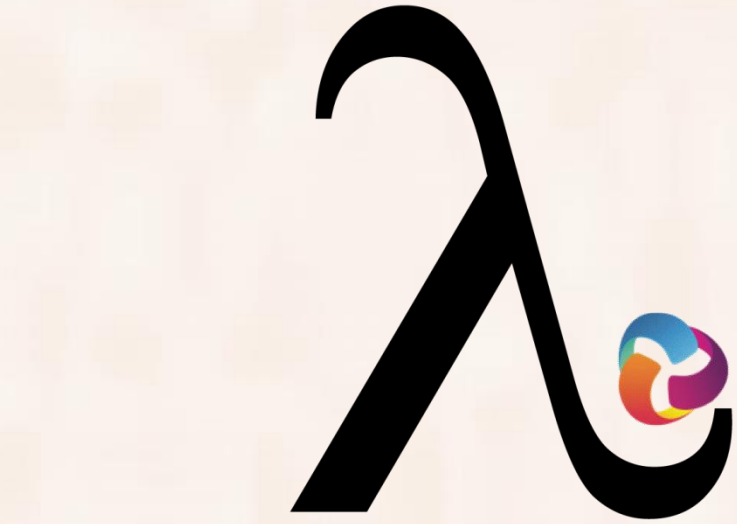

LEARNING, APPLYING, MULTIPLYING BIG DATA ANALYTICS

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

LAMBDA Deliverable 5.2
Dissemination and Communication Strategy and Preliminary Exploitation Plan

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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)	

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Document History and Contributions

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0.4	19.12.2018	Hajira Jabeen	Contribution (UBO part)
0.5	20.12.2018	Emanuel Sallinger	Contribution (UOXF part)
0.6	26.12.2018	Sahar Vahdati, Jens Lehmann	Review (UBO)

Executive Summary

This document outlines the envisioned Dissemination, Communication and Exploitation strategy of the LAMBDA project, as well as the specific objectives of dissemination activities until the end of the project. Furthermore, it reports on continuing dissemination activities of the LAMBDA project in the first six months.

The LAMBDA dissemination team has established the LAMBDA portal (https://project-lambda.org) as a main source of information about the project activities and results. In order to support LAMBDA researchers in spreading information about the project, the PUPIN team prepared general promotion material (leaflet, poster, PowerPoint presentation, templates, etc.), established the LAMBDA 'Network of Experts' Group on LinkedIn and opened the Net4LAMBDA account on Twitter.

In addition to promoting the results via the publicly available channels (partners web sites, social networks), LAMBDA researchers attended several scientific events (US-Serbia & West Balkan Data Science Workshop, Very Large Data Bases 2018, SEMANTiCS 2018, TELFOR 2018, GIS and Remote Sensing 2018) and other networking events on topics relevant for the project.

In the first six months, while working on joint proposals with Fraunhofer Insitutes, PUPIN extended its network with new partners on topics such as Data Science, Industry 4.0, Renewable energies, and Green economy.

Table of Contents

Abbreviations and Acronyms

OERs	Open Educational Resources
NoE	Network of Experts
WP	Work package

List of Figures

List of Tables

1. Introduction

The main objective of Work package 5 (WP 5 Stakeholder engagement, Community building and Dissemination) is to identify and reach out to the relevant stakeholders both on the side of actors-producers and users of Big Data, but also institutions within the domain of data science education. The dissemination and exploitation activities are tailored to the needs of the consortium partners (PUPIN as main beneficiary), as well as other relevant stakeholders from the widening county (Serbia) and the region to access, explore and understand the opportunities present in the 'Big Data' field.

1.1 Scope

At the time of writing this deliverable, it is six months after the start of the LAMBDA project and requires further plans to be matured. The aim of this preliminary document is to provide common guidelines as well as a common plan for the participants to undertake dissemination and exploitation actions following a structured and well organised approach during the course of the project, as only in this way the widest stakeholders' base can be reached and the project outcomes can be adequately protected and exploited. The final plan will include a description of the resulting socio-economic impact. Partners [1] involved in the LAMBDA project and their roles in data management are given in Table 1.

Table 1. LAMBDA partners and main roles in Dissemination and Exploitation activities

Short name	Partner	Organization Type	Main role
PUPIN	Institute Mihajlo Pupin, Serbia (Coordinator)	Research and Development Institute	- Dissemination and Exploitation (WP5) Lead
IAIS	Fraunhofer Institute for Intelligent Analysis and Information Systems, Germany	Research and Development Institute	- Innovation Lead
UBO	Institute for Computer Science - University of Bonn, Germany	University	- Education (WP3) Lead
UOXF	Department of Computer Science - University of Oxford, UK	University	- Scientific and Quality Control (WP6) Lead

1.2 Structure of the Deliverable

The first WP5 deliverable (D5.1 Stakeholders Database and Market Analysis) contains information about the activities that the PUPIN team accomplished related to the establishment of a stakeholders database on the private side of the LAMBDA portal, as well as the market research conducted in the first six months of the project.

[1] https://project-lambda.org/Partners

This Deliverable is the second relevant document delved for WP5 in December 2018 and presents the following points:

- LAMBDA Dissemination, Communication and Exploitation strategy (Section 2);
- First version of the LAMBDA Dissemination, Communication and Exploitation Plan for 2019 and 2020 (Section 3 and Section 4);
- Activity report about the
    - the general promotion material (prepared by the PUPIN team) that will be used throughout the project (Section 5);
    - Published scientific publications (Section 6);
    - Other events and networking opportunities (Section 6).

Further plans for WP5 will be prepared in the first *Report on Communication activities and Dissemination Events* by June 2019, while the first *Report on Stakeholder Engagement and Exploitation Activities by September 2019.*

2. Dissemination, Communication and Exploitation strategy

One of the activities initiated at the very beginning of the project was to establish a comprehensive dissemination strategy and action plan for its implementation, as well as to identify all available instruments for dissemination and exploitation of project outcomes. Apart from standard instruments, like publicity and promotion materials (leaflets, posters, etc,.), web portal, conference and journal papers, some specific instruments have been considered such as feedback collection from stakeholders via the private part of the portal. The appropriate instruments have been developed for the collection of inputs from all Partners regarding dissemination actions undertaken. In order to promote the LAMBDA project to the wide audience but also try to attract numerous prominent scientists, a Network of Experts has been established as a LinkedIn Group.

2.1 Dissemination and Exploitation Approach

LAMBDA consortium applies standard tools and a multi-channel dissemination approach to disseminate knowledge and experience gained in the project framework. The dissemination basically involves the transfer of information and knowledge gathered in the project activities and transfer of LAMBDA results to the different stakeholders mainly in EU, Serbia and other non-EU countries in the West Balkan region undertaking accession process, including Montenegro, FYROM, Bosnia, and Herzegovina, as LAMBDA project intention is to make PUPIN regional center of excellence and point of reference in Big Data Analytics domain. The major underlying assumption of the dissemination strategy is that the whole Consortium should commit to perform dissemination and communication activities and proactively look for dissemination opportunities and make available their own dissemination channels, as well as contribute to opening the new ones, tailored to the LAMBDA project objectives. Each Partner shall proactively contribute to communicate and disseminate contents related to the project by exploiting their existing communication channels, relevant to LAMBDA as well, in order to reach the widest audience in Serbia, West Balkan region and Europe-wide. Moreover, each dissemination activity shall be carried out by the individual partner who is the most prominent expert on the respective subject. However, communication and dissemination activities shall be performed in a well-organized and structured way, and the Coordinator shall be able to track and review any communication and dissemination action performed by any of the LAMBDA partners. As such, the Coordinator has developed a set instruments for the collection of inputs from Partners referring to planned activities as well as for the tracking of actions carried out by Partners. The Coordinator will also ensure that sensitive material is not disclosed and that all the communication and dissemination activities will be adjusted towards the specific audience.

Within this framework, the following basic criteria should be followed:

- Target audience categories should be carefully identified;
- Contents should be carefully identified and tailored towards targeted beneficiaries;
- Communication messages should be formulated both in advance and *ad-hoc* having in mind the targeted audience;
- Information channels and tools should be carefully identified and adjusted towards the targeted stakeholders and general public.

