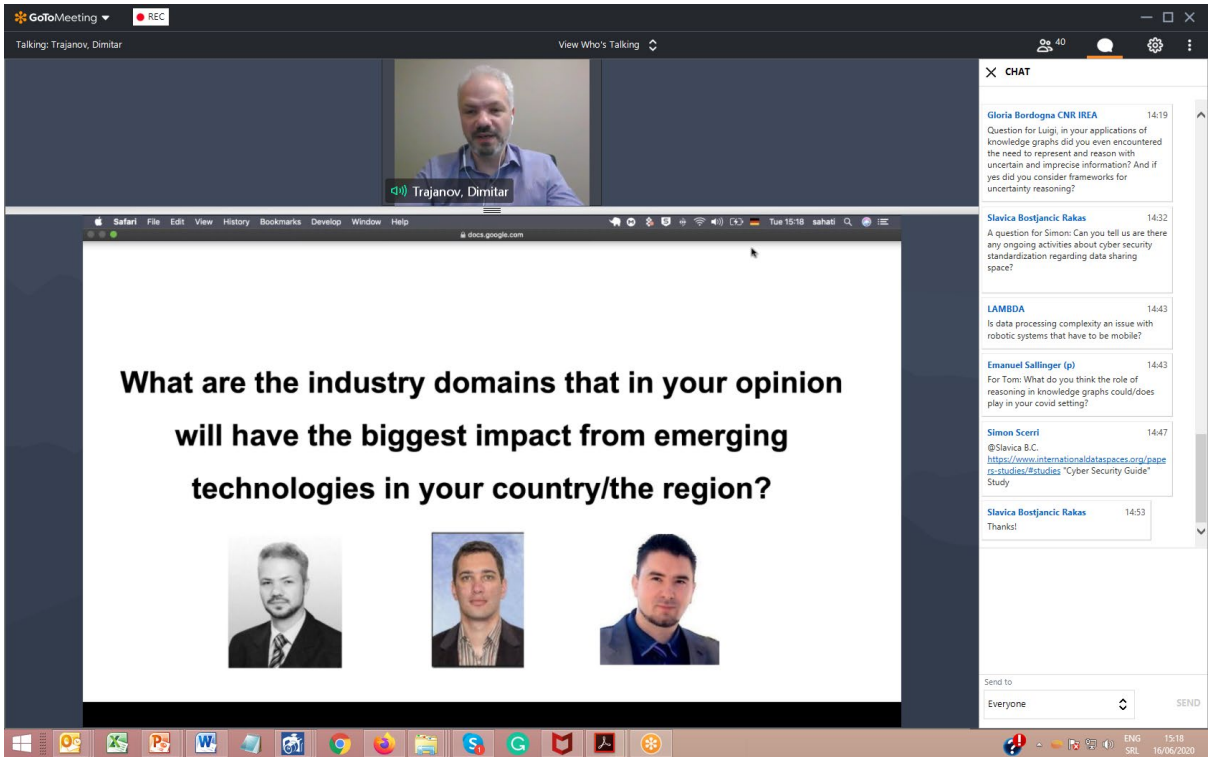
- **Luka Filipović:** By emphasizing on life science which has global impact and the West Balkan region, he highlighted bioinformatics. The essence of Big Data has been discussed by him in the topics of epidemy, biology, pharmacology, and he connected it to the currently ongoing global crises, COVID-19. He gave the example of software that was used to perform genetic analysis empowered by Big Data where they could combine multi-gene analysis with multiple options. In his opinion, biomedical and bioinformatics topics together with Big Data technologies are the future.

- **Nikola Tomasevic:** He pointed out about very many required technologies in several projects that are even running currently in many domains. The overview of trends in the energy domain was given by him such that unlocking flexibilities on the demand side, indoor energy efficiency and many of those require better policies. Nikola gave an extensive explanation about statistics of the results in total consumption and applied

analytics using Big data. Coming from the domain of smart energy, any change in behavior and ultimate results require historical and stream data which becomes huge quantities of data points with different qualities. Therefore, it is highly needed to be considered in all regions.

