

“D8.4”

1st dissemination, communication and exploitation report & outline for the following year

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SIRMA AI	SIRMA AI	Bulgaria
STICHTING KATHOLIEKE UNIVERSITEIT	RADBOUDUMC	Netherlands
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Executive summary

The report examines the results of the planned activities under D8.2 “Plan for the exploitation, dissemination, and communication of results” for the period M1-M18. This document presents a detailed report reviewing all activities related to dissemination – scientific publications, participation, and presentations at scientific events and networking with scientific communities. The communication report includes a formal assessment of the visibility of the project and social networking activities related to it. The initiatives related to standards are outlined.

The results of the dissemination activities show high publishing activity and publication of the scientific results in prestigious scientific journals and presentation of the project results at several conferences. Even a short period since the project beginning, many publications have citations and gained popularity in social media. Members of the ExaMode project consortium participated at several activities of Big Data Value Association (BDVA) and at scientific conferences, where they established contacts with scientists and shared the project objectives and current achievements.

The results of communication activities show a wide range of media and communication channels used to inform the general public about the project’s objectives and its expected impact on society, science, healthcare, and technology.

This report also outlines activities planned for the following year and overviews different types of activities. An updated version of the exploitation plan is drawn as well.

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List of Abbreviations

ACM	Association for Computing Machinery ¹
API	Application Programming Interface
BDVA	Big Data Value Association ²
CAGR	Compound Annual Growth Rate
DP	Digital Pathology
EDI	Electronic Data Interchange
EHR	Electronic Health Record
EMR	Electronic Medical Record
ETL	Extract, Transform, Load
FHIR	Fast Healthcare Interoperability Resources ³
HIPPA	Health Insurance Portability and Accountability Act ⁴
HL7	Health Level Sevens
ICT	Information and Communication Technologies
IEEE	Institute of Electrical and Electronics Engineers ⁶
IPR	Intellectual Property Rights
ML	Machine Learning
NLP	Natural Language Processing
PHI	Protected Health Information
RDF	Resource Description Framework ⁷
REST	REpresentational State Transfers
SIGIR	Special Interest Group on Information Retrieval ⁹
SDG	Sustainable Development Goals
WSI	Whole Slide Image

¹ <https://www.acm.org/>

² <http://www.bdva.eu/>

³ <https://www.hl7.org/fhir/overview.html>

⁴ https://www.certpro.in/hipaa-compliance-certification/?gclid=EA1aIQobChMIwfWAIp6c6gIVzoayCh3vYg87EAAAYASABEgKtjFD_BwE

⁵ <https://www.hl7.org/>

⁶ <https://www.ieee.org/>

⁷ <https://www.w3.org/RDF/>

⁸ <https://restfulapi.net/>

⁹ <https://sigir.org/>

1. Introduction

The main objectives of activities in WP8 are to increase the awareness of the society, scientific, medical and ICT communities, and the industry as well, about the project objectives and achievements. This requires visibility of the project objectives and results, scientific impact is implemented through different dissemination and communication activities, that allow to reach different target groups and to deliver the current scientific results and the possible application and the impact of the developed solutions.

In compliance with the D8.2 “Plan for the exploitation, dissemination, and communication of results” were initiated dissemination and communication activities, targeting a broad range of stakeholders. This document overviews the planned dissemination and communication activities and reports their fulfillment during the period M1-M18. Some formal assessment tools are used to measure the project's impact and results.

The current epidemic of COVID-19¹⁰ has changed some of the routine activities and many conferences have been canceled; some have become virtual, other events have changed dates for the near future. Social distancing has caused limitations in physical communication and participation in scientific and social events, which plays an important role in informal communication. The current activities in scientific networks are mainly virtual. This increased the role of digital communication and caused some changes and limitations in the organization of seminars, lectures, and meetings.

2. Report for the dissemination, exploitation and communication activities performed during the year

2.1. Multi-purpose tools and materials

During the first period of ExaMode were developed the main project artefacts that contribute to ExaMode visibility and target all groups of stakeholders.

From the planned activities listed in D8.2, Table 1, all are fulfilled successfully except, “ExaMode external Wikipedia page” (responsible partner UNIPD), which is not yet available (the development is postponed for the next reporting period when more results will be available in the context of ExaMode). The current status of the other activities is as follows:

- ExaMode website: <https://www.ExaMode.eu/> – the website is the main communication and information channel for the external audience. The information in rubrics “News” and “Resources” is updated periodically. The project website also provides links to the ExaMode social media channels: Twitter, Facebook, LinkedIn, and BDVA¹¹ initiative, as well as to CORDIS.
- ExaMode logo – used on all dissemination and communication project materials.
- ExaMode visual identity guidelines and templates (document template, presentation template) – used for deliverables and all types of presentations.

¹⁰ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

¹¹ <http://www.bdva.eu/>

- ExaMode slogan: “DRIVEN BY DATA, DEVELOPED FOR PATIENTS” – was selected among several options with majority voting of the consortium members. The search engines associate unambiguously this slogan with the ExaMode project.
- ExaMode Wiki page: https://wiki.ExaMode.eu/index.php/Main_Page - for internal information within the project consortium, actively used by all members.
- ExaMode promotional material (flyer, stickers) – distributed to several scientific events.
- ExaMode e-leaflet – was developed at the beginning of the project.
- ExaMode photo album – photos from all project meetings are published on the ExaMode website and are also posted in the social media. In addition, several photos of ExaMode consortium members are collected from different communication and dissemination events and posted on the ExaMode social medial channels.

The results from the top 3 search engines (Google, Bing, and Yahoo) shows (Figure 1) that the project has very high visibility on the Web and is indexed at the top place in the results, although there are some ambiguities with the name.

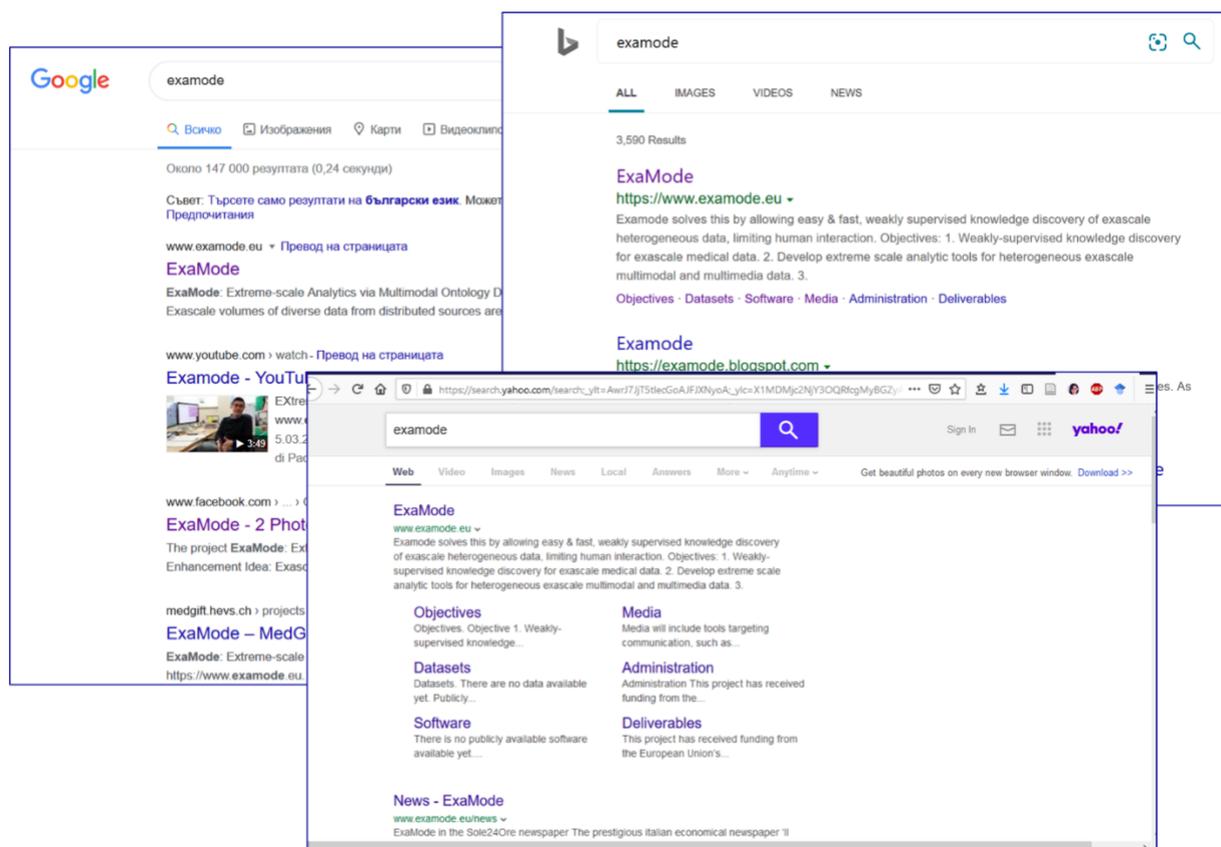


Figure 1 Search engines result for query “ExaMode”

