



Large-scale EXecution for Industry & Society

Deliverable D9.10

Impact KPI and metrics achievement report and plan – final version



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GLOSSARY

| ACRONYM | DESCRIPTION |
|---------|--|
| DEC | Dissemination, Exploitation, and Communication |
| KPI | Key Performance Indicator |
| HPC | High-Performance Computing |
| SEO | Search Engine Optimisation |
| DDI | Distributed Data Infrastructure |
| WTO | World Trade Organisation |
| DOI | Digital Object Identifier |
| CFD | Computational Fluid Dynamics |

TABLE OF PARTNERS

| ACRONYM | PARTNER |
|-----------|--|
| Avio Aero | GE AVIO SRL |
| Atos | BULL SAS |
| AWI | ALFRED WEGENER INSTITUT HELMHOLTZ ZENTRUM FUR POLAR UND MEERESFORSCHUNG |
| BLABS | BAYNCORE LABS LIMITED |
| CEA | COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES |
| CIMA | CENTRO INTERNAZIONALE IN MONITORAGGIO AMBIENTALE – FONDAZIONE CIMA |
| CYC | CYCLOPS LABS GMBH |
| ECMWF | EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS |
| EURAXENT | MARC DERQUENNES |
| aGFZ | HELMHOLTZ ZENTRUM POTSDAM DEUTSCHESGEOFORSCHUNGSZENTRUM GFZ |
| ICHEC | NATIONAL UNIVERSITY OF IRELAND GALWAY / Irish Centre for High-End Computing |
| IT4I | VYSOKA SKOLA BANSKA – TECHNICKA UNIVERZITA OSTRAVA / IT4Innovations National Supercomputing Center |
| ITHACA | ASSOCIAZIONE ITHACA |
| LINKS | FONDAZIONE LINKS / ISTITUTO SUPERIORE MARIO BOELLA ISMB |
| LRZ | BAYERISCHE AKADEMIE DER WISSENSCHAFTEN / Leibniz Rechenzentrum der BAdW |
| NUM | NUMTECH |
| O24 | OUTPOST 24 FRANCE |
| TESEO | TESEO SPA TECNOLOGIE E SISTEMI ELETTRONICI ED OTTICI |

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EXECUTIVE SUMMARY

The aim of this document is to report the final status of the LEXIS impact strategy at the project end, emphasising all the initiatives that have been carried out by the consortium members, and the main achievements. To properly report the situation, each part of the impact strategy will be analysed in detail.

The following sections will describe the initiatives of the consortium and will summarise the status of the 7 KPIs at the end of the project.

The final update about the Open Source software and tools presented in the Deliverable D9.6 [1] will be updated by the final achievements with the related Open Source links.

Description of the deliverable

The dissemination, exploitation, and communication (DEC) strategy has been continuously monitored and modified or improved when necessary during the course of the project lifetime to ensure timely results.

In this last issuance of the three deliverables related to the impact strategy of the LEXIS project (Deliverables D9.1 [2], D9.3 [3] and D9.10), we present the achievements and progresses of the LEXIS consortium in the second (and final) half of the project lifetime.

The document starts with an analysis of the project's KPIs and their measurement in order to form a preliminary sense of the impact strategy effectiveness; then each part of the LEXIS impact strategy will be analysed and achievements described, including the difficulties encountered because of the pandemic situation.

Some attention will also be given to creating a link with the other deliverables connected to the impact strategy of the project (LEXIS Pilots, market analysis and the LEXIS Platform positioning, LEXIS Open Call).

Finally, the list of Open Source software and tools of the LEXIS project will be updated, and there will be an explanation of how partners disseminated these kinds of project results and tools by making them Open Source.

1 INTRODUCTION

In deliverable D9.3 [3], the consortium reported the composition of the impact strategy requirements up until the mid-project, and presented the roadmap for up until the project's end.

The aim of this deliverable is to report on the final period of activities related to maximising the project impact strategy, and updated the project KPIs, including the changes to the strategy that were required due to the COVID-19 pandemic.

In this document, the following parts of the LEXIS impact strategy will be updated:

1. KPIs,
2. Dissemination,
3. Communication,
4. Exploitation,
5. Activities related to LEXIS Pilots,
6. LEXIS impact on HPC and big data Convergence Ecosystem,
7. LEXIS Open Source final summary.

Firstly, we will review each of the 7 KPIs for the LEXIS project, and evaluate their effectiveness.

In Table 1 below, we reiterate the definition of each KPI, including its expected value:

| KPI | DESCRIPTION | EXPECTED VALUE |
|-------|---|--|
| KPI_1 | Project website for public project outcomes, dissemination, and private use | Bounce rate < 30% for users that stay 30 seconds or more on the web page |
| KPI_2 | Social media project promotion: creation and use of social media channels to disseminate project activities and results | User actions (new followers, comments) ≥ 250 for each social media account |
| KPI_3 | Hosting blog within the website to foster and stimulate interest in the project pilot and activities | ≥ 1 post/month |
| KPI_4 | Dissemination of peer-reviewed conference proceedings and journals | ≥ 15 publications |
| KPI_5 | Workshops organized by the project partners to show project activities to a broader audience, including developed technical solutions and results | ≥ 3 over the project lifetime |
| KPI_6 | Creation of a newsletter to facilitate the rapid communication of project activities and progress | ≥ 100 subscriptions or induced clicks |
| KPI_7 | Participation in exhibitions, fairs, workshops, conferences, and seminars | ≥ 3 per each partner |

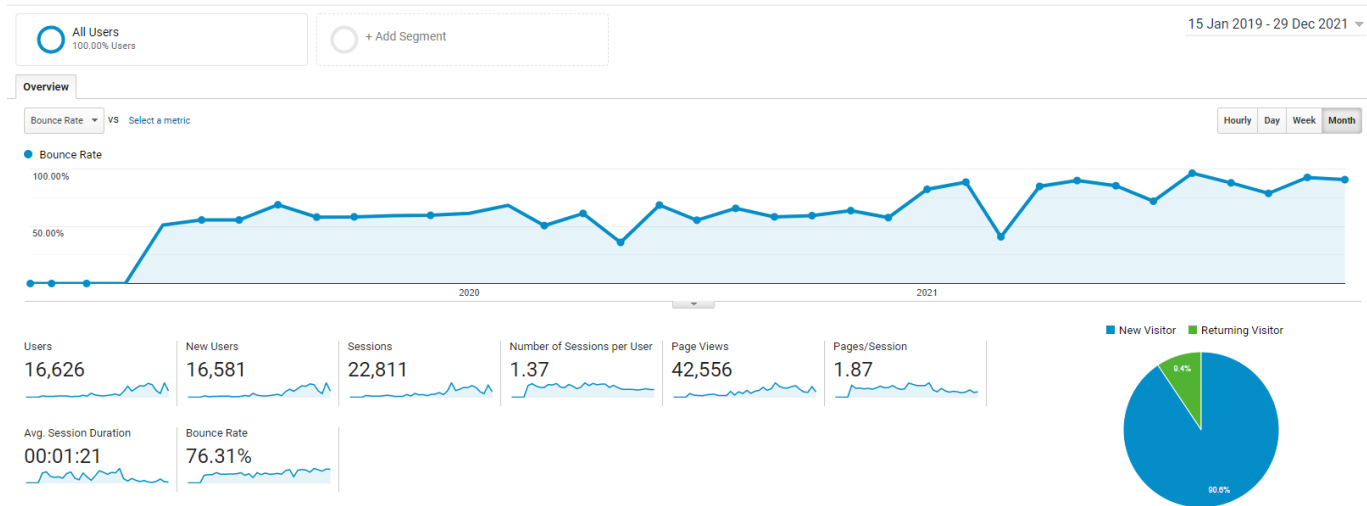
Table 1 KPIs defined for evaluating the dissemination and communication activities

KPI_1 – Project website for public project outcomes dissemination and private use

The website for the LEXIS project was always the primary channel for communicating each kind of activity done outside the consortium; for this reason, as anticipated in the other deliverables, the consortium has always put a particular focus on managing the website by updating it on regular basis, including generating the second version the website and a SEO analysis in order to enforce its effectiveness.

The measurement of this KPI has been performed using Google Analytics on a monthly basis, and the Bounce rate has been chosen as the main indicator.

A representation of the Bounce rate since the launch of the LEXIS project website is given in Figure 1:



8.

Figure 1 LEXIS project bounce rate final

Google Analytics has shown that 16,626 users have visited the website in 22,811 sessions with 42,556 page views and a Bounce rate of 76.31%.

The Bounce rate is far from the target of 30%, but with a deep analysis of the same statistics reported in D9.3 [3], we can observe a performance since the D9.3 submission.

For a better visual understanding they are grouped in Table 2:

| STATISTIC | D9.3 | D9.10 | D9.10 VS D9.3 GROWTH |
|------------|-------|--------|----------------------|
| USERS | 1,303 | 16,626 | 15,323 |
| SESSIONS | 2,449 | 22,811 | 20,362 |
| PAGE VIEWS | 6,310 | 42,556 | 36,246 |

Table 2 LEXIS website statistics comparison between D9.3 [3] and D9.10

From Table 2 above, we can observe that the work done for improving the website quality has been important; in fact, we also performed a SEO analysis, and created a dedicated maintenance and update plan for updating the website on regular basis. Finally, we also modified our strategy due to the COVID-19 pandemic that has forced us all to be more digitally oriented.

In conclusion, even if we have not achieved the target of a 30% average bounce rate, we can observe in Figure 1B that during events organisation or at important venues, the value was very close to the target.

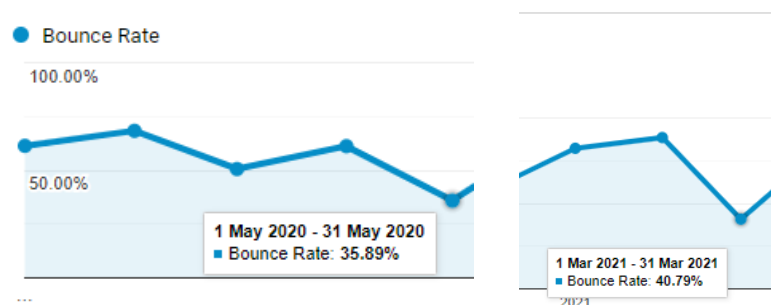


Figure 2 Bounce rate close to the target value of 30%

KPI_2 – Social media project promotion: creation and use of social media channels to disseminate project activities and results

Social media accounts have played a key role in our communication strategy; in fact they have been considered as the second main communication tool. The target of this KPI was to achieve a minimum of 250 user actions (new followers/comments) on each social media channel.