What are the industry domains that in your opinion will have the biggest impact from emerging technologies in your country/the region?





Question 2. The second question has a focus on governmental actions.

- **Vedad Pašic:** As he mentioned, he is deeply involved in governmental actions in research and the situation about related topics to Big Data is not impressive. In preparation for the foresight panel, he consulted with several people. The situation is that science is not just something that one can through money to have only education but the actual impact with a concrete application. As the world is facing the crisis right now, the investigation in academia and connecting them to actual applications and companies who are actually doing the work in the market can be the biggest challenge that one can provide to legislators. Another goal is providing the possibility for young people to work hand in hand

with companies and to also deepen their knowledge. As he pointed out, governments need to let the scientists take care of this.

- **Valentina Janev:** There is still a big need for more and more panels where people can gather and mastermind. Most of the conferences are not particularly focusing on these. She mentioned that on paper, many people talk about Big Data, however in practice there is a big gap with real possibilities. There are however, initiatives and data strategies and Pupin is involved. She mentioned that she is missing more discussions in these topics also involving governmental sectors.

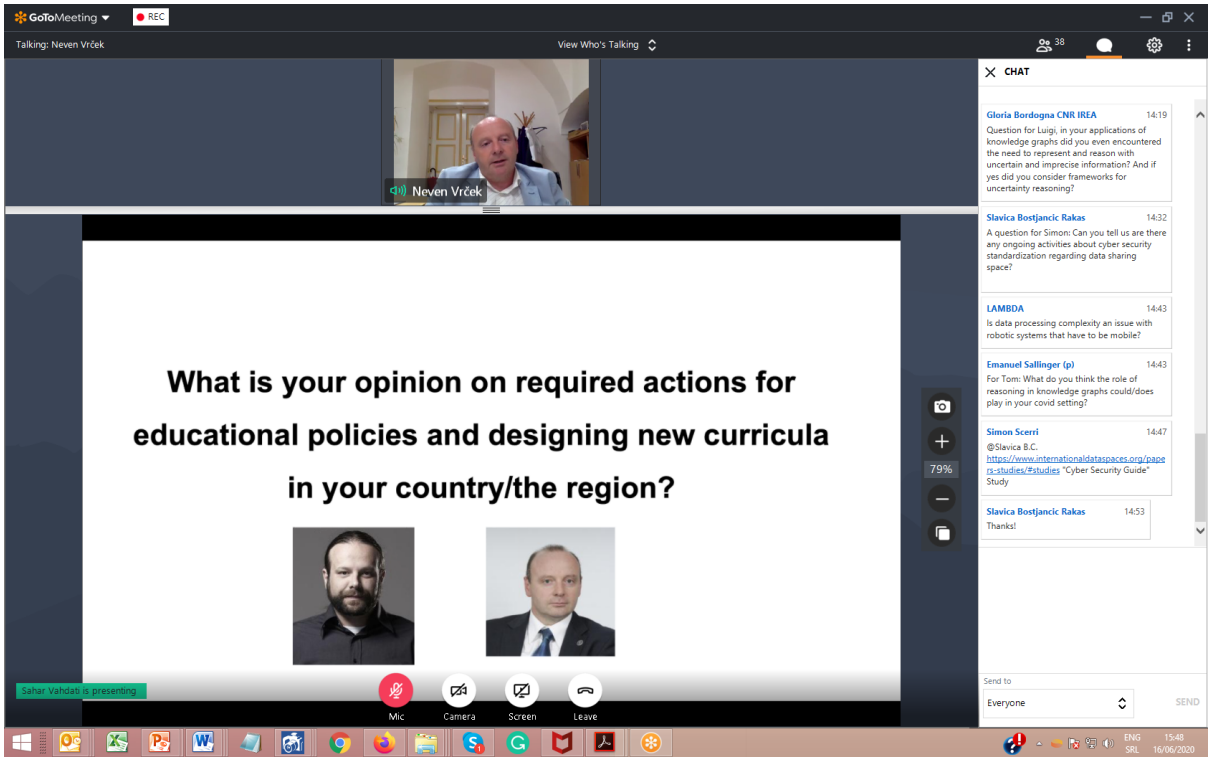
Question 3. The third question has a focus on educational policies and required guidelines.