2.2. Dissemination activities report

Dissemination activities aim to transfer project results and raw data in an appropriate form to the scientific community (i.e. academic journals, scientific conferences, workshops to the target

scientific audience). The partners' roles and responsibilities in the dissemination plan are listed in D8.2, Table 3. In addition, were listed some performance indicators related to the dissemination activities:

Table 1 Dissemination activities plan

	Dissemination activity	Plan for period M1-M48	Report for period M1-M18
1.	Participate in scientific conferences and or business/medical community domain events per year during the project lifetime	>6 per year	> 18
2.	Publish scientific publications in relevant scientific journals, including conference posters	>3	> 23

2.2.1. Scientific Publications

According to the initial dissemination plan, were planned only 3 scientific publications: Scientific publication 1 (HESSO, deadline Dec 2019), Scientific publication 2 (HESSO, deadline Dec 2021), Scientific publication 3 (RUMC, deadline Dec 2019 - poster). All planned activities were accomplished successfully and during the first period of the ExaMode project (M1-M18) were published 5 journal articles (Appendix 1, Table 4, J1-J5), 18 conference papers (Appendix 1, Table 5, C1-C18), accepted for publication 6 papers (Appendix 1, Table 6, A1-A6) and submitted for review 9 papers (Appendix 1, Table 7, S1-S9). The distribution of scientific output for 2019 and 2020 is shown in the chart below.

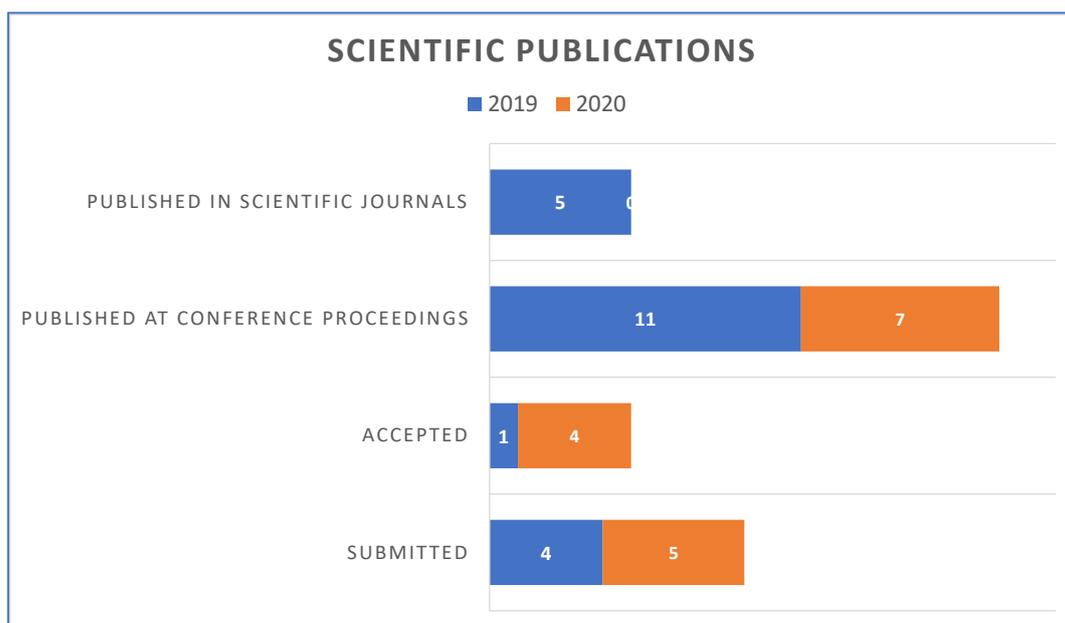


Figure 2 Scientific publications during the first period.

The publications are published in highly reputable journals (see Figure 5) and conference proceedings, 15 publications are indexed in Scopus, and 7 publications are indexed in Web of Science, 4 of which have Impact Factor and are rated in quartile Q1 in the corresponding category. For the excellent scientific results, another indicator is the 54 citations of these publications, even after such a short period.

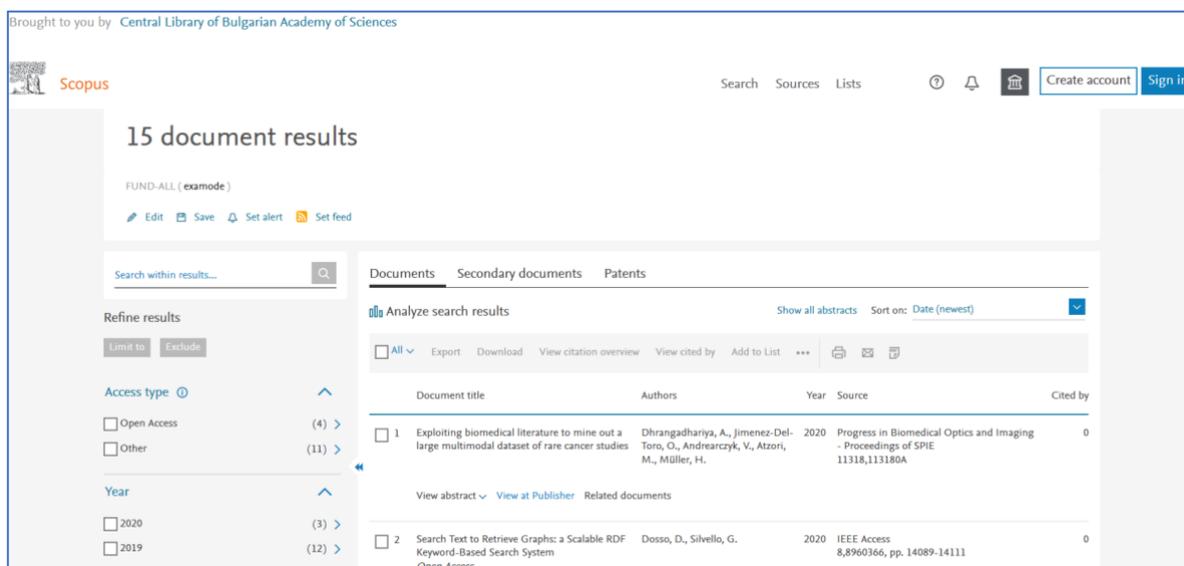


Figure 3 Scopus - search for publications funded by “ExaMode”