Below we report the data for each social media channel at the project end (M1-M36):

1. LinkedIn: 459 followers; 56,826 views; 181 shares; 1,527 clicks on profile
2. Twitter: 196 followers; 370,751 views; 84 mentions; 1,197 likes from users
3. Facebook: 177 followers; 51,307 views; 50 shares; 356 likes
4. YouTube: 41 followers; 854 views

The statistics above suggest that we are mostly on target for the social media channels except for the YouTube channel, for which the discussed recovery actions in D9.3 [3] brought improvements. In particular, we over-performed with LinkedIn; we consider this social media channel to be the one most important for professionals, and the most effective platform to spread general and technical messages.

KPI_3 – Hosting blog within the website to foster and stimulate interest in the project pilot and activities

At the time of D9.3 [3], the measurement of this KPI was not possible because we had not yet implemented the blog on the website. In the second half of the project we had results which we wanted to communicate and therefore we implemented the blog section on the LEXIS website. We have subsequently released 13 blog posts about several aspects of the LEXIS project including the platform, the Pilots, the orchestrator, and the LEXIS Open Call applicants. See the following link: <https://lexis-project.eu/web/news/>

We consider this KPI achieved because the target was to publish at least one blog post per month. Once the blog section was implemented, we were publishing a new blog post almost every month (except the summer holidays) and we gained a good return in terms of interest around the LEXIS project website.

KPI_4 – Scientific dissemination via peer-reviewed conferences and journals

Dissemination activities to the scientific community played a crucial role in the overall impact strategy; to support this aspect, the LEXIS consortium actively participated in carrying out dissemination activities by publishing project results on high-level and high-quality journals, conferences and other book chapters.

As the project was progressing and approaching to its final stage, a more mature platform became available, and this higher level of maturity allowed to generate more dissemination outcomes. As such, the target of this KPI has been successfully fulfilled.

The LEXIS consortium has reached an overall number of 22 publications on high-quality peer-reviewed journals and conferences, and book chapters. Specifically, the consortium published **9 conference papers, 2 journal papers and 1 book chapter**. Worth to mention here are two facts: first, the published book chapter was peer-reviewed by the BDVA committee, which represents the main European actor in the context of Big-Data domain. The second fact is that one of the two accepted journal publications was also selected to appear on the cover page of the MDPI Water journal where the manuscript was submitted. Besides these notable results, the consortium promoted (as editors) the preparation and publication of a **book in cooperation with other ICT11 and EuroHPC projects**. This book has seen the contribution also of the EPI project, while the **LEXIS partners contributed with 7 chapters** over 14. **The overall number of reached publication includes other 3 submitted papers** (2 journals and 1 conference papers). All these dissemination results contributed to the achievement of the KPI. Moving further, more dissemination activities become doable. As such, the LEXIS consortium still remains active to catch these opportunities. So, 3 more publications are under preparation, while the consortium foresees even more coming in the next period, also thanks to cooperation actions with other projects.

KPI_5 – Workshops organised by the project partners to showcase project activities and developed technical solutions and results to a broader audience

One way of promoting project results were represented by the organization of workshops where LEXIS consortium had the chance of showing them to a broad audience. To this end, this KPI measures the capability of the partners to disseminate project results by organizing workshops and attracting people. Albeit the worldwide COVID-19 pandemic situation that affected the capability of holding physical events, the LEXIS consortium fulfilled this KPI by far, strongly relying on its capability of moving from physical to digital events. As such, **10 events have been organized over the three years of the project**. While the consortium already fulfilled this KPI in the RP1 with the organization of 3 events, in the RP2 partners have been able to do an excellent work by more than doubling this number. Indeed, **we organized 7 events**, both at a national, European and worldwide levels as detailed in the following list. Here we report some interesting information regarding all such events being organized by the partners during the whole project (for some of the reported events, they were held multiple time over the project lifetime):

- The **HPC/Big Data/Cloud Webinar** with Mesap Innovation Cluster entitled “**LEXIS, una piattaforma di ingegneria avanzata a disposizione delle aziende**” and the webinar organized with Torino Wireless entitled “**LEXIS Open Call: How to apply to be a tester of the platform?**” organized by TESEO and LINKS,
- 2 workshops **The Heterogeneous and Low-Power Data Center technologies (HELP-DC)**, which were held in conjunction with the *HiPEAC conferences*,
- 2 workshops **The Urgent HPC: HPC for Urgent Decision Making** organized in conjunction with the *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)* events,
- The **CFD TRAF code GPU porting: needs, results and applicability** (Tech Forum) and the **Evolution of TRAF code to accelerate CFD simulations of low-pressure turbines** (Tech Forum) events organized by Avio Aero,
- The **19th Workshop on High Performance Computing in Meteorology**,
- The **Future challenges in IoT, AI, and convergence of HPC & Cloud & Big Data** workshop co-organized by IT4I within the *Data Week* event.

Worth to mention is that all these events were able to attract the attention and the interest of a broad audience, demonstrating that the LEXIS project results are of worth for many different communities, as highlighted by the high heterogeneity of participants to these events coming from different industrial and scientific sectors. For instance, the HELP-DC events attracted people in a range of 15 to 40 at each organized edition, the Urgent HPC: HPC for Urgent Decision Making and the Future challenges in IoT, AI, and convergence of HPC & Cloud & Big Data attracted around 80 and 93 people respectively, while a very large audience of around 313 people was attending the 19th Workshop on High Performance Computing in Meteorology.

KPI_6 – Creation of a newsletter to facilitate the continuous communication of project activities and progress

This KPI has been fully achieved. We have over-performed, smashing the target of 100 subscribers to the LEXIS newsletter. **We currently have ~300 subscribers to our newsletter**, which is a reward for the massive work carried out by the LRZ and IT4I teams.

Table 3 shows a recap of all the newsletters issued by the partners of the LEXIS consortium since Deliverable D9.3 [3] submission, and in Annex 1 we report the details for each number issued.

| SUM | MAIN LEADER | ACTIVITY DESCRIPTION | DATE/PERIOD | TYPE OF AUDIENCE | SIZE OF AUDIENCE |
|-----|-------------|--|-------------------------|--|---------------------|
| 45 | IT4I | IT4I Newsletters Internal and external | from 11/2019 to 11/2021 | scientific community, public and university | ~ 20,000 e-mails |
| 14 | LRZ | LRZ Newsletters | from 04/2020 to 06/2021 | scientific community, public, LRZ/BADW employees | 3,000 e-mails + web |

| | | | | | |
|----------|------------------|------------------|-------------------------|--|-------------------------|
| 4 | LEXIS consortium | LEXIS Newsletter | from 11/2020 to 10/2021 | scientific community, industry, public | ~1,100 + LEXIS web page |
|----------|------------------|------------------|-------------------------|--|-------------------------|

Table 3 LEXIS project newsletter statistics recap

KPI_7 – Exhibitions, fairs, workshops, conferences, and seminars participation

This KPI had the objective of correctly measuring the effort made by each partner of the consortium in carrying out dissemination and communication activities over the duration of the project, by attending a minimum of 3 events during the project lifetime.

Table 4 reports the final status for each partner of the consortium at the project end.

| PARTNER | NUMBER OF EXHIBITIONS, FAIRS, WORKSHOPS, CONFERENCES, AND SEMINARS PARTICIPATED IN |
|-----------|--|
| Avio Aero | 10 |
| AWI | 3 |
| BLABS | 3 |
| Bull/Atos | 12 |
| CEA | 4 |
| CIMA | 3 |
| CYC | 3 |
| ECMWF | 4 |
| GFZ | 3 |
| IT4I | 26 |
| ITHACA | 5 |
| LINKS | 11 |
| LRZ | 13 |
| NUM | 3 |
| O24 | 4 |
| TESEO | 5 |
| ICHEC | 2 |
| EURAXENT | 2 |

Table 4 LEXIS consortium events attendance at the project end

Seeing the numbers reported above, we consider this KPI as achieved as the average total number of events attended by partners is 6.44 (116/18) events. This KPI has been monitored at the partners who participated in the LEXIS project during its lifetime. Two partners (ICHEC and EURAXENT) were added to the LEXIS project by the amendment and joined the project in M25 (January 2021) only for one year. To reach the KPI they were obliged to attend minimally 1 event, which they perfectly managed.

2 IMPACT THROUGH DISSEMINATION

Previous Deliverables D9.1 [2] and D9.3 [3] defined the dissemination strategy the LEXIS consortium intended to use for spreading awareness of the project results (the former deliverable) and reported the dissemination activity results referring to the period M4 and M15 (the latter deliverable).

This deliverable is a follow-up, and reports the status of dissemination activity for the period of the project not yet covered (M16–M36). The mid-term review provided important feedback for steering the LEXIS consortium towards better dissemination actions. Specifically, the consortium realised that more emphasis was needed on getting high-level publications by targeting high-quality journals and conferences. To this end, in the reported period, thanks to the major maturation of the designed platform and the results progressively collected by the Pilots, a strong impulse was given to publishing major scientific and technical results on high-quality peer reviewed journals, conferences and book chapters. To this end, the LEXIS consortium improved its effort on targeting such high-level venues, resulting in 19 publications (as reported in the RP2 M19–M36) over the 22 done during project lifetime. These publications (as reported in the explanation of KPI_4) cover 6 accepted conference papers, 2 accepted journal papers — one of this journal paper was selected to appear in the cover page of the MDPI Water Journal, 1 book chapter peer reviewed at the level of the BDVA association, 3 submitted papers to the conferences and journals, and 7 book chapters as a part of the edited book entitled *“HPC, Big Data, AI Convergence Towards Exascale: Challenge and Vision”*. In particular, this book was used to promote the LEXIS project to the widest audience possible, thanks to the high quality and high level of published books of the Taylor & Francis international group. The book was also a mean for interacting with other projects, mainly focusing on those belonging to the ICT11 scope (a) call, the EPI project and one EuroHPC project. Notably, 3 more publications are on the way for being submitted, as well as the LEXIS consortium expects that even further will be done in the context of projects’ cooperative actions. Disseminating results is also a matter of intercepting the interest of scientific and industrial communities by organizing workshops and webinars. Such events were generally largely affected by the worldwide Covid-19 pandemic situation, which strongly limited the chances of organizing physical events. However, the LEXIS consortium addressed the challenge by putting more effort in organizing effective virtual events, which could be able to attract people. LEXIS was effective in doing this, totalling 10 events during the whole project lifetime, 8 of which have been organized in the period reported by RP2. To summarize, events at national, European and worldwide level have been organized. These include event held in conjunction with the HiPEAC conferences, the *International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)*, *Data Week* event to mention few. Notably, the organization of a workshop at the HiPEAC conference was the occasion to start and pursuit interactions with other projects being part of the H2020 ICT-11- EU call (scope (a)) funding.