2.1.1 Target Groups

The targeted dissemination and exploitation audience includes the following categories:

- Scientific communities:
  - Universities
  - Research Institutes

  - Innovation Centers
  - Science and Technology Parks
- Public authorities, and particularly:
  - Ministries
  - Governmental agencies
  - Local and municipal authorities,
- Financial sectors:
  - Banks,
  - Hedge Funds,
  - Investment funds
- Service providers, such as:
  - ESCOs,
  - Utilities,
  - Traffic authorities
  - Energy management authorities
  - Mobile providers
- Industry:
  - Software industry
  - Manufacturing industry,
  - Process industry, etc.

LAMBDA project established a Stakeholder database[2], as part of the private side of the LAMBDA platform. This database will include all stakeholders that are relevant to involve at all levels: local, regional, national and EU. Following EU and national Data Protection Regulations, the data is restricted to the members of the consortium and each stakeholder registered with the LAMBDA platform has to read and accept the 'Terms of Use' document and LAMBDA 'Privacy Policy' document. Once registered on the platform, stakeholders can use all available e-collaboration tools.

2.1.2 Objectives of the Dissemination and Exploitation Activities

The following are the objectives of the dissemination and exploitation activities to be carried out within the framework of the project:

- provide up-to-date information about the project;
- share the results of the project with the scientific community interested to the topics addressed by the LAMBDA project, to promote the research and receive useful inputs from other scientists and International Communities, especially within the West Balkan region;
- share the knowledge acquired within LAMBDA among the industrial stakeholders as a basis to create future opportunities for application of big data analytics to enhance the quality of their products and services;
- build a solid base for future partnerships, collaborations, and information exchange between relevant communities, including scientific community, industry and public sector;
- attract potential customers and generate expectation towards the project results, in order to prepare its exploitation (especially in PUPIN's standard niche areas);
- identify additional potential application fields, customers and business opportunities based on the reactions to the dissemination activity;
- gather feedback from peers, experts, researchers, potential customers, industry, and the general public;

Planned dissemination activities to fulfil the above objectives and reach targeted audience include:

[2] https://project-lambda.org/Stakeholders-Section

- **Implementation of the LAMBDA web portal** to facilitate interaction with all stakeholders and potential beneficiaries in South-east Europe;
- **Awareness raising spread and knowledge dissemination** at the national and regional level through preparation of promotional material and regular presence at international conferences and workshops in Europe; Significant events (conferences, seminars, workshops) which will be organised by LAMBDA project will be reported in the deliverable entitled 'Report on Communication activities and Dissemination Events' (a list of upcoming events is always present on the portal shown in figure 2);
- **Publishing in scientific journals,** for instance the Big Data Research published by Elsevier, https://www.journals.elsevier.com/big-data-research/**,** or the Semantic Web Journal of IOS Press.
- **Networking with universities from Serbia including** the School of Electrical Engineering (University of Belgrade), Faculty of Mechanical Engineering (University of Niš), Traffic engineering (University of Belgrade), Mathematics and Computer Science of the Universities of Belgrade (University of Novi Sad), and others. Spreading excellence towards these academic partners will be accomplished through presentations of capacity building activities in the project, and through exchange of know-how and experience.
- **Networking with universities from the Region including** the University of Zagreb, University of Tuzla, University of Montenegro, University Ss. Cyril and Methodius and others institutes and universities active in relevant research in the region.
- **Networking with regional policy makers:** seminars will be organized with the Consultative Office of the Ministry of Science of Serbia, which helps researchers and research organizations in Serbia to participate in ERA and H2020, once per year; seminars and thematic meetings organised with the regional Chambers of Commerce, and with industry clusters once per year, to facilitate cooperation with industry and SMEs from the region (WP5, Task 5.3);
- **Spreading excellence** towards regional and EU universities and research partners via existing virtual platforms such as the PACINNO virtual platform for supporting the work of the Adriatic TTOs;
- **Networking with Data Science Associations and selected projects** such as Big Data Value Association AISBL (BDVA), European Data Science Academy (EDSA), European Association for Data Science (EuADS) and European Network of National Big Data Centers of Excellence (http://www.big-data-networks.eu/) **;**

  An example of the activities planned for 2019 can be found at this link https://project-lambda.org/Action-Plan-2019, see also Figure 1 and Figure 2.