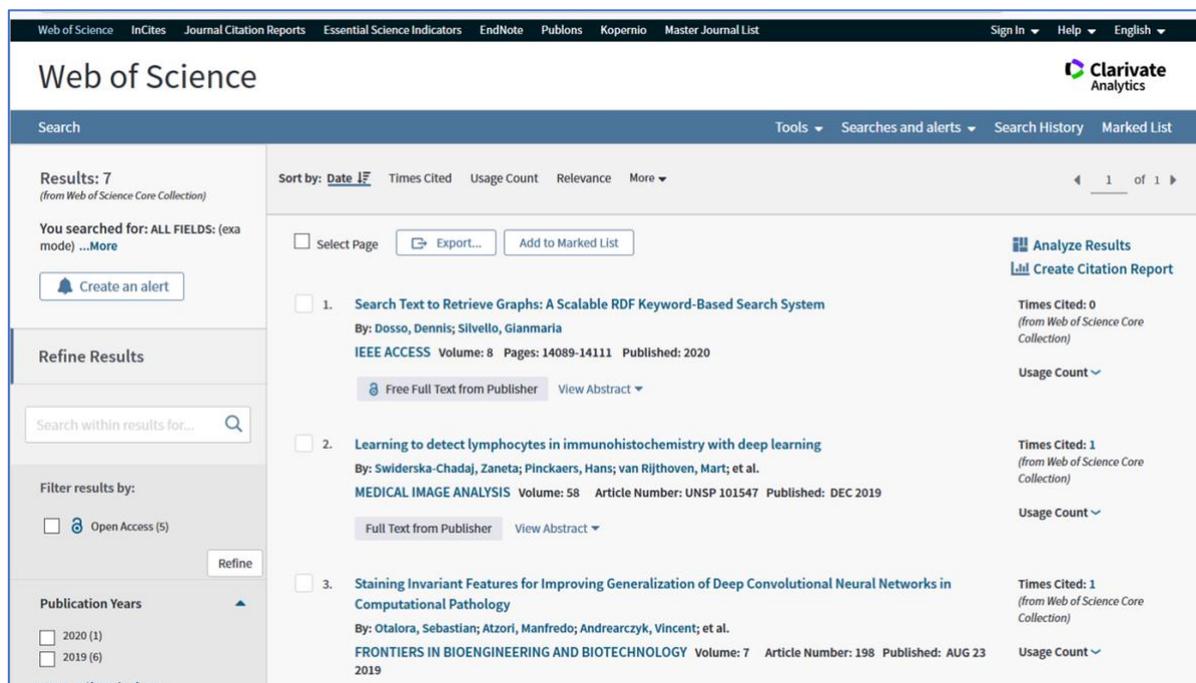


Figure 4 Web of Science - search result for “ExaMode” in ALL fields

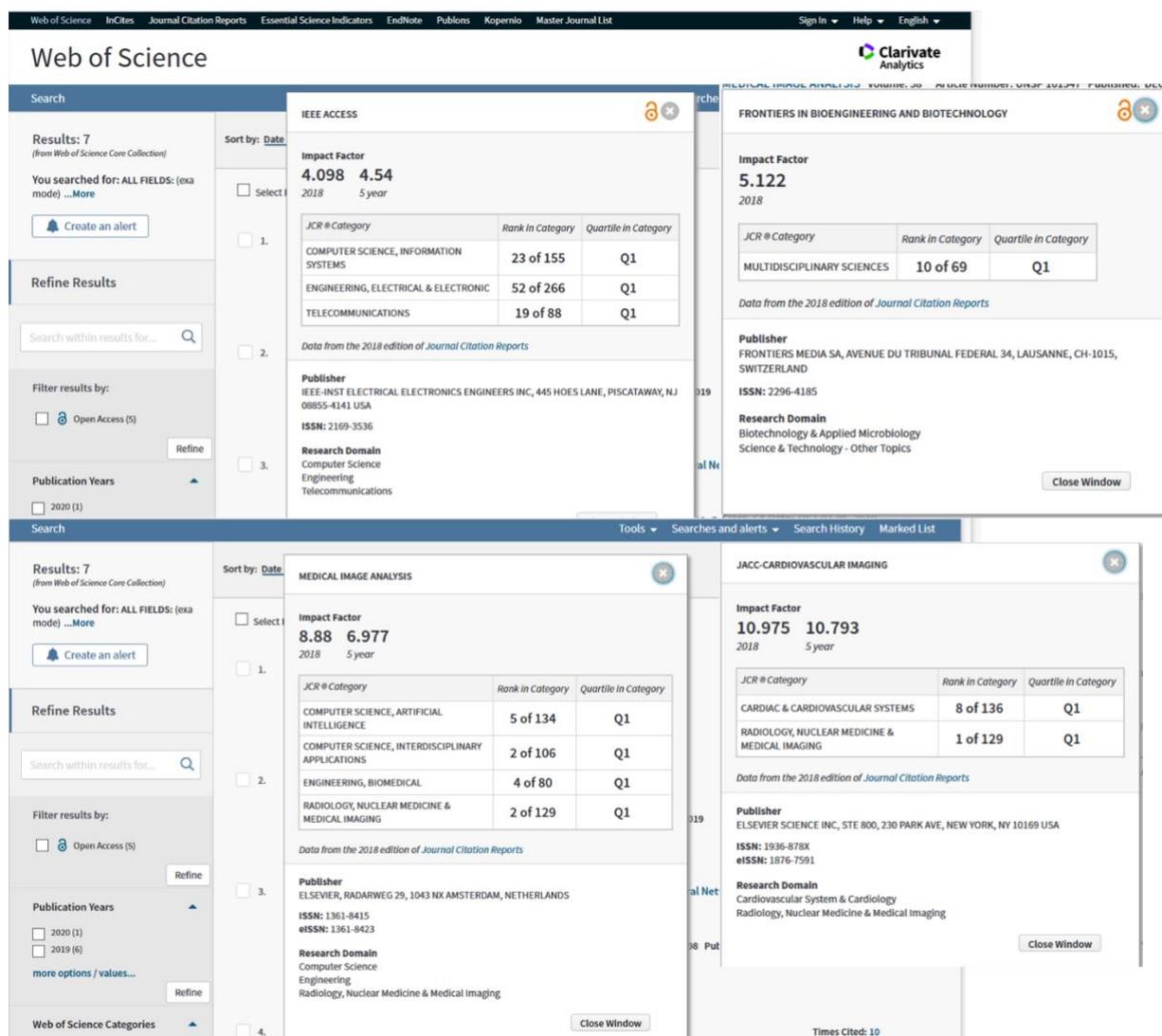


Figure 5 Web of Science - Impact Factor of the publications

The visibility of the scientific publications in Open AIRE is shown in the figure below: 9 publications are identified as related to ExaMode. Besides, the gold open access publications, the majority of ExaMode publications are posted at the institutional web sites and provide green open access.

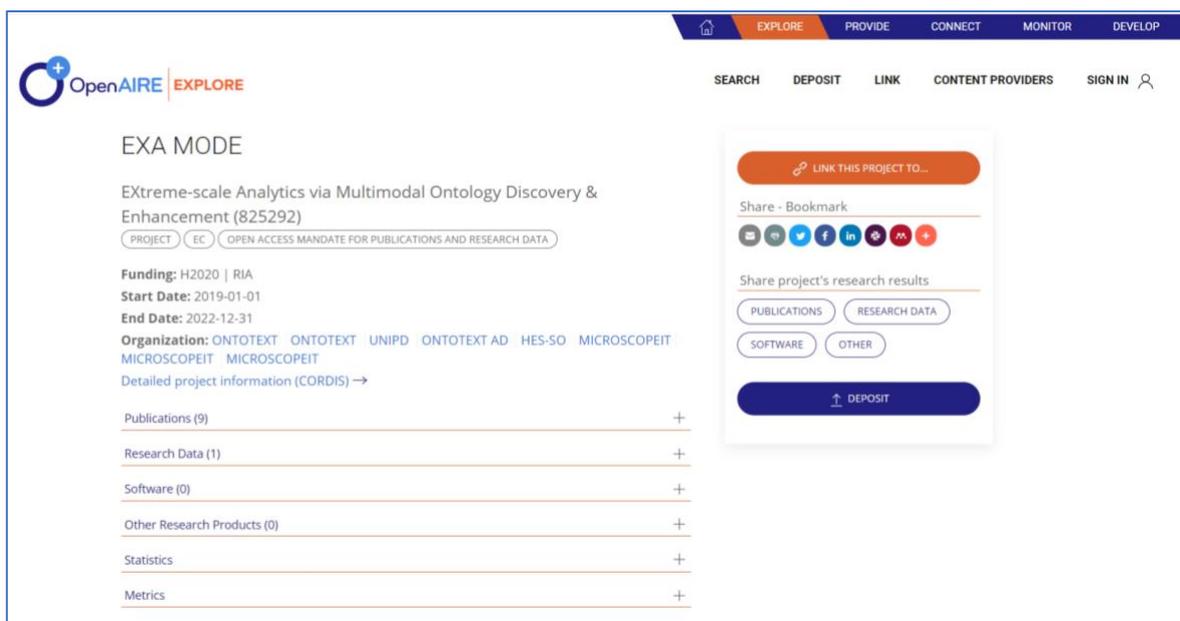


Figure 6 OpenAIRE results for ExaMode

The impact and engagement of the society with the ExaMode research output were assessed by the tool Altmetric¹². The results show that for all journal papers (J1-J5) exists posts and communications in social media Twitter and Facebook.