2.1 DISSEMINATION OF FINAL RESULTS

We followed the path already traced during the previous reported period (M4–M15) of organising dedicated events such as the workshop co-located with international conferences as the case of the HiPEAC conference (which represents one of the main events at the European level for the computing domain) and the International Conference for High Performance Computing, Networking, Storage, and Analysis (SC) - one of the major events in the HPC domain worldwide, as well as attending workshops, conferences, and exhibitions. Unfortunately, the critical situation due to the global Covid-19 pandemic introduced some limitations (such as limiting physical interactions with people interested in the project results) due to the fact that most of these events have been held remotely.

Despite these limitations, during the reported project period, dissemination activities generated interesting results through three main categories of action: *i)* scientific publications (at high quality venues, including in books); *ii)* attendance of workshops, conferences, and exhibitions; and *iii)* organisation of dedicated workshops (also co-located with other relevant events) and webinars.

Table 5 provides a list of the activities and related results achieved so far. Taking a look at this table, the dissemination activities remained aligned with the previous reported period (M4–M15), as expected, since the work done in co-designing the LEXIS Platform culminated in its final version (see Deliverable D2.5 [4] for a reporting of the final LEXIS architecture), as well as the integration of selected technologies being finalised, thus allowing the Pilots to explore and test a mature platform and gather the first overall results to be presented in scientific publications. While the general dissemination trend remained positively aligned to that of the previous reported period, some notable improvement has been achieved. In particular, scientific dissemination received a strong impulse as demonstrated by the number of publications addressed in the second half of the project. This improvement includes papers accepted on high-quality conferences, 2 peer-reviewed journal papers (accepted — one of this is included in the cover page of the *Water* journal), 1 book chapter peer reviewed at the BDVA level and an edited book. Additional 3 submitted papers are also under evaluation.

As above mentioned, it is worth saying that LEXIS was invited to contribute to the book titled “*HPC, Big Data, AI Convergence Towards Exascale: Challenge and Vision*”; as such, LEXIS provided the content of 6 out of 14 technical chapters, plus co-authored the introductory chapter describing the current state-of-the-art of HPC, big data and cloud computing, and how application domains like agriculture, healthcare, and mechanical engineering can benefit from their strong convergence. Three of the other mentioned chapters provided an overview of the LEXIS Platform as a whole, which aims to overcome the shortcoming of complicated access to HPC systems and managing of large datasets, as well as providing a detailed view of the DDI used in LEXIS to ease data management along with a description of the approach used to orchestrate distributed HPC resources and supporting large-scale workflow execution.

Finally, the remaining three mentioned chapters focused on the LEXIS Pilot use cases, highlighting: *i)* the benefit of combining HPC and Cloud resources with advanced CFD software to design and optimise critical aircraft engine components; *ii)* how such heterogeneous resources can largely improve the simulation of tsunami/earthquake events; and *iii)* how the HPC and Cloud combination allows enhanced global weather models, high-resolution regional weather models and domain-specific application models.

Concerning the organisation of dedicated dissemination events, LEXIS partners were (co-)organiser of several events. As already mentioned in this document, such events cover national, European and worldwide events. Some notable examples are as follows. The HELP-DC workshop, which was organized multiple time over the project lifetime, was also organized in January 2021 – virtual event, within the main HiPEAC conference. The event allowed us to stay in touch with the other H2020 ICT-11- EU call, scope (a) projects (i.e., CYBELE, DeepHealth, and Evolve) and thus consolidate relationships and collaborations that were established during the first half of the project, and specifically by means of the organisation of the same workshop at HiPEAC 2020. The workshop on urgent computing (*Urgent HPC: HPC for Urgent Decision Making*) co-organized within the SC’20 conference allowed to bring the LEXIS results in front of an international audience. Also, the events organized by the partner Avio Aero are of particular interest since they targeted more the industrial domain, focusing more on the aeronautics community. Besides these few notable examples, other activities where the LEXIS consortium invested large effort in terms of dissemination are represented by the organisation of dedicated booths and the participation in international events with high visibility.

As such, the LEXIS consortium consolidated its presence at international events by organising 7 booths over the M16-M36 period (most of them were virtual booths, due to the COVID-19 pandemic restrictions).

A similar situation can be seen in the number of events at which the LEXIS consortium participated, which increased from 20 in the previously reported period (see Deliverable D9.3 [3] – 5 participations in workshops and 15 at other events) to 26 in this reported period (M16-M36); this includes participation in 8 workshops/conferences and 18 other events.

As the project approached its end, the platform matured to the right level to support the execution of Pilot workflows and LEXIS Open Call participants’ workflows. This has allowed the LEXIS consortium to experiment more

with the platform, and thus collect more results. Such results have been considered large and mature enough to plan further publications through which the LEXIS Platform can be presented. In particular, 3 papers are under preparation at the moment of writing this document, covering high-quality journals and conferences.

| EVENT TYPE | DESCRIPTION |
|--------------|---|
| J (M19-M36) | Mazzoglio, P., Parodi, A., Identificazione di eventi estremi di pioggia da dati previsionali (Nova Ex Coelo) (2021) <i>Journal of the Italian Association of Professional Meteorologist (NEC – La Rivista di AMPRO)</i> https://www.meteoprofessionisti.it/nec-la-rivista-di-ampro/ |
| J (M19-M36) | Mazzoglio, P., Parodi, A., Parodi, A., Detecting Extreme Rainfall Events Using the WRF-ERDS Workflow: The 15 July 2020 Palermo Case Study (2022) <i>Water</i> (Switzerland), 14 (1), art. no. 86. DOI: 10.3390/w14010086 |
| BK (M19-M36) | <i>HPC, Big Data, AI Convergence Toward Exascale: Challenge and Vision</i> . Eds. O. Terzo, J. Martinovič. CRC Press, 2021. DOI: 10.1201/9781003176664. https://www.taylorfrancis.com/books/edit/10.1201/9781003176664/hpc-big-data-ai-convergence-towards-exascale-olivier-terzo-jan-martinovic |
| BC (M19-M36) | S. Hachinger, et al., Leveraging High-Performance-Computing and Cloud Computing with Unified Big-Data Workflows: The LEXIS Project. <i>Technology and Applications for Big Data Value</i> . Springer International Publishing, 2022. https://link.springer.com/book/9783030783068 |
| C (M1 - M15) | Scionti, A., Martinovic, J., Terzo, O., et al., HPC, Cloud and Big-Data Convergent Architectures: The LEXIS Approach (2020) <i>Advances in Intelligent Systems and Computing</i> , 993, pp. 200-212. DOI: 10.1007/978-3-030-22354-0_19. The 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS 2019) |
| C (M1 - M15) | Goubier, T., Ajmar, A., et al., Earthquake and tsunami workflow leveraging the modern hpc/cloud environment in the lexis project (2020) <i>Advances in Intelligent Systems and Computing</i> , 1036, pp. 223-234. DOI: 10.1007/978-3-030-29029-0_21. The 22nd International Conference on Network-Based Information Systems (NBIS 2019) |
| C (M1-M15) | Hachinger, S., Martinovič, J., Terzo, O., et al. HPC-Cloud-Big Data convergent architectures and research data management: The LEXIS approach (2021) <i>Proceedings of Science</i> , 378, art. no. 004. The International Symposium on Grids and Clouds (ISGC) 2021 Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119017286&partnerID=40&md5=98ef369e0427dc990285a8313482e2a0 |
| C (M19-M36) | Goubier, T., Martinovič, J., et al., Real-time model of computation over hpc/cloud orchestration - the lexis approach (2021) <i>Advances in Intelligent Systems and Computing</i> , 1194 AISC, pp. 255-266. DOI: 10.1007/978-3-030-50454-0_24. The 24th International Symposium on. Distributed Simulation and Real Time Applications (DS-RT 2020) |
| C (M19-M36) | Parodi, A., Danovaro, E., et al., Lexis weather and climate large-scale pilot (2021) <i>Advances in Intelligent Systems and Computing</i> , 1194 AISC, pp. 267-277. DOI: 10.1007/978-3-030-50454-0_25. 13th International Conference on Computational Intelligence in Security for Information Systems (CISIS 2020) |

| | |
|----------------------|---|
| C (M19-M36) | Goubier, T., Rakowsky, N., Harig, S., Fast Tsunami Simulations for a Real-Time Emergency Response Flow (2020) Proceedings of UrgentHPC 2020: 2020 International Workshops on Urgent and Interactive HPC, Held in conjunction with SC 2020: The International Conference for High Performance Computing, Networking, Storage and Analysis, art. no. 9307622, pp. 21-26. DOI: 10.1109/UrgentHPC51945.2020.00008 |
| C (M19-M36) | Mazzoglio P. et al. (2022) The WRF-ERDS Workflow in the November 2020 Calabria Flood Event. In: Borgogno-Mondino E., Zamperlin P. (eds) Geomatics and Geospatial Technologies. ASITA 2021. <i>Communications in Computer and Information Science</i> , Vol. 1507. Springer, Cham. DOI: 10.1007/978-3-030-94426-1_8 |
| C (M19-M36) | M. Golasowski, et al., A transnational data system for HPC/Cloud-Computing Workflows based on iRODS/EUDAT. In <i>Proceedings of the 13th Annual iRODS User Group Meeting</i> . https://irods.org/ugm2021/ |
| C (M19-M36) | P. Mazzoglio, et al., <i>Improving weather forecast by means of HPC solutions: the Lexis approach in the 2020 Bitti flood event</i> , Annual Meeting of the European Meteorological Society – European Conference for Applied Meteorology and Climatology EMS 2021. |
| C (M19-M36) | D. Magarielli, et al., <i>Exploring GPU-Based HPC Architectures to accelerate an Unsteady CFD Solver for Turbomachinery Applications</i> , ASME 2022 Turbomachinery Technical Conference & Exposition, June 2022. https://arnone.de.unifi.it/tgroup/node/1095 |
| B (M1 - M15) | IT4I/LEXIS booth at Supercomputing Conference 2019, November 2019 |
| B (M1 - M15) | European exascale projects booth at Supercomputing Conference 2019, November 2019 |
| B (M19 - M36) | Virtual booth at Teratec Forum 2020, October 2020 |
| B (M19 - M36) | Virtual booth with EPI and European projects, Supercomputing Conference 2020, November 2020 |
| B (M19 - M36) | Virtual booth of IT4I and e-INFRA CZ, Supercomputing Conference 2020, November 2020 |
| B (M19 - M36) | Virtual booth at Teratec Forum 2021, June 2021 |
| B (M19 - M36) | Virtual booth of the LEXIS project (released in June 2021) |
| B (M19 - M36) | Virtual booth at ISC High Performance 2021, June/July 2021 |
| B (M19 - M36) | LEXIS booth at the European Researchers' Night, Ostrava (Czech Republic), September 2021 |
| B (M19 - M36) | NUMTECH booth with LEXIS promotion for AQ use case, Pollutec 2021, October 2021 |
| B (M19 - M36) | IT4I, e-INFRA CZ, LEXIS booth, Supercomputing Conference 2021, November 2021 |
| PW (M1 - M15) | HeLP-DC: Workshop on Heterogeneous and Low-Power Data Center technologies (Workshop co-located with HiPEAC 2019), January 2019 |
| PW (M1 - M15) | ICT- H2020 Consortium Building Workshop, June 2019 |
| PW (M1 - M15) | Italian Workshop on Parallel and High Performance Computing Technologies, September 2019 |