- **Neven Vrček:** He focused on the higher education point of view. He himself has been working on the development of higher qualification standards by providing support on many topics including Big Data and AI. In a broad project, they provided extensive educational services. In the course of this project, he together with the executive board tried to combine their own knowledge with knowledge from companies gathering their needs from the labor market. For example exploring the needs of skills when they hire experts in the Big Data area. To combine this into a multi-phase approach of life-long learning and multi-disciplinary education is what they learned through this project. It is hard to expect that lectures alone will "produce" experts in such new technologies. One needs to have a wider knowledge by providing educational services in such technologies for students from the law, medicine domain, etc. and interchange knowledge among them. Not only from research and implementation point of view but also from managerial point of view, combination of knowledge is needed nowadays and requires multi-phase learning including large set of techniques in many aspects, hard-core knowledge and anything that is applied in the market.

- **Vedad Pašić:** He pointed out that governmental and hiring sectors want to have quick solutions for such problems and want quickly made experts with all the required skills. However in practice there is a long term education needed. By interviewing people in the IT sector with master or PhD level in the region, he concludes that a lot of basic knowledge is required as well as fresh education in all of the new technologies. He also pointed out that such panel discussions and more events are needed such that leading people in the region can brainstorm and provide solutions.

What is your opinion on required governmental actions for facilitating further development of Big Data research in your country/the region?

What is your opinion on required actions for educational policies and designing new curricula in your country/the region?



4. Other Foresight Events

4.1 Open Data - Opportunities and Innovation, Podgorica, March 2020

In cooperation with the ODEON project[2] and the Chamber of Economy and the Ministry of Public Administration of Montenegro, the PUPIN team organized an event 'Open Data - Business opportunities and innovation for SMEs and start-ups'. The event brought together experts from Serbia and Montenegro to discuss the European strategy for data, COM(2020) 66, 19.02.2020, and the Open Data Directive' (Directive (EU) 2019/1024).