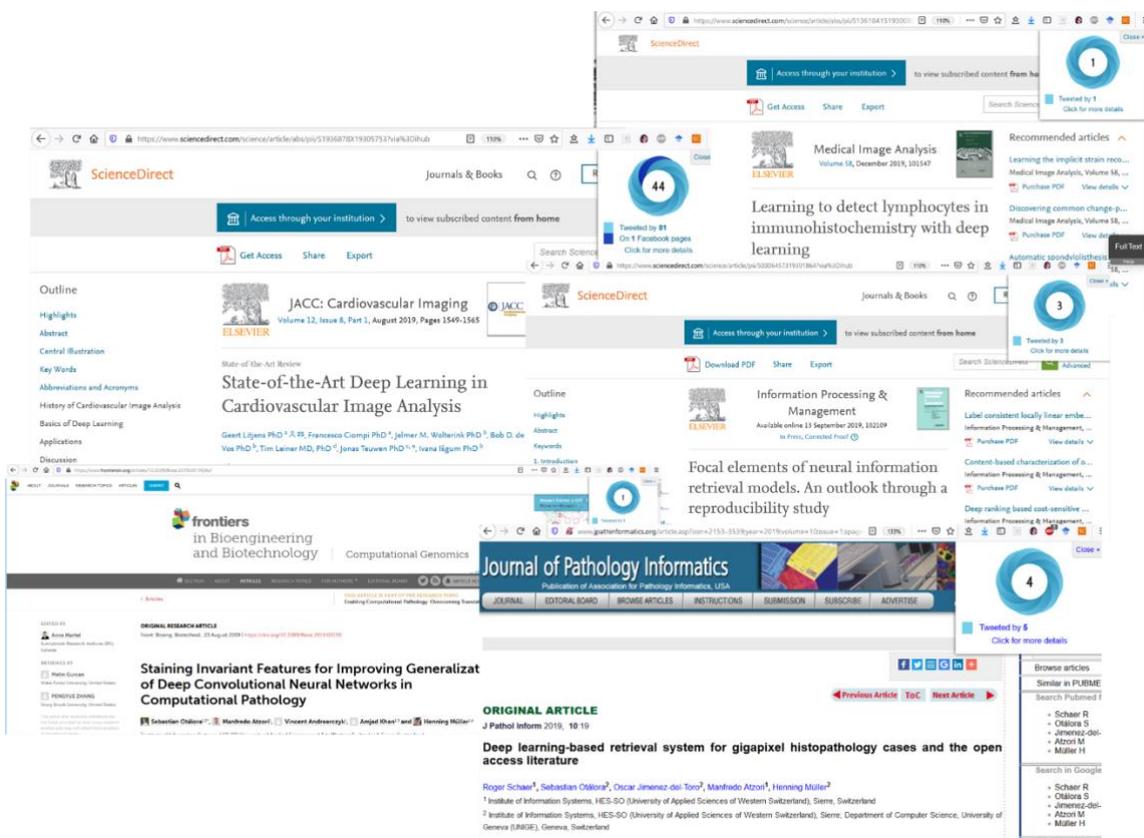


Figure 7 Social media impact on scientific publications

¹² <https://www.altmetric.com/>

The different target audience by the research output and its impact on sustainable development goals (SDG) was measured by the tool Technote¹³.



Figure 8 Sustainable Development Goals¹⁴

The assessment results show that the ExaMode research output addresses the following SDG:

- Goal 3: Good Health and Well-being – Publications J1, J2, J4, J5, C1, C3, C13, C14, C18, A1, A3, A5
- Goal 4: Quality Education – Publication J1
- Goal 9: Industries, innovation, and infrastructure – Publications J3, J4, C11, C13, C18, C6
- Goal 11: Sustainable cities and communities – Publications C6, C18
- Goal 12: Responsible consumption and production – Publications C2, C18

2.2.2. Participation at Scientific Events

The ExaMode consortium members presented papers at more than 18 conferences, workshops, symposia, scientific events (Appendix 1, Table 5) and (Appendix 2, Table 8):

- 12th European Summer School in Information Retrieval (ESSIR 2019¹⁵) Milan, Italy, July 17th to 18th, 2019
- 10th Italian Information Retrieval Workshop (IIR 2019¹⁶), September 16–18, 2019, Padova, Italy
- The 2019 ACM SIGIR International Conference on the Theory of Information Retrieval (ICTIR '19), Santa Clara CA, USA, October 2019
- Italian Research Conference on Digital Libraries

¹³ <https://technote.ai/osdg>

¹⁴ <https://www.un.org/sustainabledevelopment/blog/2015/09/why-should-you-care-about-the-sustainable-development-goals/>

¹⁵ <http://www.ir.disco.unimib.it/essir2019/>

¹⁶ <https://iir2019.dei.unipd.it/>

- the 27th SEBD
- International ACM SIGIR Conference on Research and Development in Information Retrieval
- the 9th PhD Symposium on Future Directions in Information Access (FDIA), 2019, Milan, Italy
- TREC
- International Conference on Multimedia Modeling
- In International Conference on Theory and Practice of Digital Libraries
- SPIE Medical Imaging, 2020, Houston, Texas, United States
- The 12th Language Resources and Evaluation Conference
- Medical Imaging with Deep Learning, 2019.
- IEEE Transactions on Pattern Analysis and Machine Intelligence

In addition, the ExaMode project was mentioned in several keynote presentations (Appendix 2, Table 8, E1, E19), conference presentations (Appendix 2, Table 8, E2-E6, E8, E12, E16). A special video for the dissemination of the ExaMode objectives and achievements was developed by UNIPD (Appendix 2, Table 8, E18). At different scientific conferences and events were distributed ExaMode project flyers (Appendix 2, Table 8, E7, E8-E11, E15, E17). All events were spread around the world: USA, Europe, Asia – this shows very wide dissemination of the project results.

2.2.3. Networking with Scientific Communities

Besides participation at conferences and networking with scientific communities, ExaMode consortium members were also involved in BDVA initiatives:

- Manfredo Atzori presented ExaMode at the BDVA welcome meeting for all the new projects in Brussels (Feb 2019)
- Todor Primov presented ExaMode at the Big Data Value Summit 2019 (26-28 June) in Riga, Latvia
- Regular participation at BDVA webinars
- Participation of consortium members at BDVA steering committee
- Sirma AI presented ExaMode for the Big Data Value PPP at ICT Proposers Day (19-20 September), Helsinki, Finland.

2.3. Communication activities report

Communication activities during the first period (M1-M18) were mainly addressed to the general public and included the presentation of the ExaMode project objectives.

2.3.1. Social Networks

Different social network channels were created and actively used to promote ExaMode project activities:

- Twitter: <https://twitter.com/ExaMode> - about 52 posts in total mention #ExaMode, “ExaMode”, 18 of which are from @ExaMode account
- Facebook: <https://www.facebook.com/ExaMode.eu> - 9 posts
- LinkedIn: <https://www.linkedin.com/company/ExaMode> - 8 posts
- ResearchGate: <https://www.researchgate.net/project/ExaMode-Extreme-scale-Analytics-via-Multimodal-Ontology-Discovery-Enhancement> – 17 publications are associated with the project. More partners should join the project in ResearchGate.

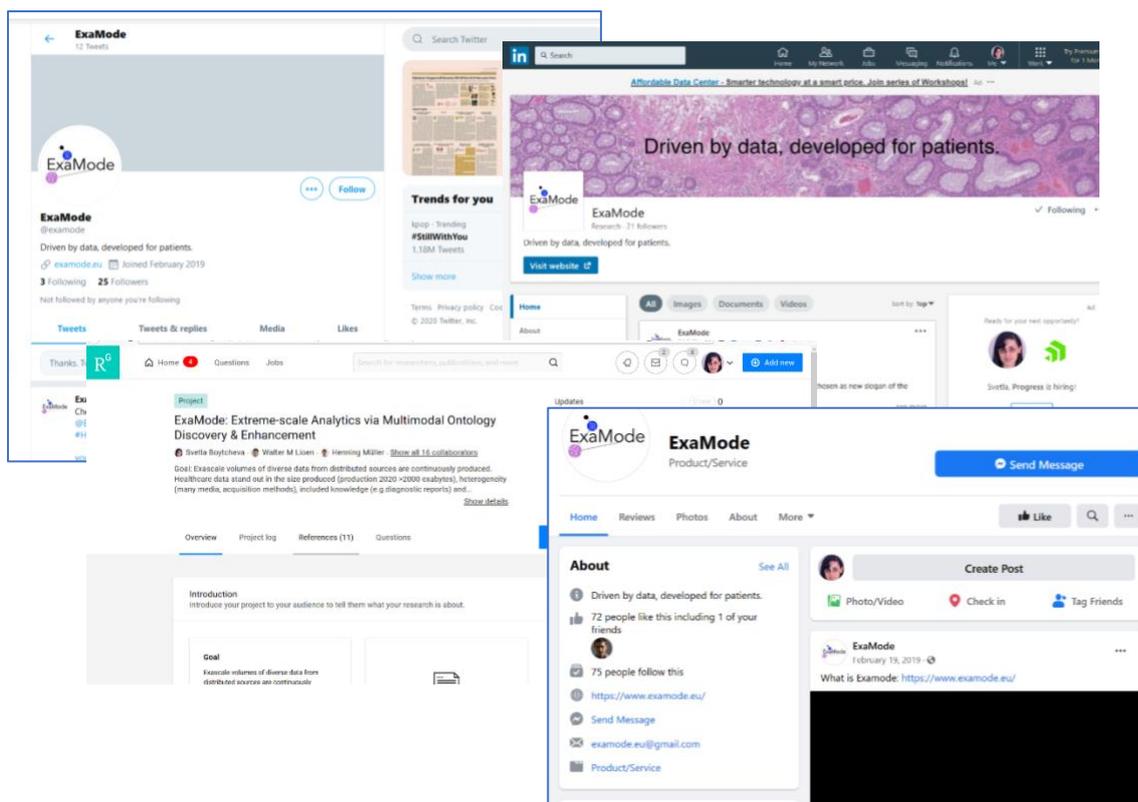


Figure 9 Screenshots from ExaMode social media accounts

2.3.2. Publications and media addressed at the general public

The project was presented in media on different EU languages (Italian: 2, French: 6; German:1, Bulgarian: 5, English: 5). A wide variety of communication channels were used to spread the ExaMode project ideas at the local and international level, to citizens in different age groups, social groups, and professions. In Appendix 3, Table 9 are listed some of them: 1 video (CM2), 1 blogpost (CM1), handbook (CM4), newspaper publication (CM3, CM12, CM13) , interview (CM11), radio (CM8), TV (CM9), online news (CM6, CM10, CM14-CM18).