| | |
|-----------------------|---|
| PW (M1 - M15) | Workshop on Cloud Storage Synchronization and Sharing Services, January 2020 |
| PW (M1 - M15) | HeLP-DC: Heterogeneous and Low Power Data Center technologies (HiPEAC 2020), January 2020 |
| PW (M15-M18) | BDVA Workshop – HPC, Big Data, IoT and AI future industry-driven collaborative strategic topics (PART 1), May 2020 |
| PW (M19-M36) | BDVA Workshop – HPC, Big Data, IoT and AI future industry-driven collaborative strategic topics (PART 2), July 2020 |
| PW (M19-M36) | BVA Activity Group meeting (AG41) / BDV PPP Technical Committee (TC#6), December 2020 (virtual event) |
| PW (M19 - M36) | 4th Workshop on Heterogeneous and Low-Power Data Center technologies – HeLP-DC (Workshop co-located with HiPEAC 2021), January 2021 (virtual event) |
| PW (M19-M36) | 2 nd workshop on HPC & applications, Middle East Technical University (ODTÜ METU) – March 2021 (virtual event) |
| PW (M19-M36) | BDVA Workshop (EuroHPC Summit Week): HPC, Big Data, IoT and AI future industry-driven collaborative strategic topics, March 2021 (virtual event) |
| PW (M19-M36) | The session at Data Week 2021: Future challenges in IoT, AI, and convergence of HPC & Cloud & Big Data, May 2021 (virtual event) |
| PW (M19-M36) | 19th Workshop on high performance computing in meteorology, September 2021 |
| PW (M19-M36) | LEXIS presentation at SOLADITE final workshop, December 2021 |
| P (M1-M15) | 10th International Conference on High-Performance and Embedded Architectures and Compilers (HiPEAC'2019), January 2019 |
| P (M1-M15) | The International Symposium on Grids and Clouds (ISGC) 2019, March 2019 |
| P (M1-M15) | EuroHPC Summit Week, May 2019 |
| P (M1-M15) | HPCSE 2019 - High Performance Computing in Science and Engineering, May 2019 |
| P (M1-M15) | ISC High Performance 2019, June 2019 |
| P (M1-M15) | The 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS 2019), July 2019 |
| P (M1-M15) | The 22nd International Conference on Network-Based Information Systems (NBIS-2019), September 2019 |
| P (M1-M15) | European Meteorological Society Annual meeting (EMS 2019), September 2019 |
| P (M1-M15) | CISIM 2019 18th International Conference on Computer Information Systems and Industrial Management Applications, September 2019 |
| P (M1-M15) | European Big Data Value Forum, October 2019 |
| P (M1-M15) | First International Symposium on Open Search Technology, October 2019 |
| P (M1-M15) | RDA Plenary 14, October 2019 |
| P (M1-M15) | The International Conference for High Performance Computing, Networking, Storage, and Analysis (Supercomputing 2019), November 2019 |

| | |
|-------------|--|
| P (M1-M15) | HiPEAC 2020, January 2020 |
| P (M16-M18) | The General Assembly 2020 of the European Geosciences Union (EGU), May 2020 |
| P (M16-M18) | SophiaConf 2020, June 2020 (virtual event) |
| P (M16-M18) | ISC High Performance 2020, June 2020 (virtual event) |
| P (M19-M36) | The 14 th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS 2020), July 2020 (virtual event) |
| P (M19-M36) | Teratec Forum 2020 – The international meeting for Simulation and High-Performance Computing, October 2020 (virtual event) |
| P (M19-M36) | EGI Conference 2020, November 2020 (virtual event) |
| P (M19-M36) | Supercomputing Conference 2020, November 2020 (virtual event) |
| P (M19-M36) | European Big Data Value Forum 2020 (EBDVF), November 2020 (virtual event) |
| P (M19-M36) | Open Source Solutions in Networks 2020, November 2020 (virtual event) |
| P (M19-M36) | 36 th INTERNATIONAL CAE CONFERENCE 2020, November/December 2020 (virtual event) |
| P (M19-M36) | State of the Map 2020 (OpenStreetMap Conference), July 2020 (virtual event) |
| P (M19-M36) | 101 st AMS (American Meteorological Society) Annual Meeting, January 2021 (virtual event) |
| P (M19-M36) | HiPEAC 2021, January 2021 |
| P (M19-M36) | The International Symposium on Grids and Clouds (ISGC) 2020 Converging High-Performance infrastructures: Supercomputers, clouds, accelerators Session: I, March 2021 (virtual event) |
| P (M19-M36) | EuroHPC Summit Week 2021 / PRACEdays21, March 2021 (virtual event) |
| P (M19-M36) | EGU General Assembly 2021 vEGU21, April 2021 (virtual event) |
| P (M19-M36) | ISC 2021, June 2021 (virtual event) |
| P (M19-M36) | SophiaConf 2021, June 2021 (both virtual and physical event) |
| P (M19-M36) | Teratec Digital Forum 2021, June 2021 |
| P (M19-M36) | Conferenza Nazionale di Geomatica e Informazione Territoriale – ASITA 2021, July 2021 (virtual event) |
| P (M19-M36) | Annual Meeting of the European Meteorological Society – European Conference for Applied Meteorology and Climatology EMS 2021, September 2021 (virtual event) |
| P (M19-M36) | Data Week 2021, May 2021 (virtual event) |
| P (M19-M36) | Supercomputing Conference 2021, St. Louis, November 2021 |

Table 5 List of events where LEXIS was disseminated (C: articles in conferences and workshops, BK: books, BC: book chapters, B: booths, PW: participation in workshops, P: participation in conferences/exhibitions)

Table 6 provides a detailed description of the planned publications. As the reader can see, one of these will be devoted to providing an overview of the LEXIS Platform, as it is in its final version, including details on the workflow

orchestration mechanic able to dynamically address the selection of the best suited set of resources, where to execute them, and the solutions implemented in the DDI and security layers. Another paper will be based on analysis of the data that have been collected from the PBS batch scheduler; the idea behind this analysis concerns the capability of training machine learning and deep learning models that can be used to predict the waiting time for the enquired jobs.

This work also represents the first means of collaboration between the LEXIS project and the EuroHPC ACROSS project, which also supported the research carried out. Other papers are planned, both for journals and international conferences in the context of WP3 activities, as well as in the context of the Pilots (WP5, WP6 and WP7).

It is important to remark that the targeted journals are well-reputed, and the venues are high-quality. This demonstrates the high quality of the work done by the LEXIS consortium and the achieved results by means of its innovative platform. Additionally, such high-level publications will allow to further disseminate the innovative aspects of the LEXIS Platform within the scientific and industrial communities.

| JOURNAL/CONFERENCE | TOPIC |
|--|---|
| Frontiers in Earth Science, section Geohazards and Georisks (submitted) | Stéphane Louise (CEA) et. al. Modelling and Implementing an Earthquake and Tsunami Event-triggered, Time-constrained Impact Assessment Workflow. <i>This paper presents the modelling and implementation of an earthquake and tsunami event-triggered, time-constrained impact assessment workflow. This paper is based on the WP6 results achieved so far using the LEXIS Platform.</i> |
| ACM Transactions on Architecture and Code Optimization – TACO (submitted) | Vercellino, C., Scionti, A., Varavallo, G., Viviani, P., Vitali, G., Terzo, O. A Machine Learning approach for an HPC use case: the jobs queuing time prediction. <i>This paper focuses on the analysis of information related to jobs submitted to a batch scheduler on a recent HPC cluster made using machine learning techniques. This paper discusses the performance of machine learning and deep learning approaches to predict the queue waiting time of newly submitted jobs.</i> |
| The Journal of Supercomputing (alternatively, ACM Transactions on Architecture and Code Optimization – TACO) | <i>This paper will discuss the methodology for porting an industrial based Fortran code to FPGA, discussing results of the synthesis on Intel Arria10 and Stratix10 FPGA cards.</i> |
| Future Generation Computer Systems Journal – FGCS | <i>A paper presenting the overall LEXIS Platform.</i> |
| IEEE Access | <i>This paper will describe the fundamentals of the LEXIS DDI, discussing requirement-based design as well as validation by performance measurements within the infrastructure and in comparison to other, similar data-management systems.</i> |

Table 6 List of submitted/planned journal papers

3 IMPACT THROUGH COMMUNICATION

Communication has always played a crucial role in the impact strategy of the LEXIS project, and the aim of this deliverable is to report on the work carried out on communication-based activities at the project end.

The following subsections will relate to the final results reached for each of the selected communication tools, and the new ones used after the submission of Deliverable D9.3 [3] for ensuring an adequate rate of communication of the LEXIS project initiatives and reaching out to a wider external audience.

3.1 COMMUNICATION OF FINAL RESULTS

As presented in the previous deliverables, communication activities have the same relevance for the LEXIS consortium as technical ones.

After the submission of Deliverable D9.3 [3], an appropriate amount of work has been carried out related to communication-based activities with the purpose of minimising the risk of failing to create the desired interest around the project achievements.