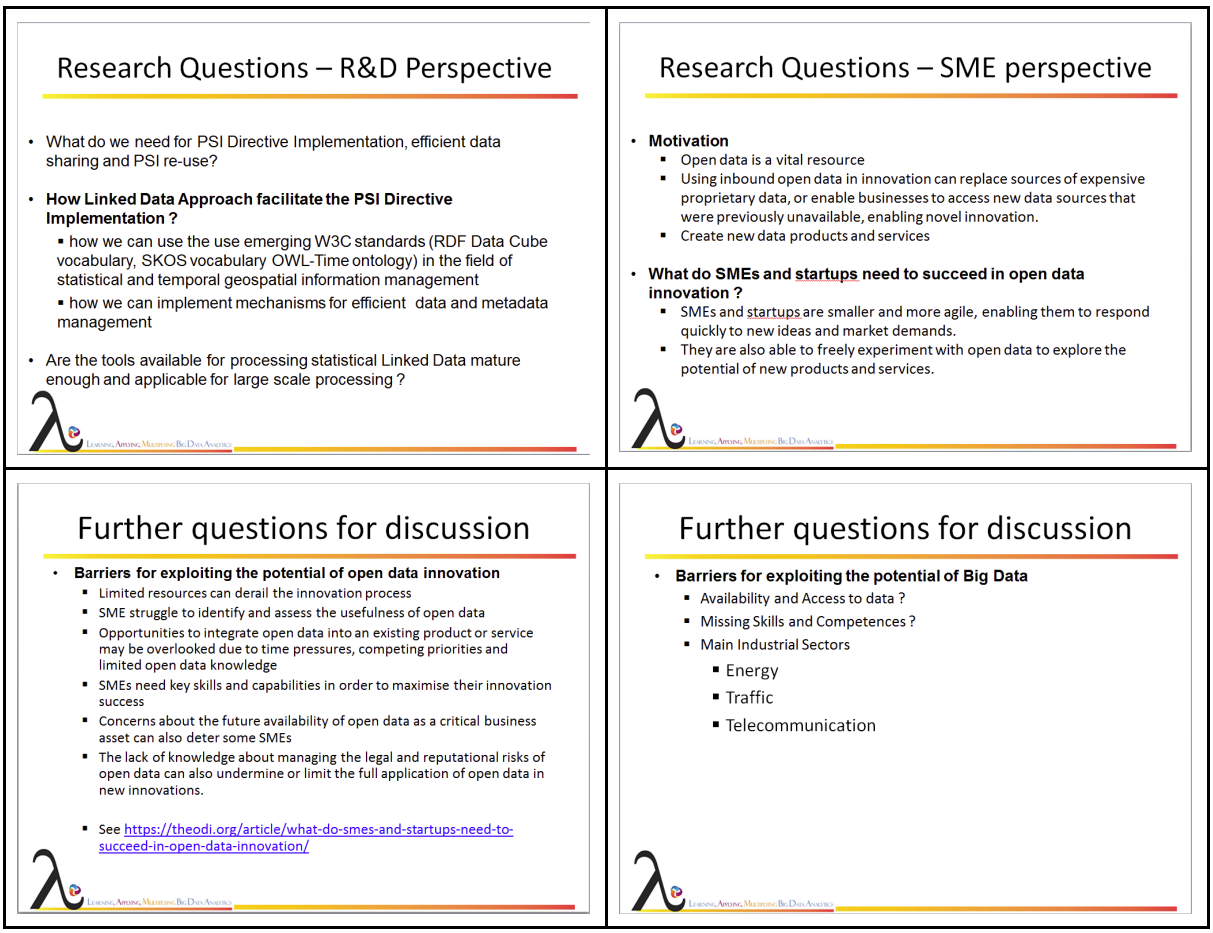


Figure 23. Discussion on 'Business opportunities and innovation for SMEs and start-ups'

[2] https://odeon.interreg-med.eu/

Figure 24. Participants at Discussion on 'Business opportunities and innovation for SMEs and start-ups'

4.2 The Challenge and Opportunity of 5G in Serbia, November 2019

The event **5G in Serbia: Challenges and Opportunities** took place at the Institut Mihajlo Pupin on the 22nd of November 2019. The event was organized by the PUPIN Scientific Council (Dr. Vladimir Krstić).

Guest speaker: Goran Laovski, Republic Agency for Electronic Communications and Postal Services.

Discussion topics:

- 5G changing the world - capabilities that differentiate 5G
- Special techniques and concepts used in 5G networks
- Potential 5G use cases
- 5G achievements and plans in Serbia
- Regulatory framework

Figure 25. Participants at event 5G in Serbia: Challenges and Opportunities

5. Conclusion

From the perspective of leading people in the region, we conclude that new policies and guidelines are needed in order to provide realistic plans for education experts in new technologies. Providing such guidelines in theory and practice requires more events bringing the leading people of the region in many sectors together in the form of such panel discussions or even bigger events. It was mentioned several times that people in charge need to meet first and discuss the situation. Industry and enterprise sectors are having different needs than what the educational sectors offer at this time. This creates a big margin between the knowledge of the graduated people and the need in the market. More projects like LAMBDA are needed in the region to bring the best practice of research and industry from other parts of the Europe to the Balkan area.