2.4. Exploitation activities report

The exploitation of results aims to promote the transfer of knowledge and dialogue with stakeholders on how the results of the project can be applied. The current COVID-19 outbreak shows some reduction in opportunities to participate in major industrial fairs and forums. For the next period we are planning to explore in addition some virtual events.

2.4.1. Business Case 1– Sirma AI (Ontotext)

The description of Business Case One by Sirma AI in ExaMode is provided in Table 2.2a Business case one (OT) in Annex 1 to the Grant Agreement, and further elaborated in the Deliverable 8.2 - “Plan for the exploitation, dissemination, and communication of results”.

As of M18 of the project, the initial solution software architecture is defined, and the core components of the application are developed as first prototypes. The progress in the system design and component development is outlined in Deliverable 6.2 – “Software Architecture and Specification for Semantic Diagnostics Knowledge Management System”.

The software solution designed by Sirma AI for semantic interoperability based on HL7 FHIR is a platform combining different software components covering the whole pipeline of semantic medical data normalization and specific functionalities requested by the testbed partners (AOEC).

1. **Generic ETL** component for the transformation of heterogeneous data inputs into RDF
2. **NLP** component for semantic data normalization of structured and unstructured textual data
3. **FHIR ETL** component for modeling the normalized data into HL7 FHIR RDF
4. **Semantic storage – GraphDB¹⁷**
5. **Graph similarity search** over FHIR model
6. Custom **semantic search** and exploration
7. Medical case **similarity search in the scientific literature**

While the first five components are generic and configurable for the specific use cases, the last two components will be developed explicitly for the needs of the histopathologists from AOEC.

The current development provides early prototypes of Generic ETL, NLP, Semantic storage, and Graph similarity search. The remaining components are not yet fully scoped and will be developed for the next version of the platform.

Sirma AI is entering the preparation phase of its exploitation plan in a very complicated situation – the COVID-19 outbreak significantly affected the possibility for participation in business development events – conferences, fairs, etc., especially abroad, as Sirma AI targets mostly the international market, not the local market in Bulgaria. Despite these obstacles, Sirma AI managed to present the latest developments in the scope of the project on several occasions.

- Participation in BioData World Congress, Basel 4-5 December 2019 – the event is the largest European congress covering big data in pharmaceutical development and healthcare. The company had a stand, on which we have presented all our current product offerings and new developments.
- Support of the W3C FHIR RDF group in building a public semantic repository for COVID-19 data extracted from scientific literature (CORD-19 data set) and modeled as FHIR RDF.
- Regular participation on the weekly calls of the W3C FHIR RDF group and discussing future collaborations between academic and commercial partners.
- Presentation on the Digital Health Innovation cluster in Bulgaria for the recent advances in the semantic data normalization and usage of industry standards like FHIR, ontologies, etc.
- Series of web presentations to large system integrator companies in the field of pharma and healthcare – Wipro, Infosys, Cognizant. Presentation of both current products, services, and capabilities, but also other potential use cases (e.g. FHIR data normalization service) that could be covered.

¹⁷ <https://www.ontotext.com/products/graphdb/>

- Demo of the core components (GraphDB, Similarity search, FHIR ETL, NLP) to Elekta – Swedish company leader in radiation medicine, but also in advanced imaging, oncology imaging, and other relevant to the focus of ExaMode technologies.

Some FHIR competitors on the market were identified and listed in the table below.

Table 2 Business case 1 - FHIR competitors

company	product name	product description
InterSystems ¹⁸	HealthShare	InterSystems has incorporated FHIR capabilities into its current releases of InterSystems HealthShare. HealthShare typically aggregates data from multiple electronic health records and other types of systems – even those that may only expose their data using legacy interfaces. Through HealthShare all the data for an individual or a population can be transformed and aggregated as a FHIR representation, and applications developed with FHIR can access it. This FHIR repository of data allows applications based on the latest technology to use that data for patient care, value-based care, quality improvement, research, and other use cases.
eClinicalWorks ¹⁹	eClinicalWorks EHR	Striving for a seamless and effective transmission of patient data between EHRs is one of the major components of the eClinicalWorks EHR. eClinicalWorks is a contributing member of the CommonWell® Health Alliance and implementer of the Carequality Interoperability Framework, and data exchanged through these networks are based on FHIR transactions.
ALTEN Calsoft Lab ²⁰	RESTful APIs	ALTEN Calsoft Lab has built an accelerator for RESTful interfaces based on FHIR for healthcare interoperability and customized apps that healthcare providers have needs for.
Lush Group ²¹	CDS-hooks and SMART on FHIR Mobile App	<p>The Lush Group created early FHIR-based solutions and has been involved with FHIR workgroups since the API introduction. We are committed to solutions that make it easier for physicians/clinicians to provide better care and to enable patients to be more involved in the choices regarding their care.</p> <p>Many of the top EMR companies have released FHIR API solutions and FHIR endpoints are currently being rolled out in health care systems across the country. The Lush Group is positioned to develop FHIR-based apps and interfaces to increase the seamless flow of health information and provide value-added benefits:</p> <ul style="list-style-type: none"> • Integrate clinical patient information with external logic to improve care • Empower patients to become more involved in their own care • Unlock the flow of clinical data exchange • Develop innovative solutions once and deploy across multiple EMRs • FHIR integration, SMART on FHIR²², and CDS-hooks²³ applications are enabling a new wave of clinical interoperability, allowing the industry to bypass some of the old roadblocks.

¹⁸ <https://www.intersystems.com/fhir>

¹⁹ <https://blog.eclinicalworks.com/whats-fhir-and-how-will-it-drive-healthcare-interoperability>

²⁰ <https://www.altencalsoftlabs.com/fhir-implementation-framework/>

²¹ <https://lgissoftware.com/fhir-solutions>

²² <https://smarthealthit.org/>

²³ <https://cds-hooks.hl7.org/>

Syntelli Solutions ²⁴	Cloud Healthcare API	The Cloud Healthcare API provides an easy solution for storing and accessing healthcare data on the google cloud platform and is committed to HIPPA compliance. Healthcare API offers managed scalability, less maintenance, and is easy to implement. Healthcare API enables users to unlock significant features like data analysis, machine learning, and AI. These capabilities in turn can change the future of next generation healthcare solutions. API provides easy and secured access to health care data to patients and providers both, by transforming EDI formatted data to FHIR data without the need to invest the huge capital in the development, management, and infrastructure.
Microsoft ²⁵	Azure API for FHIR	Rapidly exchange data in the HL7 FHIR standard format with a single, simplified data management solution for protected health information (PHI). Azure API for FHIR lets you quickly connect existing data sources, such as electronic health record systems and research databases. Create new opportunities with analytics, machine learning, and actionable intelligence across your health data.

2.4.2. Business Case 2 – MIT

The description of Business Case Two by MicroscopeIT in ExaMode is provided in Table 2.2b in Annex 1 to the Grant Agreement, and further elaborated in the Deliverable 8.2 - “Plan for the exploitation, dissemination, and communication of results”.

The software solution being developed by MicroscopeIT for digital pathology is an ensemble of three entwined products for different end-users. Until today, the first product prototype (MIT-PP1) has been developed (Deliverable 5.5) according to the plan detailed in the ExaMode proposal.