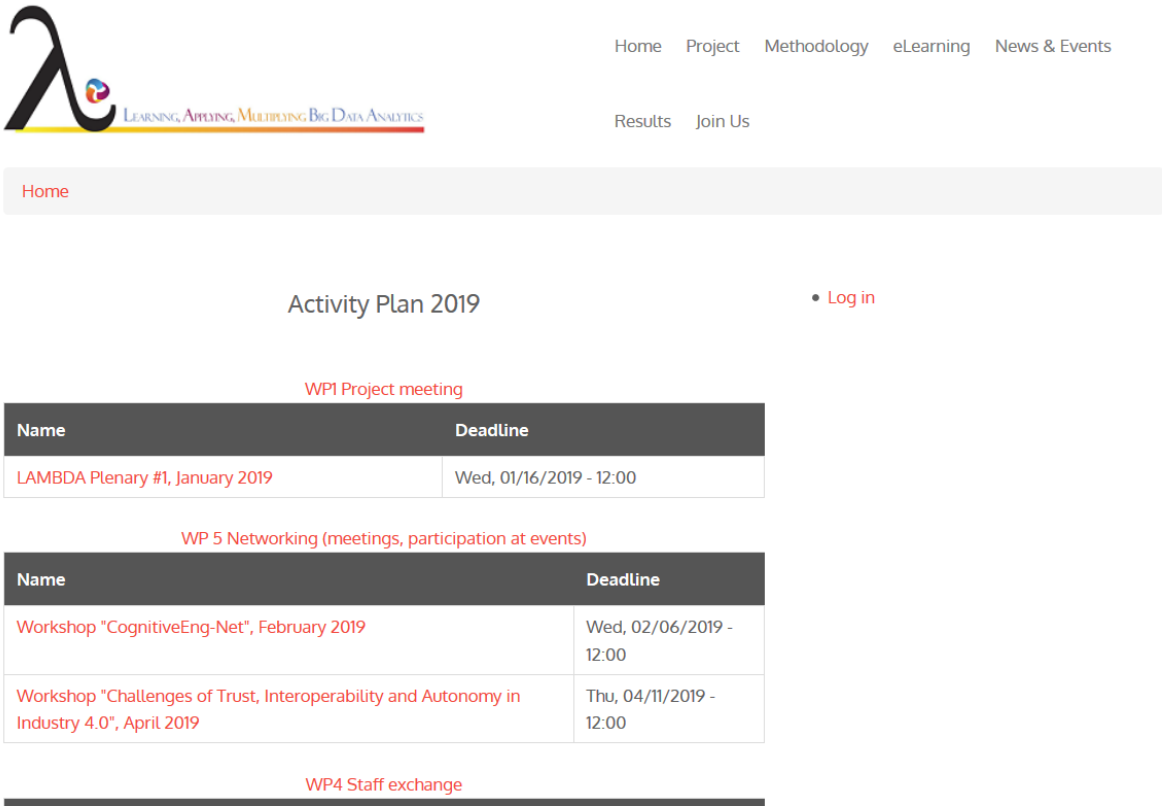

Figure 1. LAMBDA Portal – Activity Plan for 2019

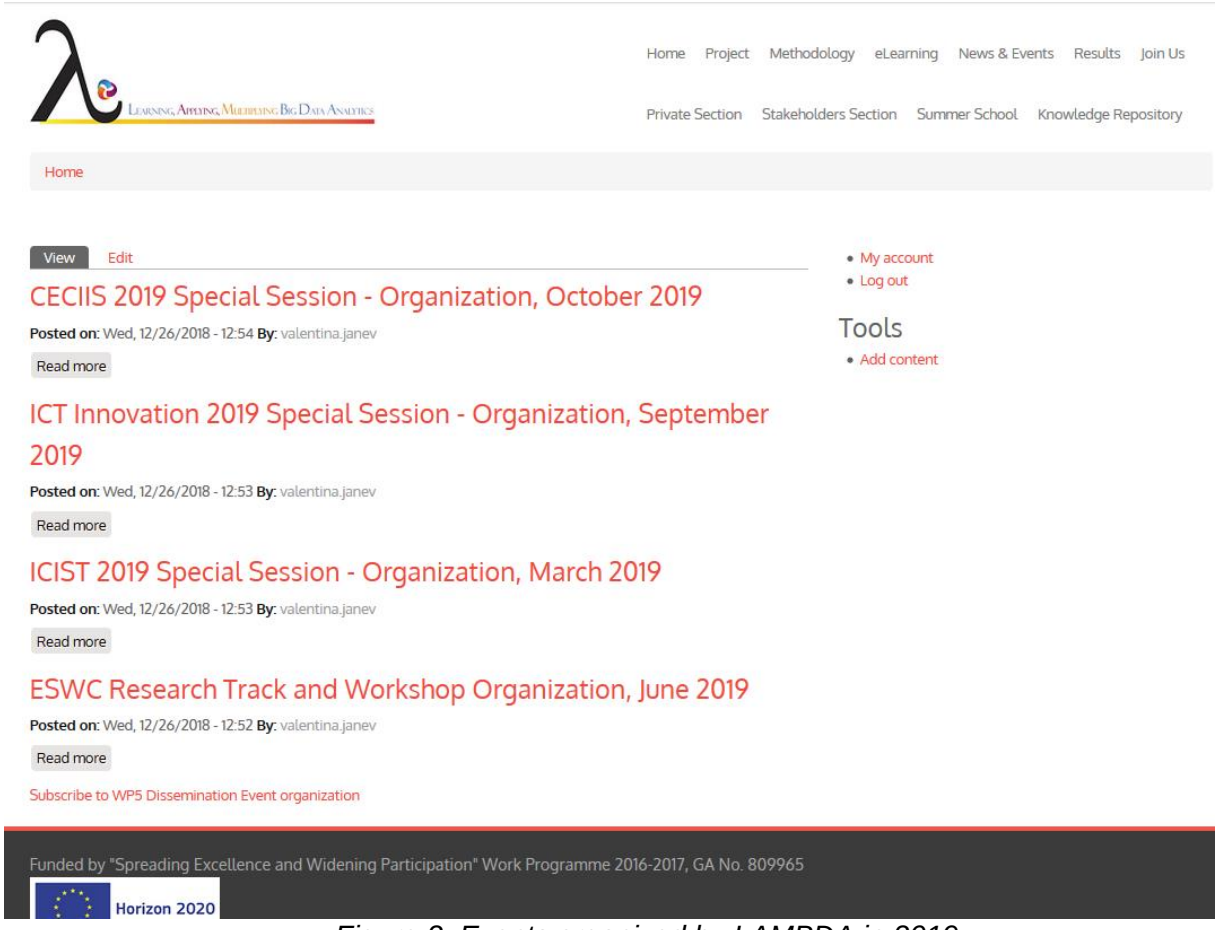

Figure 2. Events organized by LAMBDA in 2019

2.2 Communication Approach

The following Table outlines a selection of dissemination channels.

Table 2. Selection of dissemination channels

Channel	Description	Link
Project Portal	A central hub for all communication efforts will aggregate the diverse landscape of project communication into one conclusive online presence – also demonstrating the platform and the use cases.	Available from M1 (see https://project-lambda.org)
Collaborations / Mailing list and forum	Providing a forum for experts, jury, project team and interested people from domain; Leverage the existing academic partnership networks / existing client network	Stakeholder database[3] BDA-School mailing list[4]
Webinar YouTube / VideoLectures.net	Video tutorials and Webinars will be available based on the Lectures of the BDA Summer Schoosl[5] (2019[6], 2020[7])	Currently stored in the Knowledge Repository[8] on the Private site of the Portal
Social media	Multiplying communication efforts by using social media like Twitter, Facebook, LinkedIn, Google+ and SlideShare.	LinkeIn Network of Experts[9]
Printed dissemination material	Document templates, leaflets, posters, rollups, business cards and giveaways	Hand out printed materials (Leaflet) at different events
Content pool	Preparing stories and free-to-copy texts, pictures and A/V-footage.	materials in the content pool at the Private side of the LAMBDA portal
Advertorials	Booking a small but highly targeted number of advertorials in selected magazines and online media reaching the target group	Advertorials associated with the Research-Industry Forum and BDA School

2.3 Exploitation Strategy

The LAMBDA project shall implement a thoroughly prepared plan of actions for knowledge exchange and transfer in the widening institution (PUPIN) and carry out a wide range of dissemination and outreach activities in the West Balkan countries and across Europe.

[3] https://project-lambda.org/Stakeholders-Section
[4] bda-school@mail.project-lambda.org
[5] https://project-lambda.org/BDA-School
[6] https://project-lambda.org/BDA-SS-2019
[7] https://project-lambda.org/BDA-School-2020
[8] https://project-lambda.org/Knowledge-reporitory
[9] https://www.linkedin.com/groups/12129621/

The PUPIN capacity building within LAMBDA is focused on the EC and Horizon 2020 priority topics from Big Data Analytics field and should ensure a **smooth integration** of PUPIN into the European Research Area (ERA). **Providing a gateway** towards ERA, LAMBDA will have a significant impact on the entire region, setting the **best practice of EU-level competitiveness** within the region, and encouraging other stakeholders (research establishments and ICT industry) to follow in its footsteps.

In Section 4.2 we give the individual exploitation plans of LAMBDA partners.

3. Dissemination and Communication Plan

An adaptive framework for dissemination and communication has been defined within the LAMBDA consortium that is based on the following dissemination types:

- **Scientific dissemination** will target relevant journals related to open, linked and/or big data and important national and international conferences (see examples in the Table below);
- **Industrial dissemination** will be the most critical part of the dissemination phase because of the relevance of addressing SMEs and large industry directly and of ensuring technical takeup by competitive players. In order to generate awareness within the business community special workshops and events will be organised to spread the project's work and results. Further information on the workshops will be defined in the **Twinning Strategy and Action Plan for 2018-2020**. Spreading excellence towards industry partners will emphasize the formulation of research problems from the real-world perspective, and solving the problems by taking into account possibilities of the cutting edge technologies.
- **Traditional dissemination and promotional material** - leaflets, brochures and posters, will be created and distributed in all appropriate events, including meetings with stakeholders, contacts with press or television, and national and regional conferences.

3.1 Dissemination at Scientific Conferences in 2019 / 2020

Table 3. Scientific Conferences in 2019 / 2020

Who	Event	Call for Papers
2019 / 2020		
UBO	European Semantic Web Conference 2019	Call[10]
UBO, IAIS, PUPIN	SEMANTiCS 2019	
UBO, IAIS	International *Semantic Web Conference(e.g. ISCW, https://iswc2017.semanticweb.org/*	
UBO	The 6th Computer Science Conference for University of Bonn Students (CSCUBS)	Call[11]
UOXF	ACM SIGMOD/PODS, ACM International Conference on the Management of Data	
UOXF	EDBT/ICDT, International Conference on Extending Database Technology / Database Theory	
UOXF	ICDE, International Conference on Data Engineering	

[10] https://2019.eswc-conferences.org/call-for-papers-research-of-research-track
[11] http://cscubs.cs.uni-bonn.de/2019/

UOXF	AMW, Alberto Mendelzon International Workshop on Foundations of Data Management	
UOXF	VLDB, International Conference on Very Large Data Bases	

Other conferences interesting for the LAMBDA consortium are DEXA[12], EDBT[13], and European Big Data Value Forum[14].