To minimise this risk, the following activities have been carried out in the reporting period of this deliverable:

- Website work (maintenance, improvement and update),
- Social media channel engagement (Facebook, LinkedIn, Twitter and YouTube),
- Paper-based communication activities and gadgets,
- Digital-based communication activities, a blog, newsletter and videos,
- Reporting activities.

A further more detailed breakdown of these activities now follows:

Website

As the website is the primary communication channel of the LEXIS project. It perpetually has a high priority in our communication strategy, and is continuously updated and maintained in order to improve its quality and further disseminate the achievements and results that have been made during the project lifetime.

The major achievements in term of activities done to improve the website since the submission of Deliverable D9.3 [3] are the following:

- SEO implementation for optimised and high-quality content,
- New Blog section,
- New Outcomes section,
- Update of the events timeline,
- New LEXIS Open Call section and subsections.

A screenshot of the website as it is today is provided below, but for a more complete and accurate understanding of what has been achieved, one can refer to the following link: <https://lexis-project.eu>

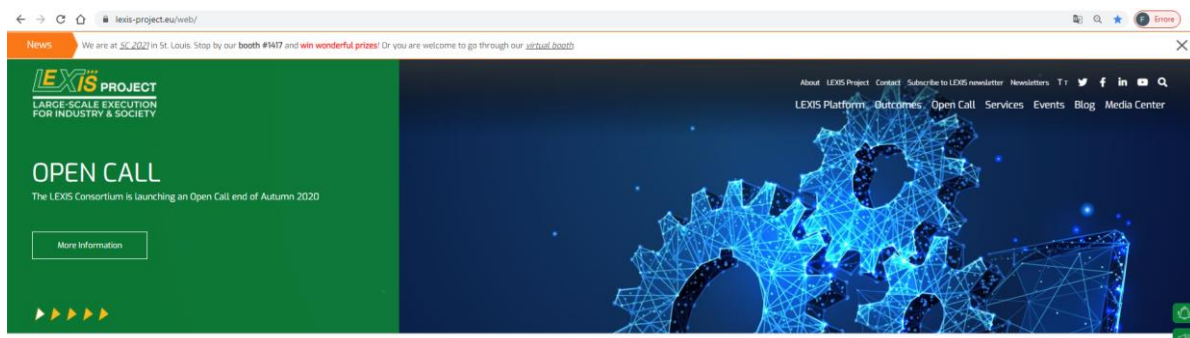


Figure 3 LEXIS project website home page

IT4I took the responsibility of maintaining and updating the website, and it has continuously updated and improved the website quality and structure to gather major interest around the LEXIS project and better communicate the results achieved during the final part of the project. Regarding sustainability, the domains `lexis-project.eu` and `lexis.tech` were paid for next 5 years and IT4I will update and sustain the website of the LEXIS project.

Particular focus has been devoted to the LEXIS Open Call, and that section has been built to be simple and smart, and to allow applicants to understand how to proceed in their application process. Around this, two webinars (already mentioned above) have been organised to attract and explain the LEXIS Open Call and registration process.

Social media channels

Efforts to maintain a presence in the major social media accounts for the LEXIS project have been continuous and intensified due to the pandemic situation, which has required us to modify our strategy to be a mostly digital one. The management of the social media accounts was mainly in charge of the WP9 leader, but IT4I and LRZ heavily contributed during the whole project.

In this regard, special attention has been dedicated to the YouTube channel and its management; several videos have been uploaded on the channel, and a general video of the LEXIS project has been created to let a wider audience better understand the whole project and increase the effectiveness of the YouTube Channel.

As introduced in Deliverable D9.3 [3], the cooperation with other H2020 projects was confirmed and several joint activities have been carried out such as the workshops during HiPEAC 2021 and Supercomputing Conference 2021.

The final status of each social media account is given in the screenshots in Figure 4, Figure 5, Figure 6, and Figure 7.