According to the plan presented in the Deliverable 8.2, MicroscopeIT is currently in the Preparation Phase of the Exploitation Plan for its products and thus is taking actions to establish direct contact with the future clients and end-users. Unfortunately, over the last months, these actions are limited due to the Covid-19 situation, as no direct personal contacts are currently possible, especially outside of Poland, where most of MIT’s potential clients are located. Also, many events in the histopathology domain have been already canceled or will be canceled for 2020. Nevertheless, MicroscopeIT takes available measures to reach as many potential clients and partners as possible using online means of communication.

Below, we present a summary of MicroscopeIT activities related to the exploitation of its product prototypes taken over the first 18 months of the ExaMode project.

- Participation in the event “Intelligent Health AI” in Basel, Switzerland, September 11-12, 2019. Intelligent Health gathers the world’s brightest AI health brains from pharmaceutical, biotech, medtech, health provisions, clinicians, tech companies, startups, investment, and science. MicroscopeIT established connections to about 10 companies and institutions operating in the field of digital pathology.
- Participation in the event “Digital Pathology & AI Congress” in London, UK, December 4-5, 2019. MicroscopeIT established connections to about 20 companies and institutions operating in the field of digital pathology. Here, the first demo of MIT-PP1 was presented.
- MicroscopeIT prepared two service offers in the domain of digital pathology for the Pharmaceutical Company 1 (the name to remain confidential according to the NDA) - one of

²⁴ <https://www.syntelli.com/implementing-fast-healthcare-interoperability-resources-fhir-for-compliance>

²⁵ <https://azure.microsoft.com/en-us/services/azure-api-for-fhir/>

the largest Pharma companies in the world. Connection established during the “Digital Pathology & AI Congress” in London. The offers were partially based on MIT-PP1.

- MicroscopeIT prepared a service offer in the domain of digital pathology for the Pharmaceutical Company 2 (the name to remain confidential according to the NDA) - one of the largest Pharma companies in the world. The offer was related to the WSI annotation system largely based on MIT-PP1.
- MicroscopeIT established a connection with DPT (Digital Pathology Team) - a network of Polish pathologists. As a result, MicroscopeIT received valuable feedback on MIT-PP2 (and annotation tool in particular) and created a business partnership with DPT.
- MicroscopeIT established a connection with Israeli startup (the name to remain confidential) interested in WSI annotations with the use of MIT-PP1 based annotation system.
- MicroscopeIT established a connection with Irish startup (the name to remain confidential) interested in collaboration on digital-pathology related projects, possibly with the use of product prototypes developed within the ExaMode project.
- MicroscopeIT established a connection with French startup (the name to remain confidential) interested in collaboration on digital-pathology related software developed based on Virtum technology.
- MicroscopeIT established a connection with Canadian startup (the name to remain confidential) interested in collaboration on digital-pathology related software, possibly developed based on Virtum technology.
- MicroscopeIT established a connection with the Italian teleinformatics company (the name to remain confidential) interested in collaboration on digital-pathology related software developed within the ExaMode project.
- MicroscopeIT creates a database of potential clients and partners and systematically reaches out to these companies via cold-mailing approach. So far, contact has been made to about 15 entities.
- Experience gained within the ExaMode project allowed MicroscopeIT to apply for new research grants related to the histopathology and medical-imaging domains, such as Edith.AI (IMI) or HINAS, MAISKIN, and TB.Cockpit (H2020).

3. Outline for dissemination, communication and exploitation activities planned for the next year

3.1. Dissemination activities

For the next period M19-M30 are planned the following activities listed in the D8.2.

Table 3 Dissemination activities plan

	Dissemination activity	Plan for period M1-M48	Plan for period M19-M30	Responsible partner/ Participants/ Deadline
1.	Participate in scientific conferences and or business/medical community domain events per year during the project lifetime	> 6 per year	> 9	UNIPD (ALL, Dec 2022)

2.	Publish scientific publications in relevant scientific journals, including conference posters;	> 3	> 1	ALL
3.	Release white papers	> 3	1	HESSO, UNIPD, Sirma AI (ALL / Dec 2020)
4.	Prepare webinars on the ExaMode project and its results;	> 2	1	Sirma AI (All / Sep 2020)
5.	Give demo presentations during target community events;	> 3	1	Sirma AI (AOEC, Radboud / Jun 2021)
6.	Give lectures ²⁶ , in-depth seminars, workshops or training on the technologies with the targeted audience being especially students, PhD students, and early-stage researchers;	> 4	1	UNIPD (Radboud, HESSO/ Nov 2020)
7.	Organize a Technology Transfer Day to facilitate the transfer of ExaMode results to the market	>1		Sirma AI (All / Apr 2022)
8.	LinkedIn posts updates	continuous	continuous	Sirma AI
9.	ExaMode website updates	continuous	continuous	UNIPD
10.	ExaMode external Wikipedia updates	planned	continuous	UNIPD
11.	ExaMode Workshop	>2	1	UNIPD (ALL / Dec 2020)

The plans for the next period include more active collaboration with different scientific networks like RDA²⁷ (Research Data Alliance), synergies, and collaboration with related H2020 projects.

3.2. Communication activities

For the next period M19-M30 are planned the following activities listed in the D8.2.

	Communication activity	Plan for period M19-M30	Participants/ Deadline
1.	General Article 1	1	UNIPD (Dec 2020)
2.	Webinar 1	1	Sirma AI (Sep 2020)

²⁶ Academic partners include scientific ExaMode developments into their lectures.

²⁷ <https://www.rd-alliance.org/>

3.	Attendance to general-audience event in Year 2	>1	HES-SO, UNIPD, Sirma AI (Dec 2020)
4.	Updates on partners' own websites	regular	All
5.	ExaMode Workshop	1	UNIPD (ALL / Dec 2020)
6.	Facebook posts	continuous	Sirma AI
7.	Twitter posts	continuous	Sirma AI
8.	Media releases after M18	1	Sirma AI (Jul 2020)
9.	ExaMode website updates	continuous	UNIPD
10.	ExaMode external Wikipedia updates	continuous	UNIPD

The plans for communication activities include more active promotion of the ExaMode project objectives and results through social media. Another direction is the proactive involvement of different target groups in the project activities.

3.3. Exploitation plans update

Both industry partners MicroscopeIT and Sirma AI (Ontotext) agreed to submit some of the developed tools and prototypes for external evaluation for Technology Readiness Level (TRL). Such an opportunity was offered by some initiatives in the BDVA community. The plans are the software with accompanying documentation to be submitted at the beginning of the next period.

The activities for constant update of the competitors list and networking with potential clients, looking for collaboration with industry and research communities will continue also during the next period.

4. Conclusion

The results of the dissemination activities show high scientific achievements in research and publication in scientific journals with high impact and participation in prestigious international conferences.

The widespread of the ExaMode project results and its objectives are carried out through various scientific networks and bilateral cooperation between different partner organizations in the project.

The results of the communication activities show a wide range of media and communication channels used to inform the general public about the objectives of the project and its expected impact on society, science, health, and technology.

The activities related to exploitation show interest in the developed innovative tools and services in the project, and potential opportunities for business cooperation, investment and market for the developed software products and solutions. The current market forecasts of Forbes²⁸ show that the expected

²⁸ <https://www.forbes.com/sites/louiscolombus/2020/01/19/roundup-of-machine-learning-forecasts-and-market-estimates-2020/#1e7c72795c02>

Compound Annual Growth Rate (CAGR) for the period 2017-2024 is 44.06% for Machine Learning market. The foreseen CAGR for the Artificial Intelligence software is about 43.41% until 2025. Although the acceleration of Artificial Intelligence technologies in the last decade, and new competitors appeared in the market, there is still lack of highly qualified experts in some domains. We hope and expect that the technology developed in the ExaMode project (software tools and services) will be still highly competitive in the market after the project end.