3.2 Main LAMBDA Events in Serbia and the Region

Table 4. Organization of Events in Serbia and the Region in 2019 / 2020

Who	Event	Call for Papers
	2019	
PUPIN, UBO, UOXF	International Conference on Information Society and Technology (Serbia, ICIST 2019)	Call[15]
All	Research-Government-Industry	Call[16]
All	Big Data Analytics School I	Call[17]
IAIS, PUPIN	European Conference on Information and Intelligent Systems (Croatia, CECIIS, http://www.ceciis.foi.hr/about)	
UBO, PUPIN	ICT Innovations (FYROM, http://ictinnovations.org/)	
All	Conference on e-Learning (Serbia, http://econference.metropolitan.ac.rs/)	
All	Computer Information Systems and Industrial management (Serbia, CISIM 2019, see e.g. http://cisim2018.wi.pb.edu.pl/)	
	2020	
All	International Scientific-Professional Information Technology Conference (Montenegro, e.g. http://www.it.ac.me/eng/)	
All	International Conference on Information Society and Technology (Serbia, e.g. ICIST)	
All	Research-Government-Industry (Foresight Exercise)https://project-lambda.org/Research-Industry-Forum	Call[18]
All	Big Data Analytics School II	Call[19]
All	European Conference on Information and Intelligent Systems (Croatia, e.g. CECIIS, http://www.ceciis.foi.hr/about)	
All	ICT Innovations (FYROM, http://ictinnovations.org/)	
All	Conference on e-Learning, http://econference.metropolitan.ac.rs/elearning-conference-2017/	

[12] International Conference on Database and Expert Systems Applications http://www.dexa.org/
[13] Extending Database Technology (e.g. https://www.edbt.org/)
[14] http://www.bdva.eu/?q=node/742
[15] http://www.eventiotic.com/eventiotic/conference/icist2019
[16] https://project-lambda.org/BDA-Research-Industry-Forum-2019
[17] https://project-lambda.org/BDA-Summer-School-2019
[18] https://project-lambda.org/BDA-Summer-School-2020
[19] https://project-lambda.org/BDA-Research-Industry-Forum-2020

3.3 Examples of Announcements for LAMBDA Events in 2019

3.3.1 ICIST, Serbia, March 2019

The 9th International Conference on Information Society and Techology will be held on Kopaonik, Serbia on Mar 10-13, 2019. The Semantic technologies for Big Data: Volume, Velocity, Variety and Veracity Session supported by LAMBDA project. Figure 2 show the call for paper announce in the homepage of the event.

Figure 3. ICIST Special Track

3.3.2 ESWC, Slovenia, June 2019

The announcement can be found in the following link: https://2019.eswc-conferences.org/call-for-papers-research-of-research-track/
A “Workshop on Large Scale RDF Analytics - LASCAR” is accepted at ESWC and it will be organized by members of UBO and IAIS.

A tutorial entitled “SANSA’s Leap of Faith: Scalable RDF and Heterogeneous Data Lakes” is accepted at ESWC with members from UBO and IAIS.

A research sub-track namely research of the research is accepted in the ESWC with members of UBO as co-chairs and program committee.

3.3.3 Belgrade Big Data Analytics Summer School, Serbia, June 2019

One of the objectives of the LAMBDA project is organization of a **Big Data Analytics Summer School in Belgrade in 2019 and 2020**. The event will bring together researchers and professionals from respectable EU Universities and companies and stakeholders from the West Balkan countries to discuss state-of-the-art in Big Data research and applications. The Big Data Analytics Summer School will allow the invited PhD students (participants of the School from Serbia and the Region) to learn about the newest technologies and trends in this and related fields. The 3-day event is scheduled as follows

- 1st day LAMBDA Research-Industry Forum - Keynotes + Presentations from Companies
- 2nd day Big Data Analytics Summer School - Invited Lectures and Lectures from LAMBDA partners (UBO and UOXF)
- 3nd day Big Data Analytics Summer School - Lectures from LAMBDA partners (UBO and UOXF)

Figure 3 shows the Announcement for the Big Data Analytics School as it is presented on the Web.

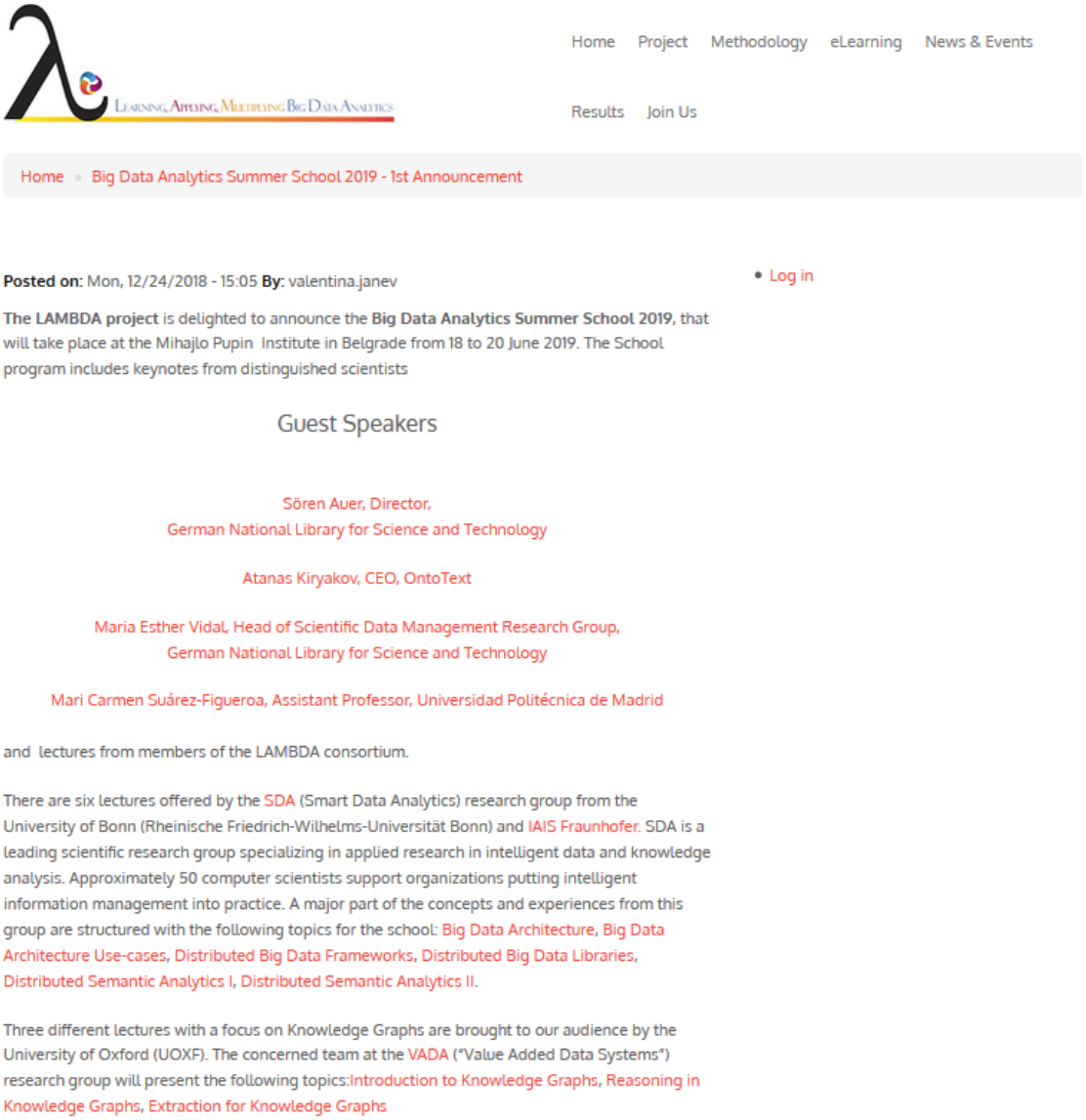

Figure 4. Big Data Analytics Summer School - Announcement

The **LAMBDA Research-Industry Forum** is a one-day event that will be organized together with the **Big Data Analytics Summer School** so that PhD students (participants of the School) have an opportunity to network with experts and professionals from the domain.
More about the organization of this event can be found in Deliverable 2.2.