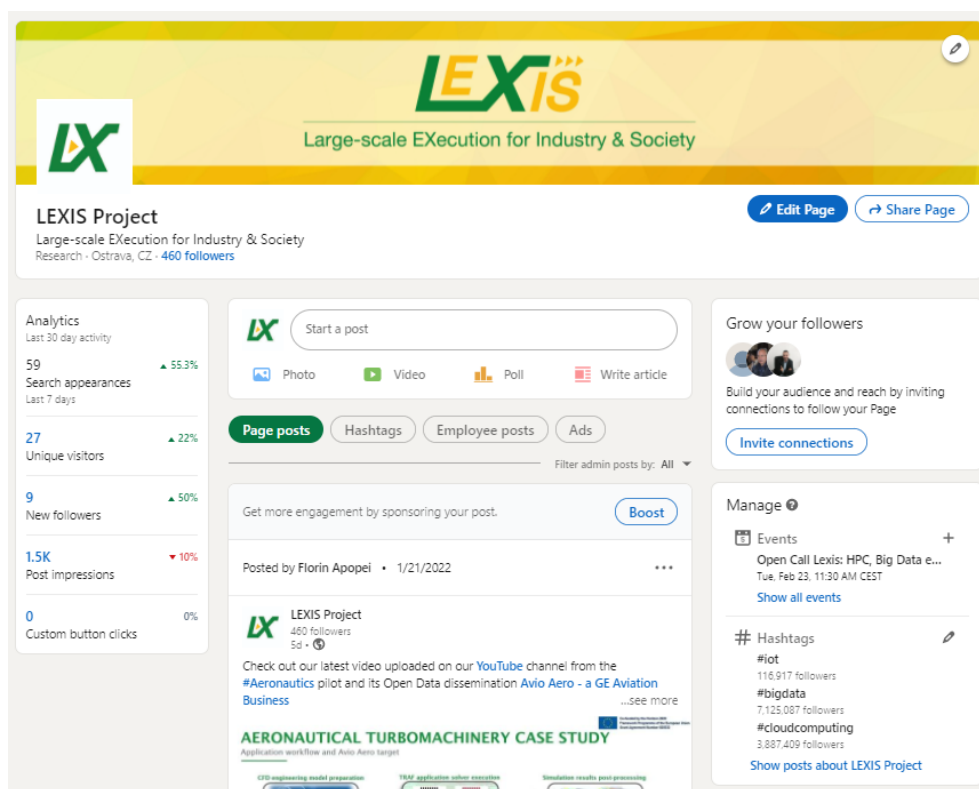


Figure 4 LEXIS Project LinkedIn final statistics



Figure 5 LEXIS project Twitter final statistics

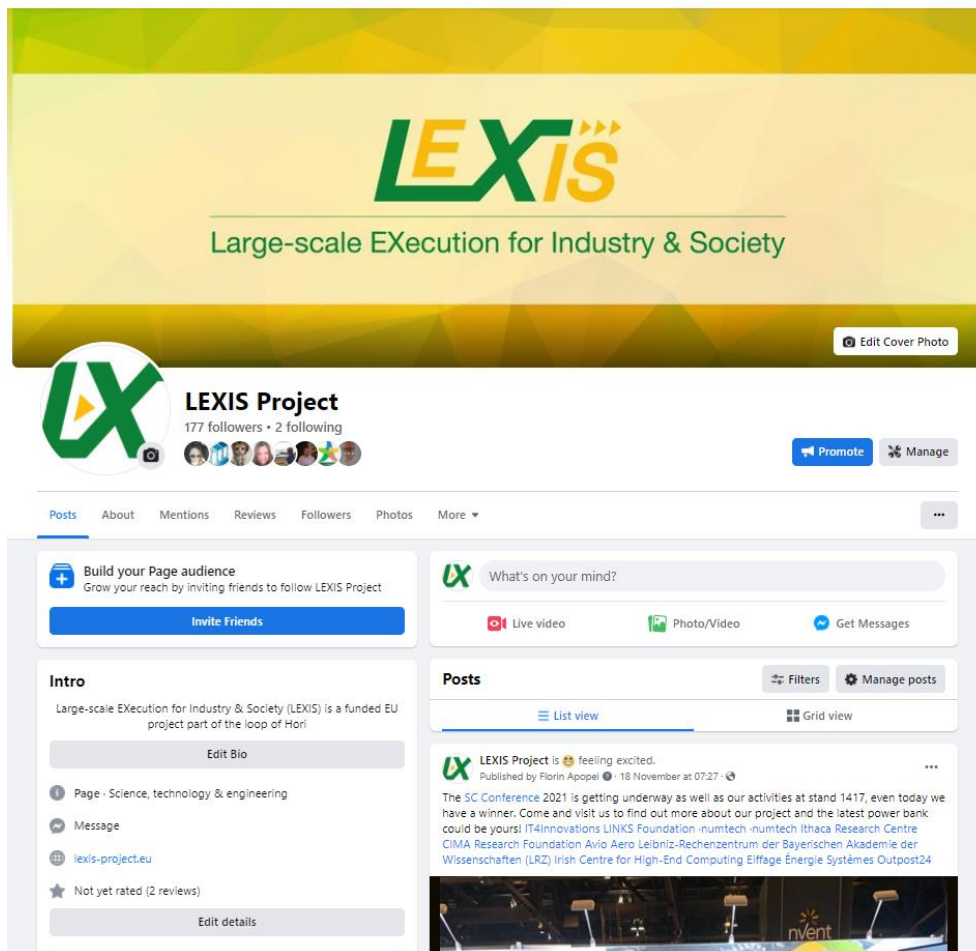


Figure 6 LEXIS project Facebook final statistics

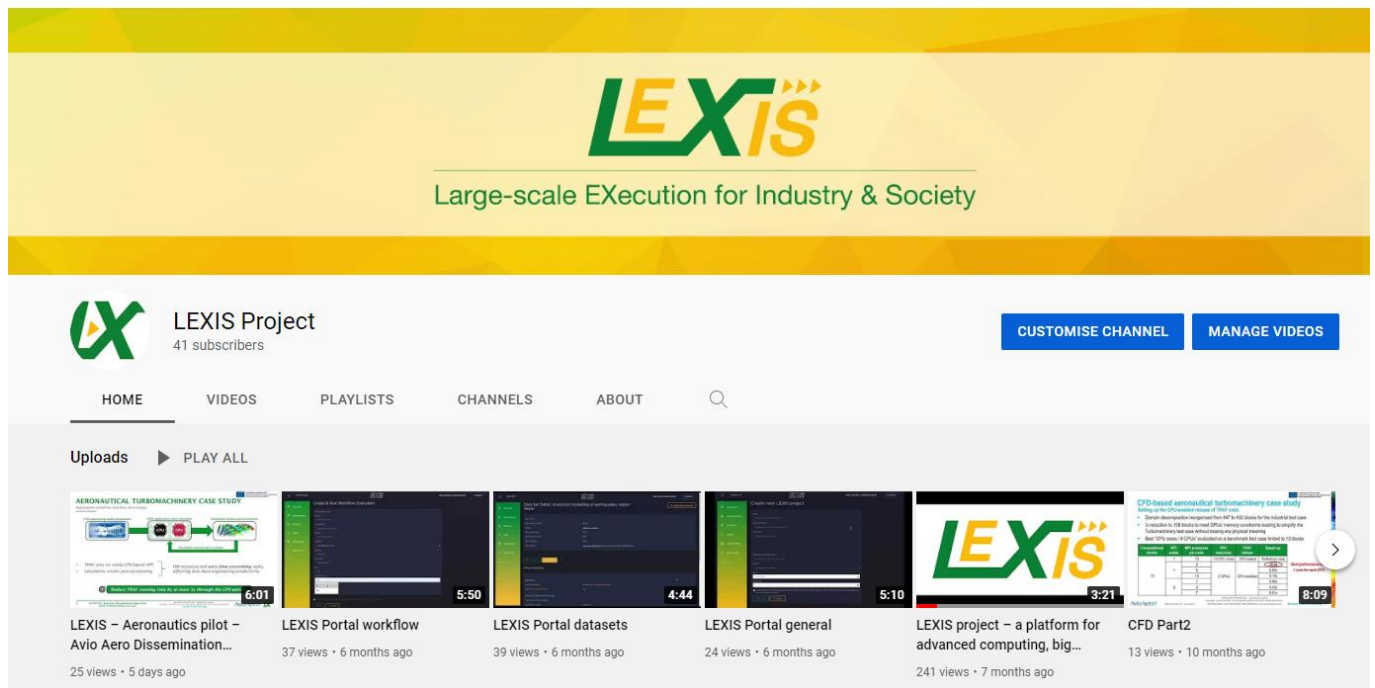


Figure 7 LEXIS project YouTube final statistics

Paper based communication activities and gadgets

During the last period of the project, the following paper-based communication tools have been used:

- Posters,
- Leaflets,
- Press releases (available on the LEXIS website).

Pictures of each of the listed items are given in Figure 8, Figure 9, and Figure 10:

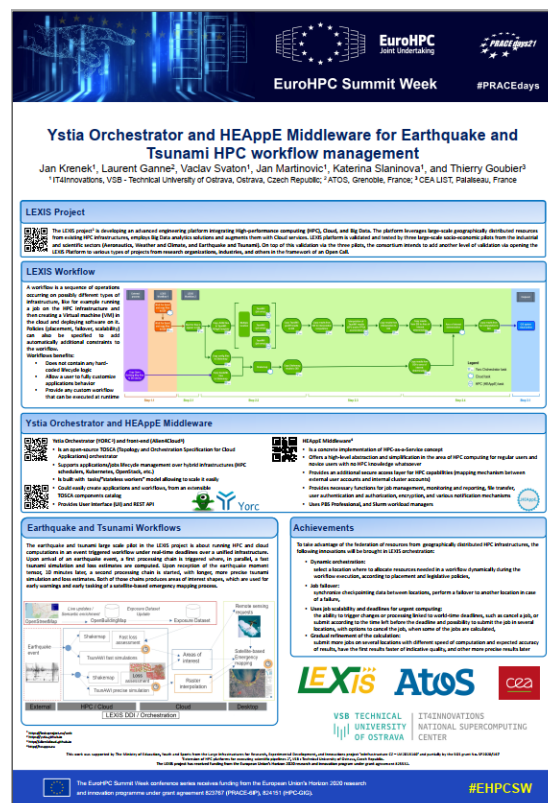


Figure 8 LEXIS poster presented at the EUROHPC Summit Week 2021



Figure 9 LEXIS leaflet used by IT4I for national dissemination (a)



Figure 10 LEXIS leaflet used by IT4I for national dissemination (b)

In addition to this, during SC21, a three-day raffle was organised at the LEXIS booth, where we distributed LEXIS T-shirts and power banks, see Figure 11.



Figure 11 Two of the three winners of the 3 days raffle during SC21 at the LEXIS booth

For ISC High Performance 2021, the LEXIS project also prepared a virtual stand made by the IT4I team highlighting all important achievements of the project: <https://stand.easyevent.cz/lexis>. This virtual stand will be updated and used in the future to present the LEXIS platform and communicate the related activities and results, see Figure 12.



Figure 12 The virtual stand of the LEXIS project

Blog

In the second half of the project, the blog on the website has been fed with news and achievements from the project. IT4I published 8 blog articles speaking about results from the Pilots (Aeronautics, Earthquake and tsunami, and Weather and climate), the LEXIS DDI, the orchestration module, and also about the LEXIS Open Call participants and in particular about CompBioMed2. During the last month of the project we also posted some interesting articles about the LEXIS project in relation with the air quality modelling or Internet of things, and a blog from Avio Aero.

All the articles in the LEXIS blog can be found here: <https://lexis-project.eu/web/news/>.

Newsletter

The communication plan of the LEXIS project through the newsletter was updated in response to the pandemic situation in the second project period. We emphasised more the use of digital media to continue efficient communication. Since the second half of 2020, the LEXIS project has started to create its own project newsletter (*aka. LEXIS Newsletter*). The LEXIS Newsletter functions as a continuous communication channel to:

- Continuously increase visibility of the LEXIS project to the target groups,
- Regularly communicate about project activities, results, and achievements,
- Efficiently inform readers about state-of-the-art HPC, cloud and big data technologies employed in the LEXIS project,
- Promote and enhance impacts of other LEXIS DEC activities.

The target groups of the LEXIS project are entities interested in the development and exploitation of the LEXIS Platform in their daily business, which could be categorised into:

- Research communities and academia,
- Industry and manufacturing,
- Companies, SMEs, and start-ups,
- General public (indirect target group, since the LEXIS Newsletter has been published on the LEXIS website).

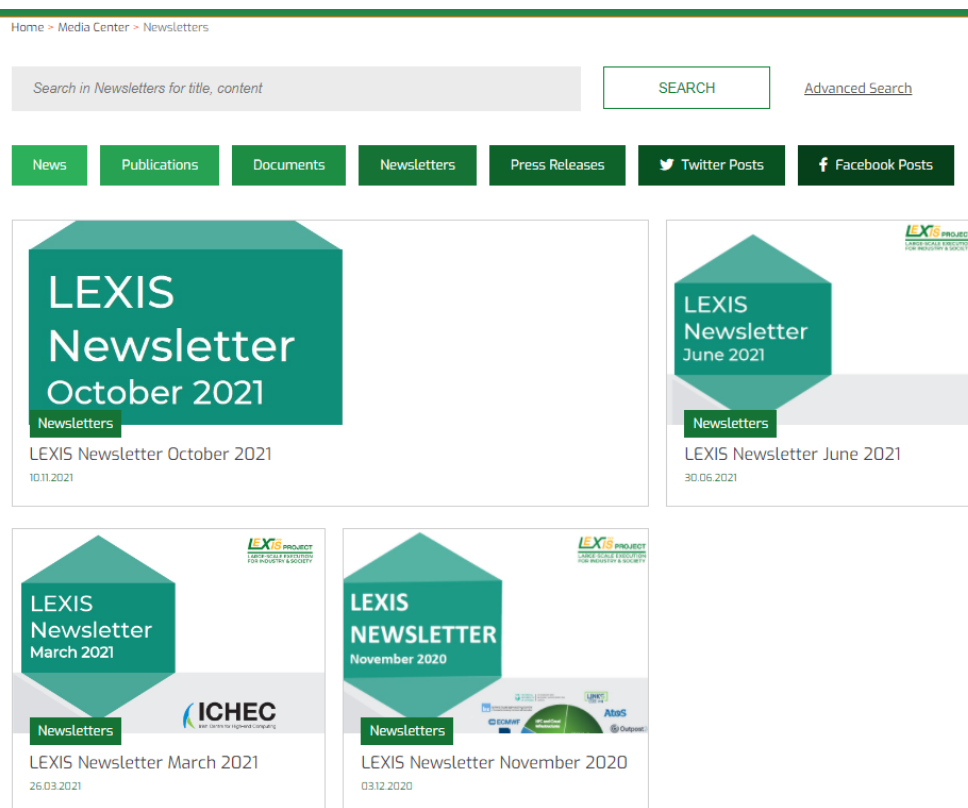


Figure 13 Newsletter page on the LEXIS website

Figure 13 shows the Newsletter page on the LEXIS website. The KPI (KPI_6) set for the newsletter targeting the acquisition of more than 100 subscribers was successfully achieved since the first release of the newsletter (ca. 300 contacts).

We have acquired subscribers through active dissemination activities of the consortium at well-known HPC and BDVA events, through the LEXIS Open Call promotion campaign, and through the project website. At the final project stage, we managed to raise interest in the project target users, gaining in total ~300 newsletter subscribers. Within the last 18 project months, we have released 4 newsletters, and the final newsletter is under preparation.

Each newsletter was structured into 5 sections:

- Breaking news,
- LEXIS Open Call,
- Large-scale Pilots progress and results,
- LEXIS technology,
- Reporting of DEC activities.

The following Figure 14, Figure 15, Figure 16, Figure 17, and Figure 18 show an overview of LEXIS news and articles communicated in different sections of the newsletters.

To read the entire collection of LEXIS newsletters, please visit the project website: <https://lexis-project.eu/web/newsletters/>.