Appendix 1 List of publications

Table 4 Journal articles

J1	Litjens, G., Ciompi, F., Wolterink, J. M., de Vos, B. D., Leiner, T., Teuwen, J., & Išgum, I. (2019). State-of-the-art deep learning in cardiovascular image analysis. <i>JACC: Cardiovascular Imaging</i> , 12(8), 1549-1565. https://doi.org/10.1016/j.jcmg.2019.06.009
J2	Marchesin, S., Purpura, A., & Silvello, G. (2019). Focal elements of neural information retrieval models. An outlook through a reproducibility study. <i>Information Processing & Management</i> , 102109. https://doi.org/10.1016/j.ipm.2019.102109
J3	Otálora, S., Atzori, M., Andrearczyk, V., Khan, A., & Müller, H. (2019). Staining invariant features for improving generalization of deep convolutional neural networks in computational pathology. <i>Frontiers in Bioengineering and Biotechnology</i> , 7, 198. https://doi.org/10.3389/fbioe.2019.00198
J4	Schaer, R., Otálora, S., Jimenez-del-Toro, O., Atzori, M., & Müller, H. (2019). Deep learning-based retrieval system for gigapixel histopathology cases and the open access literature. <i>Journal of pathology informatics</i> , 10. https://doi.org/10.4103/jpi.jpi_88_18
J5	Swiderska-Chadaj, Z., Pinckaers, H., van Rijthoven, M., Balkenhol, M., Melnikova, M., Geessink, O., ... & Ciompi, F. (2019). Learning to detect lymphocytes in immunohistochemistry with deep learning. <i>Medical image analysis</i> , 58, 101547. https://doi.org/10.1016/j.media.2019.101547

Table 5 Conference papers

C1	Agosti, M., Di Nunzio, G. M., & Marchesin, S. (2019, July). An Analysis of Query Reformulation Techniques for Precision Medicine. In <i>Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval</i> (pp. 973-976). https://doi.org/10.1145/3331184.3331289
C2	Agosti, M., Di Nunzio, G. M., Marchesin, S., & Silvello, G. (2019). Medical Retrieval using Structured Information Extracted from Knowledge Bases. <i>Proc. of the 27th SEBD</i> . http://ceur-ws.org/Vol-2400/paper-14.pdf
C3	Dhrangadhariya, A., Jimenez-del-Toro, O., Andrearczyk, V., Atzori, M., & Müller, H. (2020, March). Exploiting biomedical literature to mine out a large multimodal dataset of rare cancer studies. In <i>Medical Imaging 2020: Imaging Informatics for Healthcare, Research, and Applications</i> (Vol. 11318, p. 113180A). International Society for Optics and Photonics. https://doi.org/10.1117/12.2549565
C4	Di Nunzio, G. M., Marchesin, S., & Agosti, M. (2019). Exploring how to Combine Query Reformulations for Precision Medicine. In <i>Proc. TREC</i> . https://trec.nist.gov/pubs/trec28/papers/ims_unipd.PM.pdf

C5	Dosso, D. (2019). A Keyword Search and Citation System for RDF Graphs. Proc. of the 9th PhD Symposium on Future Directions in Information Access (FDIA), 2019, Milan, Italy. http://www.dei.unipd.it/~dosso/papers/fdia19.pdf
C6	Dosso, D., & Silvello, G. (2019, July). A Scalable Virtual Document-Based Keyword Search System for RDF Datasets. In <i>Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval</i> (pp. 965-968). https://doi.org/10.1145/3331184.3331284
C7	Dosso, D., & Silvello, G. (2020). Search Text to Retrieve Graphs: A Scalable RDF Keyword-Based Search System. <i>IEEE Access</i> , 8, 14089-14111. https://doi.org/10.1109/ACCESS.2020.2966823
C8	Bokhorst, J., Pinckaers, H., van Zwam, P., Nagetgaal, I., van der Laak, J. and F. Ciompi, "Learning from sparsely annotated data for semantic segmentation in histopathology images"(poster presentation). <i>Medical Imaging with Deep Learning</i> , 2019. https://openreview.net/forum?id=SkeBT7BxeV
C9	Fabris, E., Kuhn, T., & Silvello, G. (2020, January). Nanocitation: Complete and Interoperable Citations of Nanopublications. In <i>Italian Research Conference on Digital Libraries</i> (pp. 182-187). Springer, Cham. https://doi.org/10.1007/978-3-030-39905-4_18
C10	Fabris, E., Kuhn, T., & Silvello, G. (2019, September). A Framework for Citing Nanopublications. In <i>International Conference on Theory and Practice of Digital Libraries</i> (pp. 70-83). Springer, Cham. https://doi.org/10.1007/978-3-030-30760-8_6
C11	Khan A, Atzori M, Otálora S, Andrearczyk V, Müller H. Generalizing convolution neural networks on stain color heterogeneous data for computational pathology. In <i>Medical Imaging 2020: Digital Pathology 2020 Mar 16 (Vol. 11320, p. 113200R)</i> . International Society for Optics and Photonics. https://doi.org/10.1117/12.2549718
C12	Marchesin, S. (2019). Knowledge Enhanced Representations to Reduce the Semantic Gap in Clinical Decision Support. <i>Proceedings of the 9th PhD Symposium on Future Directions in Information Access co-located with 12th European Summer School in Information Retrieval (ESSIR 2019)</i> Milan, Italy, July 17th to 18th, 2019. http://ceur-ws.org/Vol-2537/paper-02.pdf
C13	Marchesin, S., & Agosti, M. (2019). Knowledge Enhanced Representations for Clinical Decision Support. In <i>Proc. Proc. of the IIR 2019</i> , September 16–18, 2019, Padova, Italy https://pdfs.semanticscholar.org/ef6d/d7ed630eb5565732fe29b8c7dd6863b696b3.pdf
C14	Müller, H., Andrearczyk, V., del Toro, O. J., Dhrangadhariya, A., Schaer, R., & Atzori, M. (2020, January). Studying Public Medical Images from the Open Access Literature and Social Networks for Model Training and Knowledge Extraction. In <i>International Conference on Multimedia Modeling</i> (pp. 553-564). Springer, Cham. https://doi.org/10.1007/978-3-030-37734-2_45
C15	Otálora, S., Atzori, M., Khan, A., Jimenez-del-Toro, O., Andrearczyk, V., & Müller, H. (2020, March). A systematic comparison of deep learning strategies for weakly supervised Gleason grading. In <i>Medical Imaging 2020: Digital Pathology</i> (Vol.

	11320, p. 113200L). International Society for Optics and Photonics. https://doi.org/10.1117/12.2548571
C16	Purpura, A., Maggipinto, M., Silvello, G., & Susto, G. A. (2019, September). Probabilistic Word Embeddings in Neural IR: A Promising Model That Does Not Work as Expected (For Now). In <i>Proceedings of the 2019 ACM SIGIR International Conference on Theory of Information Retrieval</i> (pp. 3-10). https://doi.org/10.1145/3341981.3344217
C17	Tellez D, Litjens G, van der Laak J, Ciompi F. Neural image compression for gigapixel histopathology image analysis. <i>IEEE Transactions on Pattern Analysis and Machine Intelligence</i> . 2019 Aug 22. https://doi.org/10.1109/TPAMI.2019.2936841
C18	Vezzani, F., & Di Nunzio, G. M. (2020, May). On the Formal Standardization of Terminology Resources: The Case Study of TriMED. In <i>Proceedings of The 12th Language Resources and Evaluation Conference</i> (pp. 4903-4910). https://www.aclweb.org/anthology/2020.lrec-1.603/

Table 6 Accepted papers (in print)

A1	Maristella Agosti, Giorgio Maria Di Nunzio, Stefano Marchesin. "A Post-Analysis of Query Reformulation Methods for Clinical Trials Retrieval (discussion paper)". 28th Symposium on Advanced Database Systems (SEBD 2020), June 21-24, 2020, Villasimius, Italy.
A2	Dennis Dosso, Gianmaria Silvello. "A Document-based RDF Keyword Search System: Query-by-Query Analysis". 28th Symposium on Advanced Database Systems (SEBD 2020)
A3	Dennis Dosso, Gianmaria Silvello (2020). "Data Provenance for Attributes: Attribute Lineage". <i>Theory and Practice of Provenance (TaPP)</i> (accepted)
A4	Juan S. Lara, Victor H. Contreras O., Sebastián Otálora, Henning Müller, Fabio A. González. "Multimodal Latent Semantic Alignment for Automated Prostate Tissue Classification and Retrieval". MICCAI 2020.
A5	David Tellez, Diederik Hoppener, Cornelis Verhoef, Dirk Grunhagen, Pieter Nierop, Michal Drozdal, Jeroen van der Laak, Francesco Ciompi. "Extending Unsupervised Neural Image Compression With Supervised Multitask Learning", <i>Medical Imaging with Deep Learning (MIDL)</i> , 2020 arXiv preprint: https://arxiv.org/pdf/2004.07041.pdf
A6	D. Tellez, G. Litjens, P. Bandi, W. Bulten, J. Bokhorst, F. Ciompi, and J. van der Laak. "Quantifying the effects of data augmentation and stain color normalization in convolutional neural networks for computational pathology", <i>Medical Image Analysis</i> , 2019.