4. Exploitation Plan

This LAMBDA consortium developed an exploitation plan for the LAMBDA project, aiming at maximising the achievements of the project in and beyond its runtime. As described in the LAMBDA Grant Agreement, the integrated exploitation approach of the LAMBDA project will be supported by the following activities, some of which have already started:

- An initial research analysis of current state-of-the-art and practice in Big Data Analytics with respect to topics relevant for LAMBDA (knowledge graphs, distributed computing, visualization) as well as further monitoring of the scientific achievements throughout the project. This has been reported in D2.1.
- An initial market analysis of main software providers of high performance computing platforms, NoSQL stores, machine learning tools, semantic technologies, etc. The results of the analysis have been reported in D2.1 and D5.1.
- Transferring the teaching and learning materials of UBO and UOXF into lectures adopted for the needs of PUPIN staff and potential stakeholders from West Balkan. This is an ongoing activity already started in WP3.
- Using the research results of IAIS, UBO and UOXF for potential improvement of PUPIN products. This is an ongoing activity foreseen in WP4.
- Continuous analysis of transfer opportunities, flexible adjustment of the project if necessary for best possible outcome (see for example the IAIS proposal for conducting the training for PUPIN staff in collaboration with the BOOST 4.0 project).
- Continuous investigation of possible economic benefits and impact of LAMBDA.

4.1 Transferable Outputs

The current chapter presents the transferable outputs (exploitable results) identified during first six months of the LAMBDA project. The list of the four result categories (Table 1) has been proposed by the project Coordinator (PUPIN), agreed by the identified (taking the WP as reference) responsible partners and afterwards communicated to the whole project Consortium for final agreement. The description of each result is based on the information acquired from the partners and it aims

To provide, for this preliminary perspective, initial (but limited) details. Such overview constitutes a preliminary basis on which to build the final strategy for the overall exploitation of the LAMBDA results.

Table 5. LAMBDA Transferable outputs

#	Transferable Outputs (TO)
1	Lectures prepared for summer school[20] (please see Deliverable 2.2) ● Big Data Architectures ● Distributed Big Data Analytics ● Predictive Analytics ● Semantic Data Web Technologies ● Deep Learning ● Natural language processing ● Spark Fundamentals ● SANSA ● Knowledge Graphs, etc. ● Storage systems - MongoDB, Hive, Cassandra
2	SANSA instantiations for different industries ● Energy sector ● Traffic sector ● e-government sector ● Smart City sector
3	Case studies exercises in ● Energy sector ● Traffic sector ● e-government sector ● Smart City Sector
4	Big data analytics services ● Transforming traditional or **big data** into actionable insights ● Big data visualization ● Custom dashboard design ● Big data consulting services

[20] https://project-lambda.org/Knowledge-repository/Lectures

4.2 Individual Exploitation Plans of the Consortium Partners

4.2.1 Institute Mihajlo Pupin

PUPIN Exploitation plan is aligned with the objectives of the H2020-WIDESPREAD-05-2017:

- **[Policy exploitation] Develop Serbia's capacity** to benefit from the knowledge based society. The results of the project will be delivered as contributions to policies (Open and Big Data policy, Science and Technology innovation policy); where PUPIN's center for policy development has been contributing for several decades. Using Big Data Analytics tool, Pupin will be able to contribute better informed, scientifically grounded, policy proposals, and establish itself as a valuable adviser to policy makers at both governmental and local levels.
- **[Research / Education exploitation] Develop PUPIN's Human resources** as the most valuable asset. PUPIN staff is currently involved in the teaching activities at the University of Belgrade, METROPOLITAN University and the University of Novi Sad. Additional possibilities will be opened (e.g. Faculties of technical sciences in Čačak, Bor and Kosovska Mitrovica) during the LAMBDA project.
- **[Business exploitation]** Further develop local/regional **business support structures** (clusters, incubators, business/technology parks, etc.) in order to promote business, **research and innovation related activities** and public services"; Collaborating with industry, educating professionals, promote business related activities and delivering improved products and services, PUPIN will contribute to future economcentresic development of Serbia and the Region. Most importantly, Pupin will exploit knowledge and experience gained through the LAMBDA project to improve its portfolio of products and services, by exploiting big data analytics paradigm and enhancing the capabilities and quality of its standard products for its usual niche customer base, i.e.:
    - Energy management sector, where PUPIN already has a 80% market share in Serbia, when it comes to power production automation, control and supervision (thermal power plants, hydro-power plants, photovoltaic plants, wind farms), power transmission and dispatching (the national dispatching center is completely done by PUPIN, as well as most of the regional and municipal dispatching centres. Capitalizing on the knowledge and experience on big data analytics, gained during the course of LAMBDA projects, PUPIN will significantly improve its solutions, especially in the area of fault detection and diagnosis, predictive maintenance, energy trading, tariffing, renewable generation forecasting, consumption forecasting, non-intrusive load monitoring, energy infrastructure security and safety services, etc. Since PUPIN uses its homegrown cutting edge SCADA software, it will be enhanced by implementing numerous plug-ins for powerful data analytics, upon which a plethora of innovative services will be implemented.
    - Traffic management sector, where PUPIN is also a regional leader when it comes to the intelligent transportation system, pay-toll collection systems, tunnel management, urban traffic management, access control systems, etc. Again, BDA paradigm has a huge potential for reinforcing PUPIN's products and services in this area as well, offering all sorts of useful analytics to its customer, using a huge amount of data it gathers anyway on its pay toll collection stations, tunnel SCADAs, and numerous sensors installed in the cities and along the highways. It could provide numerous analytics on traffic intensity, bottlenecks, yearly, monthly, daily, hourly distributions, forecasts, to use it for planning purposes for avoiding congestions, for dynamic signaling, for toll tariffing, etc.
    - E-government applications, where PUPIN also has a significant presence in Serbia, implementing numerous applications for Ministry of Finance (tax administration, local and central, business registries – solvency register, register of financial reports, one-stop-shop, anti- money laundry agency's information system, document management system and decision support system, Ministry of agriculture register of governmental incentives, etc. All these solutions could be significantly enhanced using BDA paradigm, which will certainly be exploited in the near future. All sorts of analytics will be offered to

PUPINs, using big data in taxpayers data base and in business registry database, which are developed by PUPIN, and which archive data for 150000 companies and millions of citizens for the time span of 30 years. Numerous innovative services could be offered, based on cross-fertilization of the two currently completely disjunctive big data sources – correlation of financial results, row data and various derivatives we currently offer, from the business registries, and taxes paid different entities, while the anti-money laundry data warehouse could provide interesting insights when correlated with previous two as well. All these services will be offered to the Ministry of finance, once their mock-up prototypes are developed.

- It can be seen from the deliverable 2.2. that describes the dynamics of training and education, that the year 2019 is devoted to acquiring theoretical knowledge on big data analytics, as well as to gaining skills when it comes to open source tools, but also those produced in partner institutions, while the year 2020 is devoted to applying all the theoretical knowledge and skills in concrete, real-world use cases, among which are above mentioned energy management and traffic management areas, being constituent parts of smart city, where the rudimental versions of improved solutions will be developed with the help of project partners, while the more mature solutions, at the technology readiness level 8 or 9, ready for the market, will be developed afterword.

4.2.2 Fraunhofer Institute for Intelligent Analysis and Information Systems

Fraunhofer Gesellschaft, as an international research organisation with several subsidiaries outside of Germany, but none so far in Southeast Europe, will take advantage of the LAMBDA activities and establish an indirect presence in the Balkan region, in which it will promote its successful business model for applied research and innovation. In addition, Fraunhofer will directly benefit in terms of:

- extending its network of academic partners, researchers, industrial collaborators and foreign government representatives;
- access to additional customers, thus increasing possibilities of commercialising existing services through the CoE;
- access to additional data, not only of national but also international value (e.g. government data), that was previously not made available;
- improve its “data scientist” professional training offers using the experience gained by training PUPIN researchers on Big Data topics;
- increased possibilities and an ideal environment for testing techniques and innovative services (e.g. participatory budgets, semantic data lakes, smart city technology, etc.), given the small and manageable size of the host country;
- understanding the standardisation and certification requirements of the industry in Serbia and the Region, which will serve as input to the standardisation activities Fraunhofer is contributing to (including various W3C activities around mapping from heterogeneous data formats to Linked Data as well as data quality, and the Industrial Data Space activities around trusted and meaningful data exchange).