Figure 14 Breaking news section of each LEXIS Newsletter issued



Figure 15 LEXIS Open Call framework

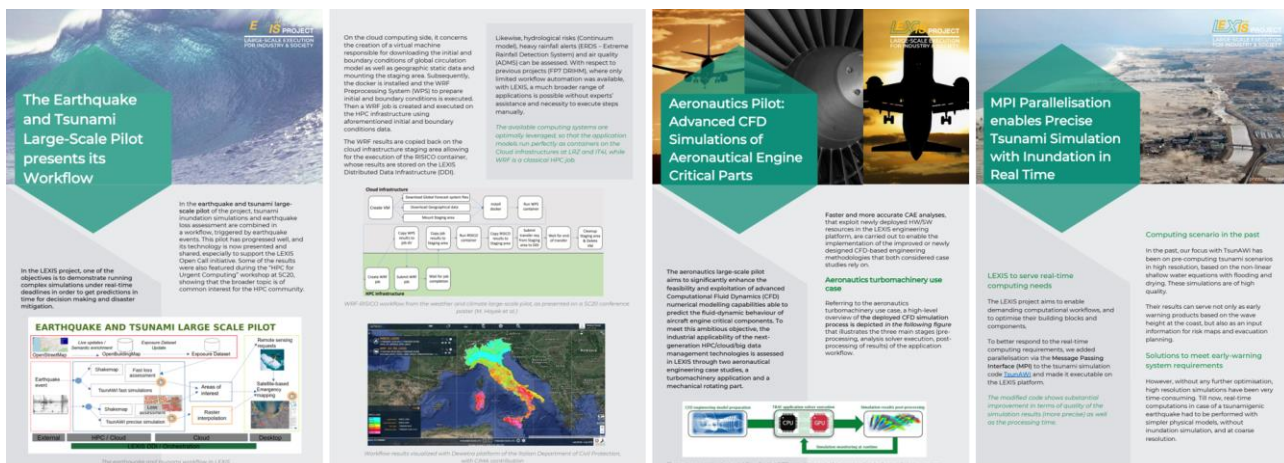


Figure 16 Results from Pilots in the newsletters



Figure 17 LEXIS technologies in the newsletters



Figure 18 LEXIS DEC activities in the newsletters

Videos

There are 9 videos available which communicate activities and results of the LEXIS project. We have created one video to introduce novel computing systems at IT4I and LRZ. We gathered couple of videos which were recorded during the conferences and we created 3 videos that present the LEXIS portal. IT4I also prepared a general video called “LEXIS project – platform for advanced computing, big data and cloud”. It describes the project to the general public, informs about the LEXIS Platform and summarises its large-scale Pilots. All the videos can be found at the LEXIS YouTube channel: <https://www.youtube.com/channel/UCiU3w-dw9-eaOCD4Zlf8qVw>.



Figure 19 LEXIS videos

Reporting activities

The following and reporting process of the communication and dissemination activities carried out during this reporting period covered by this deliverable has been done as presented in the previous Deliverable D9.3 [3].

As a reminder, the “communication” spreadsheet tracked the following items:

- Project website,
- Social media channels,
- Blog,
- LEXIS Newsletters,
- Press releases,
- Press monitoring,
- Other activities.

Additionally, the “dissemination” spreadsheet tracked the following items:

- Articles in journals and books,
- Articles in conference proceedings,
- Booths,
- Participation in workshops,
- Participation in conferences,
- Participation in other events,
- Organisation of events,
- Other activities.

The two spreadsheets together allowed the WP9 leader (and in general the whole consortium) to have an overview of the progresses related to each of the 7 KPIs that were part of the LEXIS project, and increased the commitment of each partner inside the consortium.

The recording period was quarterly, and the relevant information recorded in the above-mentioned spreadsheets has also been published on the LEXIS website.

As introduced previously in Deliverable D9.3 [3], in the second half of the project, major focus has been placed on the exploitation plan, due to results availability, and how to exploit the LEXIS Platform across Europe after the project ends with public and private bodies. Major details and insights will be given in the next section of this document.

4 IMPACT THROUGH EXPLOITATION

Both commercial and non-commercial exploitation and exploitation initiatives are essential for the success of the project, and in this regard the consortium has put a strong focus on the exploitation plan since the beginning of the project, as documented and reported in the previous documents.

This document retains the same approach proposed in Deliverable D9.3 [3], presents the updated exploitation plan for each partner, and introduces their 'beyond the project' activities.

Exploitation initiatives were boosted in this last period of the project, and we are happy to report some important achievements here below:

- The LEXIS Platform reached a TRL near to 8 and the LEXIS Platform modules have been released as Open Source modules (see Section 5),
- The LEXIS Pilots garnered some important results as reported in the impact Deliverables D9.7 [5], D9.8 [6], and D9.9 [7],
- The LEXIS project is visible on the Innovation Radar¹ platform with seven results (see Deliverable D9.6 [1]),
- The Smart Gateway has reached TRL 9. After the first two units reported in Deliverable D7.7 [8], the design and the assembly have been refined to ease manufacturing, and five additional units were assembled in December 2021. The Smart Gateway is thus ready to be integrated into TESEO's products portfolio. More information can be found at the LEXIS website: <https://lexis-project.eu/web/news/the-lexis-front-door-to-the-internet-of-things-era/>,
- The LEXIS project organised LEXIS Open Call for collection the feedback about the LEXIS Platform from external parties (see Deliverable D9.12 [9]) together with the feedback for the LEXIS Portal improvement (cf. Deliverable D8.4 [10]),
- Several new international and national projects with potential to use LEXIS technologies have already started with participation of one or more LEXIS project partners.

4.1 FINAL EXPLOITATION RESULTS

In this section, we will describe the initiatives launched with respect to the exploitation process and its steering. We also report actions made to properly let partners understand the importance of exploiting project results.

The actions carried out since the submission of Deliverable D9.3 [3] have been:

1. Continuous monitoring of exploitation initiatives by consortium partners - both commercial and non-commercial,
2. Continuous monitoring of new innovations coming from the LEXIS project thanks to the availability of results,
3. Organisation and participation on several events which have given us a possibility to show LEXIS project results to potential customers, to BigData & HPC communities, and to students. Selected events are listed below:
 - a. Workshops with the MESAP Cluster and Torino Wireless were organised with the purpose of attracting LEXIS Open Call applicants and explaining the potential of the platform,
 - b. A session was organised at Data Week 2021: Future challenges in IoT, AI, and convergence of HPC & Cloud & Big Data, May 2021 (virtual event),
 - c. LEXIS was presented at the SOLADITE final workshop, December 2021,
 - d. LEXIS had a presentation in the DeepHealth Winter School 2022, January 2022.

Table 7 breaks down the actions listed by partners carrying them out. Some of the results are confidential and therefore the details are not available in the public context here.

¹ Innovation Radar: <https://www.innoradar.eu/resultbykeyword/lexis>

| CATEGORY | NUMBER OF EXPLOITABLE RESULTS |
|------------------------------------|-------------------------------|
| LEXIS Platform | 4 |
| LEXIS DDI | 5 |
| LEXIS Orchestration | 9 |
| LEXIS Portal, Accounting & Billing | 4 |
| LEXIS PILOTS: Aeronautics | 2 |
| LEXIS PILOTS: Earthquake & Tsunami | 8 |
| LEXIS PILOTS: Weather & Climate | 7 |
| TOTAL | 39 |

Table 7 LEXIS exploitable results

From these results, various types of exploitation opportunities and paths have been identified and developed (see Table 8).

| CATEGORY | NUMBER |
|--|--------|
| Non-Commercial Exploitation Paths | 23 |
| Commercial Exploitation Paths | 18 |
| Cooperation with projects where LEXIS partners are involved | 10 |

Table 8 LEXIS exploitation opportunities

In the context of Commercial Exploitation, we have identified exploitation paths for different partners, which can be categorised to four groups: (i) LEXIS Services (7x); (ii) Tools, Methodologies & Technologies (9x); (iii) Converged HPC/Cloud Accounting & Billing (1x); and (iv) Development Platforms (1x).

The non-commercial exploitation paths of the LEXIS project partners have different directions, for which we would like to point out several examples here:

- Training courses for the HPC centre users or related communities,
- Presentations of potential new services provided by LEXIS commercial partners,
- Code optimisation by research and development activities,
- PhD, Master or Bachelor degree theses mentored or supported by HPC centres,
- Mobility and knowledge transfer.

4.2 IMPACT THROUGH PILOT RELATED ACTIVITIES

In Deliverable D9.3 [3], intermediate results in terms of pilot related activities regarding DEC have been properly described and reported, and a roadmap for the remaining project period has been devised.

As each Pilot has its deliverable dedicated to impact, a deep analysis of the impact and results for each Pilot is properly performed in Deliverables D9.7 [5], D9.8 [6], and D9.9 [7] respectively, which refers to the LEXIS WP5 (Aeronautics Pilot), WP6 (Earthquake and Tsunami Pilot), and WP7 (Weather and Climate Pilot) activities and achievements at the end of the project.

4.3 LEXIS IMPACT ON HPC AND BIG DATA CONVERGENCE ECOSYSTEM

In Deliverable D9.5 [11], as well as in Deliverable D9.11 [12], we provided an in-depth analysis of market trends in HPC, big data and cloud ecosystems in Europe and globally.

Specifically, within Deliverable D9.11 [12], we further analysed how the COVID-19 global pandemic may have impacted the technology adoption and what role new emerging market segments play in the convergence trends. The LEXIS technical outcome was put in the context with these emerging market trends.

LEXIS project's approach of federating available cloud and HPC capacities at HPC centres within Europe is based on visions strong enough to create a disruption in the existing market scenario, and this approach was already positively vetted at the recently concluded SC21 event.

The interest expressed by LEXIS Open Call participants also validates the technical approach taken within the LEXIS project; with a "one stop shop" portal access covering resource provisioning, workflow execution, data management, and overall support for multi-organisation and multi-project scenarios. The LEXIS Platform clearly brings cloud and HPC resources together in a seamless manner, further driving convergence trends seen elsewhere in our market analysis. The only impediment we recognised in fully exploiting the commercial capabilities of the LEXIS Platform and associated services are regulatory and national policies that limit exploitation of resources available within European HPC centres.

4.4 FUTURE ROADMAP BEYOND THE END OF THE PROJECT

We firmly believe that exploitation should not stop at the project end. We gathered important feedback from customers and participants within the HPC/Cloud ecosystem, e.g. by issuing and supporting the LEXIS Open Call. Thus, we are able to outline a roadmap for the LEXIS Platform beyond the end of the project (as per the consortium time frame) in order to continue exploitation and also development. Work in this direction is reflected in Deliverable D9.11 [12] (Section 7 therein in particular), which analyses the future LEXIS exploitation potential in depth. Furthermore, a detailed Exploitation Plan as an internal private consortium document has been produced and continuously updated during the project duration.

5 LEXIS OPEN SOURCE – FINAL SUMMARY

LEXIS puts a strong focus on dissemination of its results, including Open Source code and documentation, to the community and its users. This applies not only to components of the LEXIS Platform (cf. Section 5.1 below), but also to components crucial for the Pilots with their workflows (cf. Section 5.2).