Table 7 Submitted papers

S1	Dennis Dosso, Gianmaria Silvello (2020). Data Credit Distribution: A New Method to Estimate Databases Impact. Journal of Informetrics. 2dn review round
S2	Federica Vezzani, Giorgio Maria Di Nunzio (2020). Methodology for the standardization of terminological resources: the design of the TriMED database for supporting multi-register medical communication. Terminology. 2nd review round
S3	S Otalora et al., Semi-weakly Supervised Training of CNNs for Prostate Cancer Image Classification Using a Teacher-Student Model, MICCAI 2020
S4	N Marini, S Otalora, H Müller, M Atzori Semi-supervised Training of a CNN for histopathology image classification using a teacher/student paradigm, ICPR 2020
S5	Ruben Hekster, Damian Podareanu, Joris Mollinga, Maxwell Cai, Caspar van Leeuwen, David Ruhe, and Valeriu Codreanu, "Gigapixel patch semantic segmentation for histopathology" - Submitted to ISC 2020 (December 2019)
S6	Maristella Agosti, Stefano Marchesin, and Gianmaria Silvello, "Reducing the Semantic Gap in IR by Learning Unsupervised Knowledge-Enhanced Representations". Submitted to ACM TOIS (December 2019).
S7	Mart van Rijthoven et al. HookNet: Multi-resolution convolutional neural networks for semantic segmentation in histopathology whole-slide images. Medical Image Analysis (Special Issue in Computational Pathology) - Submission deadline: 31 December 2019
S8	Sebastian Otálora, Niccolò Marini, Manfredo Atzori, Henning Müller. Combining Weak and Strong Supervision In Convolutional Neural Networks for Gleason Pattern Classification. IEEE- Journal of Biohealth Informatics. - Submitted the 31st of October of 2019.
S9	Sebastian Otálora et. al. Combining Nuclei Morphology and Deep Learning Features for Gleason Grading. European Congress on Digital Pathology (ECDP 2019) - Submitted the 1st of February of 2019.

Appendix 2 List of dissemination activities for a scientific audience

Table 8 Dissemination activities

E1	(invited talk) Agosti, M. (2019). The Roots and the Tree of Information Retrieval in Italy. 10th Italian Information Retrieval Workshop, Padova, Italy, September 16-18, 2019.
E2	(poster presentation) Giorgio Maria Di Nunzio, Stefano Marchesin, Maristella Agosti, "Combining Query Reformulations to Perform Rank Fusion for Precision

	Medicine ". Precision Medicine Track, The Text Retrieval Conference (TREC 2019), NIST, Gaithersburg, Md. USA, 13-15 November 2019.
E3	(presentation) Valeriu Codreanu (SURF) mentioned large patch histopathology work and the ExaMode consortium at the Super Computing Conference in Denver, USA. Youtube: https://www.youtube.com/watch?v=tDFCtaCKD2k
E4	(presentation) Francesco Ciompi (RUMC) presented ExaMode at the Computational Pathology Symposium of the European Conference of Pathology (8 September), Nice, France
E5	(presentation) Francesco Ciompi (RUMC) to present ExaMode at the 8th Italian Conference of Pathology (18 October), Turin, Italy
E6	(presentation) Francesco Ciompi (RUMC) mentioned ExaMode in a short "pitch presentation" at the MICCAI Computational Pathology Workshop (13 October), Shenzhen, China
E7	(Project materials distributions) Sirma AI to distribute the ExaMode flyer at the 12th International Conference Recent Advances in Natural Language Processing (RANLP 2019), September 2-4, Varna, Bulgaria
E8	(presentation + project materials distributions) Sirma AI to present ExaMode for the Big Data Value PPP at ICT Proposers Day (19-20 September), Helsinki, Finland
E9	(Project materials distributions) UNIPD distributed the ExaMode flyer at ESSIR 2019, the 12th European Summer School in Information Retrieval, from 15th to 19th July 2019 in Milan, Italy
E10	(Project materials distributions) UNIPD to distribute the ExaMode flyer at the 10th Italian Information Retrieval Workshop (IIR 2019), September 16-18, 2019, Padua, Italy
E11	(Project materials distributions) UNIPD to distribute the ExaMode flyer at the 10th CLEF Conference (CLEF 2019), Conference and Labs of the Evaluation Forum, 9-12 September 2019, Lugano, Switzerland
E12	(presentation) Henning Müller to present at the University of Braunschweig on April 16, 2019
E13	(presentation) Todor Primov presented ExaMode at the Big Data Value Summit 2019 (26-28 June) in Riga, Latvia
E14	(presentation) Manfredo Atzori presented ExaMode at the BDVA welcome meeting for all the new projects in Brussels on 27/2/19
E15	(Project materials distributions) UNIPD distributed the ExaMode flyer at ECIR 2019, the 41st European Conference on Information Retrieval, 14-18 April 2019, Cologne, Germany
E16	(presentation) Manfredo Atzori & Sebastian Otalora presented ExaMode at the Swiss Digital Pathology Association meeting in Bern (Switzerland) on June 5th, 2019
E17	(Project materials distributions) UNIPD distributed the ExaMode flyer at the IRCDL 2019 Conference, 31st January and 1st February 2019, Pisa, Italy

E18	(video) Gianmaria Silvello, a promotional video made by the Department of Information Engineering, University of Padua. Available in YouTube: https://www.youtube.com/watch?v=VpKqcbvIJ9I
E19	(keynote talk) Svetla Boytcheva mentioned ExaMode in keynote presentation “The impact of the Semantic Knowledge Graphs and Big Data on the Digital Economy” at the 18th International Conference e-Society 2020, 2-4 April 2020, Sofia, Bulgaria
E20	(Web page) A page dedicated to the ExaMode project has been added to the SEBD2020 website (8 June 2020) https://sebd2020.unica.it/projects

Appendix 3 List of communication activities for the general public

Table 9 Communication activities

CM1	(Blogpost) May 2020: a blog post "On the Hunt for Patterns: from Hippocrates to Supercomputers", that explains for the general public the objectives of ExaMode, was published on the Ontotext website and spread via different communication channels https://www.ontotext.com/blog/patterns-from-hippocrates-to-supercomputers/
CM2	(video) March 2019: Youtube video presenting WP2 and UNIPD work in ExaMode: https://www.youtube.com/watch?v=VpKqcbvIJ9I
CM3	(newspaper publication) December 2019: the Italian newspaper, il Sole24Ore, talked about ExaMode in the contest of the European projects followed by the Department of Information Engineering (DEI) in Padua
CM4	(handbook) November 2019: ETP4HPC association. We are Inclusion in the European HPC Handbook, by ETP4HPC
CM5	(posts) 2019-07-10: Publication of a post about the 2nd ExaMode meeting in Catania, Italy in the official Instagram and Facebook pages of the Department of Information Engineering (DEI) of the University of Padova (Instagram, Facebook)
CM6	(online news) 2019-02-11: Publication of a Web page on the kick-off meeting of ExaMode at the UNIPD-DEI https://www.dei.unipd.it/node/19843
CM7	(flyer) The first draft of a flyer
CM8	(radio) RRO, a local Swiss radio station has written in their webpage the project description
CM9	(TV) Kanal 9, a local Swiss TV Channel mentioned the project on their webpage
CM10	(online news) A local Swiss finance news agency: The Nouvelle Agence Economique et Financière SA has mentioned ExaMode in their webpage
CM11	(newspaper publication, interview) Le Nouvelliste, a Swiss daily newspaper, has mentioned the role of the HES-SO in the ExaMode project and also made an interview with Prof. Henning Müller about the project

CM12	(newspaper publication) Walliser Bote, a Swiss newspaper in has written about the ExaMode project
CM13	(newspaper publication) La revue Polytechnique, a specialized Swiss publication has mentioned the ExaMode project
CM14	(online news) 2019-02-15: Publication of news about the kick-off meeting of ExaMode at the Ontotext Web site: https://www.ontotext.com/company/news/ExaMode-research-project-starts-with-a-kick-off-in-sierre/ And Sirma Group Holding Web site: https://sirma.com/news/ExaMode-research-project-starts-with-a-kick-off-in-sierre.html
CM15	(online news) 2019-02-19: Publication of news about ExaMode in Bulgarian electronic magazine (in Bulgarian) "Pixelmedia" https://shorturl.at/tvRV4
CM16	(online news) 2019-02-19: Publication of news about ExaMode in Bulgarian electronic magazine (in Bulgarian) "Tvoite Technologii" http://tvoite.technology/?p=9968
CM17	(online news) 2019-02-19: Publication of news about ExaMode in Bulgarian electronic magazine (in Bulgarian) "Kreativen" http://shorturl.at/csK39
CM18	(online news) 2019-02-19: Publication of news about ExaMode in Bulgarian electronic magazine (in Bulgarian) "Economic" https://www.economic.bg/bg/news/11/sirma-ai-vkarva-izkustveniya-intelekt-v-borbata-s-raka.html