As an applied research association, Fraunhofer brings in business best practices, models and communication strategies aimed at involving the industry in both requirements compilation and in design of different data services, which can then be marketed both locally and internationally. The Consortium members will jointly be responsible for developing the required data value chains and research prototypes for identified selected domains, in constant collaboration with the respective entities, in order to improve on the developed services, products and infrastructures in different iterations. By implementing diverse knowledge transfer activities (hosting PhD students, intra-consortium workshops on specific research topics, invited lectures, summer/winter schools, tutorials at international conferences, etc.), Fraunhofer will substantially intensify the scientific collaboration with researchers from Serbia and the Region. In the long run, benefit are expected in

terms of access to new research avenues, creativity and the development of new approaches, as well as a source for increased mobility (inwards and outwards) of qualified scientists'.

4.2.3 Institute for Computer Science - University of Bonn

While the Institute of Computer Science at the **University of Bonn** carries out *commercial* exploitation primarily via its close ties to the Fraunhofer institutes nearby (in the case of LAMBDA: Fraunhofer), it will exploit the project results towards advancing its excellence in research and teaching. The advancement of the development and application of Big Data platforms in the course of LAMBDA will give UBO a competitive advantage in applying for future funds on building national and European research infrastructures. For UBO as well as the surrounding region, Big Data and knowledge graphs are strategically important topics (e.g. fostered by the Big Data Europe coordination and support action) which LAMBDA will contribute to. The extension of its networks to South-Eastern Europe will give it easier access to highly qualified candidates for its English-language master and PhD programmes, including the possibility of obtaining a dual PhD degree by doing part of one's PhD studies in Bonn and the other part in a widening country. For the master programme, the Big Data Analytics Summer School will serve as a source of up-to-date and attractively presented educational material.
UBO is actively involved in cutting-edge research related to Big Data and Distributed computing. They have active involvement in top-level research conferences both at the organizing level and at the research presentation. UBO will work in close collaboration with UoXf and IMP during the course of this project. UBO plans to work on joint proposal writing and joint research.

The joint lectures will not only strengthen the skills of attendees but also give chance to UBO to get feedback from distinct attendees and help in improving and adapting the content accordingly. At the same time, this will also allow knowledge exchange with UOXF. In addition, the joint proposals will allow knowledge and skill sharing and, if accepted, will help in further strengthening the knowledge ties across Europe.

UBO is working on several open source projects like AskNow, SANSA, DL-Learner. UBO will help the attendees of the schools and lectures from the experiences learned during the development and use of these tools for specialised use cases.

UBO will work together with other partner for further development of these tools and their uses for expanding the network across the Balkan region.

4.2.4 Department of Computer Science - University of Oxford

The **University of Oxford** has a strong tradition in *excellence in education*, as well as *in transferability of research to the benefit of businesses and society* in the context of a charitable organization. Concretely, the University of Oxford will benefit, on the side of **[Research / Education exploitation]** by

- attracting strong students from the region of the host institution to apply for admission at Oxford
- crucially – giving students the right skills and abilities to be able to make competitive applications, thus strengthening the profile of available candidates

The vision and hope is for LAMBDA to leave a lasting impression on the academic strength of candidates from the region, and thus on applications from the region.

In terms of education material and courses, the LAMBDA project will:

- allow Oxford to gain significant additional resources to develop and extend state-of-the-art course and learning material

- exploit the synergies between top courses created within the international LAMBDA network
- allow for validation and improvement of the material at a large scale, including LAMBDA's partners and through LAMBDA's summer schools

In terms of research, the LAMBDA project will:

- create opportunities for joint international project applications to the benefit of the University of Oxford and all participating partners

On the side of **[Business exploitation]**, it is known that:

- the region of the host institution is a growth area
- the University of Oxford is a leading research organization in terms of transferability of research to businesses in the context of a charitable organization

Thus, creating lasting contacts with researchers, regulators and businesses in the region has the potential to directly and in the long term create such opportunities.

5. LAMBDA Promotion Channels and Dissemination Materials

5.1 LAMBDA Portal

The LAMBDA portal (shown in figure 5) is continuously updated with new information about the LAMBDA activities, publications and networking events. Websites most often updated are

- Events, https://project-lambda.org/Events
- Deliverables, https://project-lambda.org/Deliverables
- Publications, https://project-lambda.org/Publications

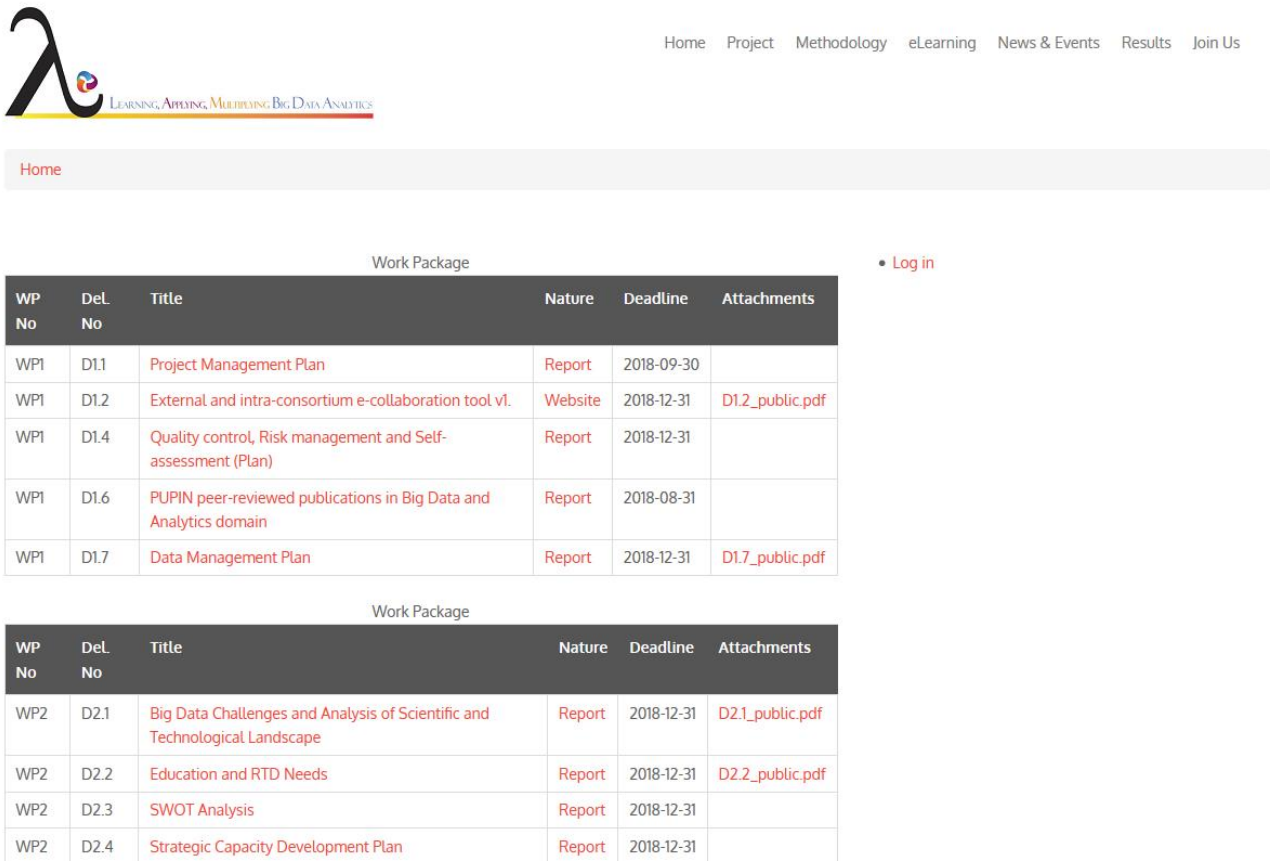

Figure 5. LAMBDA Portal – Results

5.2 LAMBDA Network of Experts

The LAMBDA Network of Experts (shown in figure 6), established as LinkedIn group from the very beginning of the project, has over 40 members (December 2018) including

- members of the Advisory Board, https://project-lambda.org/Advisory-Board
- representatives from stakeholders, https://project-lambda.org/Stakeholders-Education-Research , https://project-lambda.org/Stakeholders-Public-Administration-NGO, https://project-lambda.org/Stakeholders-Industry

14 news were posted to the Group related to PUPIN or other members activities.

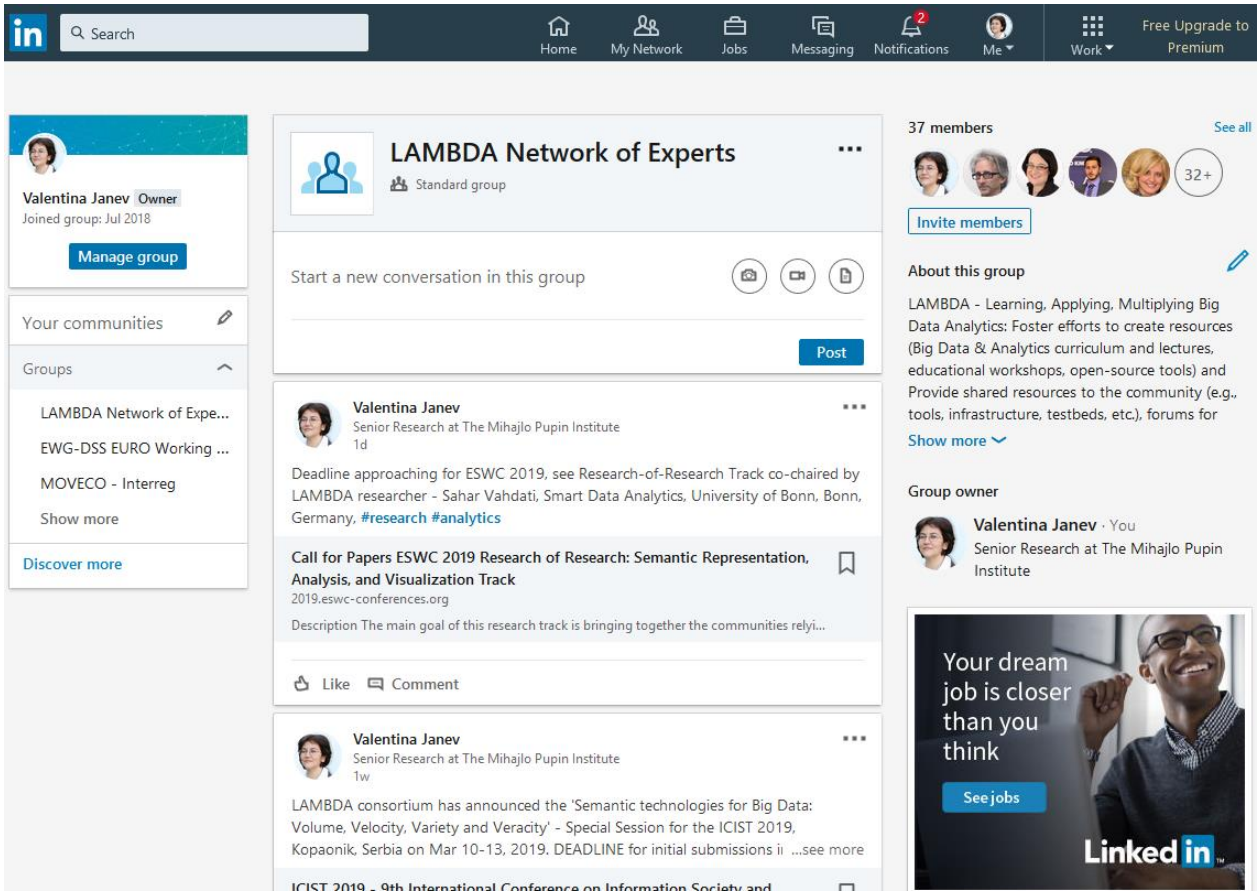

Figure 6. LAMBDA Network of Experts

5.3 LAMBDA Twitter Account

In the very beginning of the project the LAMBDA Twitter account was created https://twitter.com/Net4LAMBDA.
General statistics for this account for the last six months are: 58 Tweets, 20 Following, 14 Followers. Figure 5 shows the usage of social media mainly twitter for the publicity of the project.

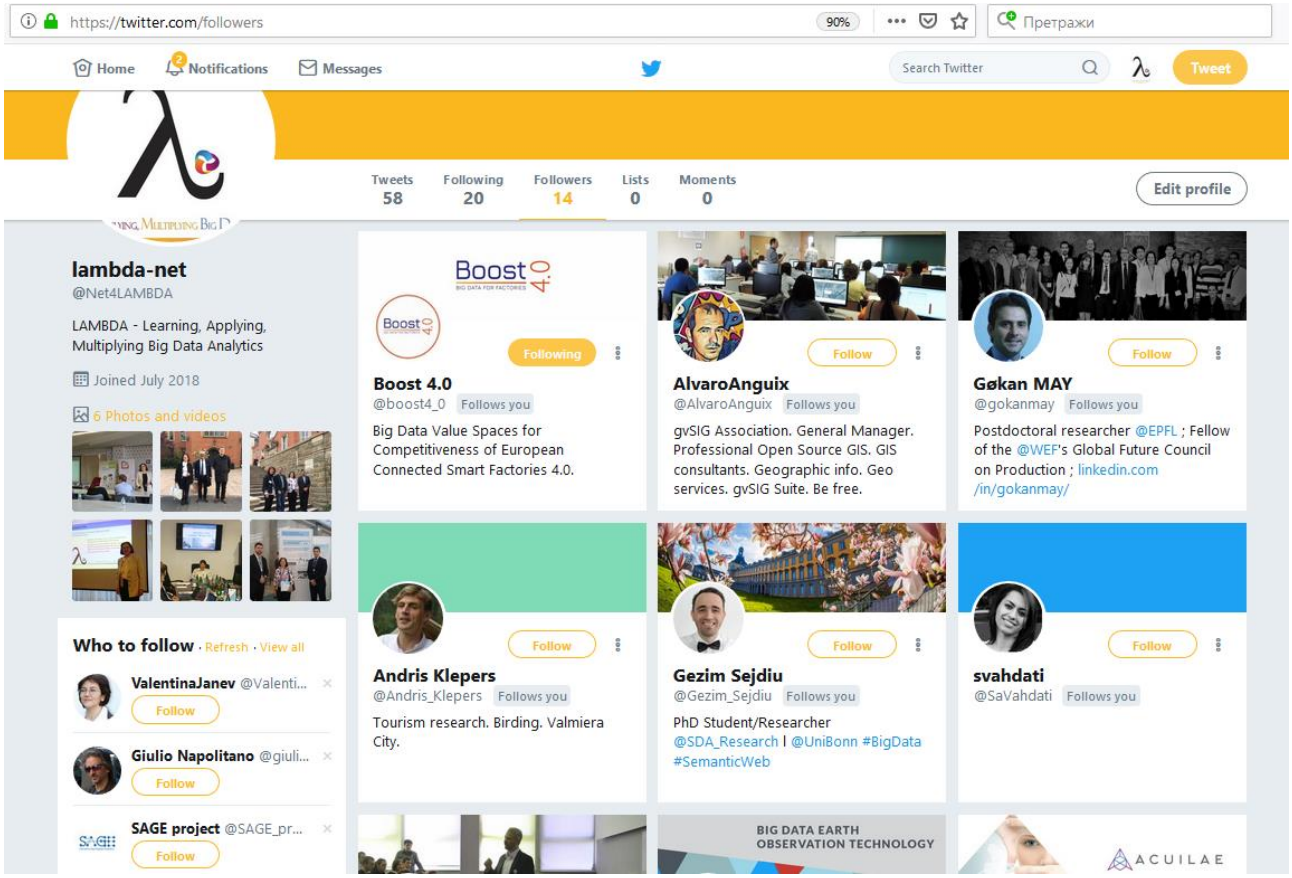

Figure 7. LAMBDA Twitter account

5.4 Promotional Material (Logo, Leaflet, Templates)

Developing the LAMBDA logo (Figure 8) was one of the first steps taken by the project consortium to establish the project's branding. The logo has been designed to help external audiences to easily identify LAMBDA and contributes to the project's visibility from the very beginning. Through the selection process, various designs were suggested and developed to find a version that is easy to recognise and connect with the main project objectives.

The promotional material was prepared with Adobe Illustrator® industry-standard vector graphics software.

Figure 8. LAMBDA Logo

The LAMBDA leaflet (Figure 9 and Figure 10) was developed in order to be distributed for communication/dissemination and awareness raising purposes to stakeholders with an interest in LAMBDA during conferences, workshops or other local event. The leaflet is available on the public website, under the "Promotional Material" link[21].

Different templates (Presentation template, Deliverable template, Agenda meeting template) have been created and are available for downloaded and use by project partner via the LAMBDA G-folder Templates and Dissemination Material.

[21] https://project-lambda.org/Promotional-Material

Figure 9. LAMBDA Leaflet (1)

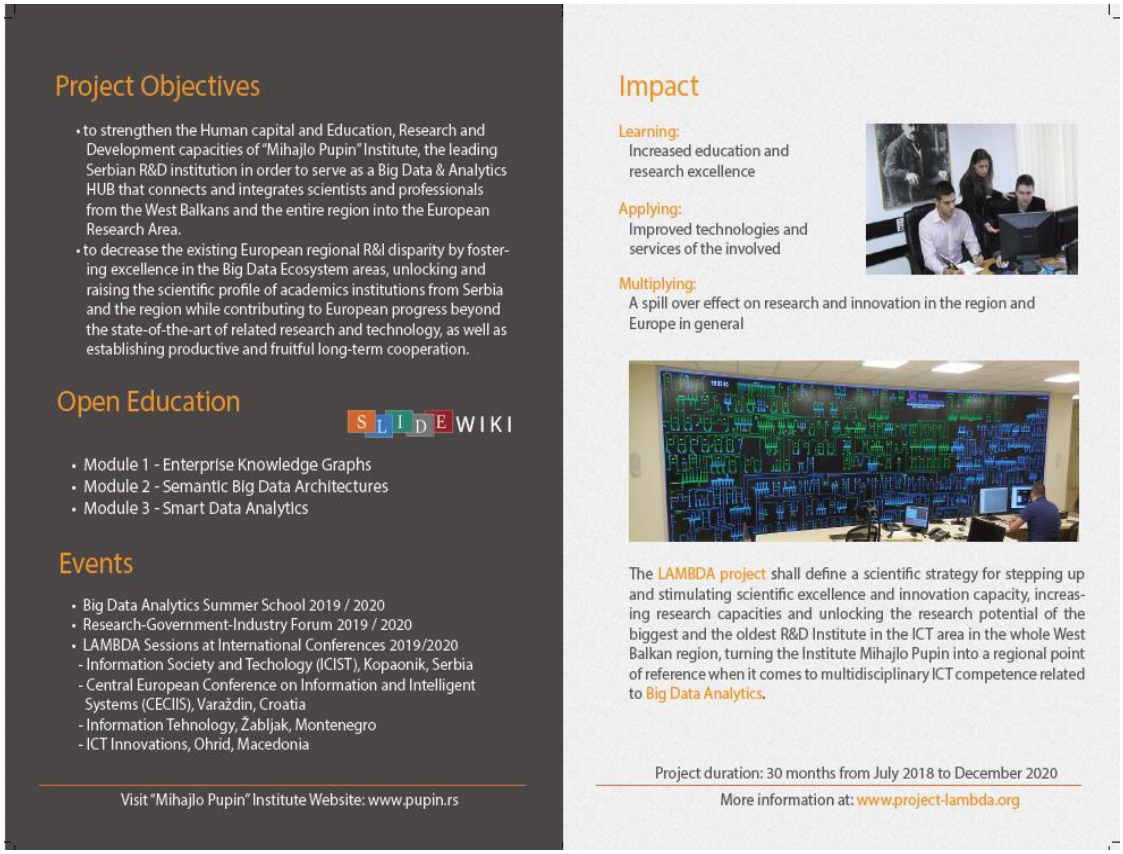

Figure 10. LAMBDA Leaflet (2)

6. Main Achievements

6.1 Published Scientific Papers – PUPIN Staff

6.1.1 Journal Papers

- Vuk Mijovic, Nikola Tomasević, Valentina Janev, Mladen Stanojević, Sanja Vraneš (2018). *Emergency Management In Critical Infrastructures: A Complex-Event-Processing Paradigm*, Journal of Systems Science and Systems Engineering, Springer Berlin Heidelberg, ISSN: 1004-3756 (Paper) 1861-9576 (Online), pp 1–26, https://doi.org/10.1007/s11518-018-5393-5, 2018. **Online link**: https://link.springer.com/article/10.1007/s11518-018-5393-5

6.1.2 Publications in Conference/Workshop proceedings

- Lazar Berbakov, Nikola Tomašević, Marko Batić, Architecture and implementation of IoT system for energy efficient living. In Proc. 26th Telecommunications Forum (TELFOR 2018, 20-21.11.2018), Belgrade, Serbia. IEEE.

6.2 Events Organized by LAMBDA Consortium

6.2.1 LAMBDA Kick-off meeting, Belgrade, Serbia, 17 - 18 September 2018

The two-days Kick-off meeting was organized middle of September. The consortium partners discussed the

- Big Data Challenges and Technological Landscape (session organized by Dr. Hajira Jabeen and Dr. Emanuel Sallinger)
- Education and RTD Needs (PUPIN and the Region) (session organized by Sahar Vahdati and Dr. Jens Lehmann)
- Strategic Capacity Development Plan for PUPIN (session organized by Mohammad Nammous)

Figure 11. LAMBDA Kick-off meeting (Group photo)

6.2.2 SlideWiki Developer Hackathon, Belgrade, Serbia, 26-28 September 2018

On 26-28 September 2018, SlideWiki developers met in Belgrade, Serbia for the 8th hackathon[22]. An important benefit of the Hackathon was that PUPIN staff met SlideWiki DevOps (Development and Operations) team and learn how to implement new features head-on, e.g., by sitting together behind one screen (pair-programming).

Figure 12. SlideWiki Developer Hackathon, Belgrade

[22] https://project-lambda.org/node/31

6.3 Extending the PUPIN Research Network

6.3.1 Networking at Scientific events

Table 6. Networking at Scientific Events in 2018

Event	Description
2018	
TELFOR 2018	Lazar Berbakov, paper, http://www.telfor.rs/files/Program%20TELFOR%202018.pdf
US-Serbia & West Balkan Data Science Workshop	Nikola Tomašević, Valentina Janev, Sanja Vraneš, poster https://nsfserbia.rs/posters/
eLearning Conference, http://econference.metropolitan.ac.rs/	PUPIN team, networking and dissemination of leaflets
Business Information Security BISEC'2018, http://bisec.metropolitan.ac.rs/	PUPIN team, networking and dissemination of leaflets

6.3.2 Networking with Regional Policy Makers

Table 7. Networking with Policy makers in 2018

Event	Description
2018	
Reinventing the world- The power of Industry 4.0" http://ntpark-conf.rs	PUPIN team, networking and dissemination of leaflets
Green Economy Congress 2018	PUPIN team, networking and dissemination of leaflets
ICT Network, https://www.ict-net.com/	PUPIN team, networking and dissemination of leaflets

6.3.3 Work on join projects

Table 8. Extending the PUPIN partner network together with IAIS

Event	Description
2018	
1st CognitiveEng-net Workshop, October 2018	Valentina Janev, networking and dissemination of leaflets
CESSDA ERIC Event in Belgrade, 14 - 15 November 2018	Valentina Janev, networking and dissemination of leaflets

6.3.4 Other Events Participation

The following table contains details about events where LAMBDA project promotional material has been distributed by UBO / IAIS / UOXF members.

Table 9. Promotional activities of UBO and UOXF

Who	Event	Description
		2018
UOXF	VLDB2018, 44th International conference on Very Large Data Bases 2018	Emanuel Sallinger, paper, http://www.vldb.org/pvldb/vol11/p975-bellomarini.pdf
UBO	SEMANTiCS Conference 2018	Hajira JAbeen, paper, https://2018.semantics.cc/using-sansa-stack-38-billion-triple-ethereum-blockchain-dataset