5.1 LEXIS PLATFORM

We are following an **Open Source strategy oriented around three goals**:

1. **Publication of code belonging to the LEXIS modules** (cf. Deliverable D2.6 [13]) within the LEXIS GitHub group (<https://github.com/lexis-project>) or (for results partially from LEXIS) within the original GitHub repositories,
2. **Assignment of Digital Object Identifiers (DOIs) to code** via ZENODO (<https://zenodo.org>) on a sensible granularity level, i.e., for significant sets of code,
3. **Systematic web publication/presentation of an overview** of the published code within the "LEXIS community" on the ZENODO research data repository (<https://zenodo.org/communities/lexis/>) and on www.lexis-project.eu.

The development of this strategy had been indicated already in Deliverable D9.2 [14], where the Open Source dimension of LEXIS had been outlined (Section 2.6). In Deliverable D9.6 [1] (Section 2.5), LEXIS results to be delivered in an Open Source scheme have been identified. Table 9 shows an updated version of the Open Source module table presented in Deliverable D9.6 [1], including contributing project partners, the role of the component

within the LEXIS Platform, and corresponding items considered by the Innovation Radar of the EC. With respect to the table in Deliverable D9.6 [1], the items “Monitoring” and “3D Remote Visualisation: XRV and noVNC” have been deselected for separate publication. These items mostly consist of appropriately configured software already available elsewhere [15, 16, 17], for which a sort of “re-publication” would merely create confusion at the user base.

| TECHNOLOGY/LEXIS MODULE NAME + LINK TO REPOSITORY | LEXIS RESULT | CONTRIBUTING CONSORTIUM MEMBERS | ROLE WITHIN LEXIS | INNOVATION RADAR |
|---|--------------|---------------------------------|---|--|
| WCDA LEXIS Submodule: DDI SERVICE – WCDA <ul style="list-style-type: none"> https://github.com/ecmwf | Yes | ECMWF | API for storing and retrieving curated weather and climate data and metadata. | DEEP TECH INNOVATION 38136 |
| DDI SERVICE & APIs LEXIS Submodules: DDI SERVICE – iRODS, DDI SERVICE – APIs, DDISERVICE – PERF. MONITORING, MONITORING – SYSTEM TESTS <ul style="list-style-type: none"> https://github.com/lexis-project/ddi-service-irods https://github.com/lexis-project/ddi-service-apis https://github.com/lexis-project/ddi-service-performance-monitoring https://github.com/lexis-project/monitoring-system-tests | Yes | IT4I LRZ Atos O24 | Distributed Data Infrastructure (iRODS/EUDAT-based) with REST APIs for data management and staging. In addition, automated system functionality and performance test scripts are published. | DEEP TECH INNOVATION 38136 , DEEP TECH INNOVATION 39139 |
| Yorc and Alien4Cloud LEXIS Submodules: ORCHESTRATOR SERVICE – YORC, ORCHESTRATOR SERVICE – ALIEN4CLOUD, ORCHESTRATOR SERVICE – A4C GO CLIENT <ul style="list-style-type: none"> https://github.com/ystia https://github.com/alien4cloud | Partial | Atos | Yorc orchestration engine and Alien4Cloud frontend used as the basis for deploying workload to the federated clusters. In addition, a go client for A4C is published. | DEEP TECH INNOVATION 38136 , DEEP TECH INNOVATION 38142 |

| | | | | |
|---|---------|-------|---|--|
| Yorc Plugins LEXIS Submodules: ORCHESTRATOR SERVICE – YORC OIDC CLIENT, ORCHESTRATOR SERVICE – YORC DYNAMIC ORCHESTRATION PLUGIN, ORCHESTRATOR SERVICE – YORC PLUGIN – HEAppE, ORCHESTRATOR SERVICE – YORC PLUGIN – DDI <ul style="list-style-type: none"> https://github.com/lexis-project/orch-service-yorc-oidc-client https://github.com/lexis-project/orch-service-yorc-dynamic-orchestration-plugin https://github.com/lexis-project/orch-service-yorc-heappe-plugin https://github.com/lexis-project/orch-service-yorc-ddi-plugin | Yes | Atos | Yorc plugins developed so that Yorc can use the OpenID-Connect-based LEXIS AAI, the Dynamic Allocation Module, the HEAppE API to manage HPC resources and the DDI API to manage Data transfers. | DEEP TECH INNOVATION 38136 , DEEP TECH INNOVATION 38142 |
| TOSCA Templates LEXIS Submodule: ORCHESTRATOR SERVICE – TOSCA TEMPLATES <ul style="list-style-type: none"> https://github.com/lexis-project/orch-service-tosca-templates | Yes | Atos | TOSCA templates for common workflows in LEXIS, for easy uptake by users. | DEEP TECH INNOVATION 38136 , DEEP TECH INNOVATION 38142 |
| HEAppE Middleware LEXIS Submodules: HPC – HEAPPE INSTANCES, HPC – USAGE COLLECTORS <ul style="list-style-type: none"> https://github.com/lt4innovations/HEAppE https://github.com/lexis-project/hpc-usage-collectors | Partial | IT4I | HEAppE, a secure middleware layer between Ystia/Yorc and HPC/Cloud infrastructure for the management of computational tasks. | DEEP TECH INNOVATION 38136 , DEEP TECH INNOVATION 38142 |
| Dynamic Allocator Module LEXIS Submodule: ORCHESTRATOR SERVICE – DYNAMIC ALLOCATOR MODULE | Yes | LINKS | Module which dynamic job allocation is delegated to. | DEEP TECH INNOVATION 38136 , |

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|--|---------|--------------------------------|---|---|
| <ul style="list-style-type: none"> https://github.com/lexis-project/orch-service-dynamic-allocator-module | | | | DEEP TECH INNOVATION 38142 |
| Orchestration Service APIs LEXIS Submodule: ORCHESTRATOR SERVICE – API <ul style="list-style-type: none"> https://github.com/lexis-project/orch-service-api | Yes | Atos ICHEC IT4I LINKS | APIs exposed to the portal to interact with orchestrator. | DEEP TECH INNOVATION 38136, DEEP TECH INNOVATION 38142 |
| Cyclops and Extensions LEXIS Module: ACCOUNTING AND BILLING SERVICE <ul style="list-style-type: none"> https://github.com/Cyclops-Labs/cyclops-4-hpc | Partial | CYC | Cyclops forms the core of the LEXIS accounting and billing solution and has been extended further within LEXIS. | DEEP TECH INNOVATION 38136, DEEP TECH INNOVATION 38143 |
| Cyclops Usage Collectors LEXIS Submodules: HPC – USAGE COLLECTORS, CLOUD – OPEN STACK USAGE COLLECTORS <ul style="list-style-type: none"> https://github.com/Cyclops-Labs/cyclops-4-hpc | Partial | CYC IT4I | Resource usage collectors for Billing system. | DEEP TECH INNOVATION 38136, DEEP TECH INNOVATION 38143 |
| LEXIS Portal LEXIS Module: LEXIS FRONTEND <ul style="list-style-type: none"> https://github.com/lexis-project/lexis-frontend-portal-backend-services https://github.com/lexis-project/lexis-frontend-general | Yes | CYC IT4I ICHEC LRZ | LEXIS Front-end which allows for easy user interaction with the platform. | DEEP TECH INNOVATION 38136 |
| LEXIS Backend Services LEXIS Module: LEXIS BACKEND SERVICES <ul style="list-style-type: none"> https://github.com/lexis-project/lexis-backend-services-api https://github.com/lexis-project/lexis-backend-services-userorg-service | Yes | CYC | Go Module to serve the Portal Front-end and keep up part of the interaction with the users. | DEEP TECH INNOVATION 38136 |

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|--|-----|-----|---|--|
| <ul style="list-style-type: none"> https://github.com/lexis-project/lexis-backend-services-interface-approval-system https://github.com/lexis-project/lexis-backend-services-interface-datasets | | | | |
| AAI Services LEXIS Module: AAI SERVICES <ul style="list-style-type: none"> https://github.com/lexis-project/aai-services-keycloak-library https://github.com/lexis-project/aai-services-keycloak-theme | Yes | O24 | Authentication and Authorization system components, including connectors to specific modules. | DEEP TECH INNOVATION 38136 |

Table 9 LEXIS Platform Open Source results

5.2 LEXIS PILOTS

Part of the LEXIS work was a development or extension of the open-source software used by the Pilots and used in the LEXIS. In Table 10, we present Open Source software used in the Pilots and the relevant public repositories.

| SOFTWARE | CONTRIBUTION IN LEXIS | SHORT DESCRIPTION | URL | LICENSE |
|-------------------------------|--|---|---|-----------------|
| ShakeMAPI | Developed under LEXIS | Web engine to generate synthetic ShakeMaps harnessing the OpenQuake engine of the Global Earthquake. | https://git.gfz-potsdam.de/marius/ShakeMapi | BSD 3-Clause |
| OBMGapAnalysis | Developed under LEXIS and RISE (H2020) | Procedures to map the Global Human Settlement Layer to zoom-level 18 Quadtree tiles and assess the building completeness by comparison with OBM footprints. | https://git.gfz-potsdam.de/dynamicexposure/openbuildingmap/obm-gapanalysis | AGPLv3+ license |
| Rabotnik | Developed under LEXIS | Main processing engine for the OpenBuildingMap and the Dynamic Exposure model. | https://git.gfz-potsdam.de/dynamicexposure/rabotnik/rabotnik | AGPLv3+ license |
| OpenBuildingMap | Extended | Various software projects around the OpenBuildingMap (e.g. database, website). | https://git.gfz-potsdam.de/dynamicexposure/openbuildingmap | AGPLv3+ license |
| Dynamic exposure model | Extended | Various software projects around the Dynamic Exposure | https://git.gfz-potsdam.de/dynamicexposure/globaldynamicexposure | AGPLv3+ license |

| | | | | |
|----------------|---|--|---|--|
| | | model (e.g. loss calculator, example exposure models). | | |
| TsunAWI | Extended and optimized | Simulates all stages of a tsunami from the origin and the propagation in the ocean to the arrival at the coast and the inundation on land. | https://gitlab.awi.de/tsunawi/tsunawi | TsunAWI License GPLv2 with modifications |
| FDB | Extended | Domain-specific object store for meteorological data. It has been extended to support cloud (Ceph) data store. | https://github.com/ecmwf/fdb | Apache-2.0 License |
| WCDA | Developed under LEXIS and HIDALGO (H2020) | RESTful API for curated meteorological datasets (observations and numerical model outputs). | https://git.ecmwf.int/projects/LEX/repos/polytope-client | Apache-2.0 License |

Table 10 LEXIS Pilots Open Source results

6 SUMMARY

This deliverable presents all the progress made since Deliverable D9.3 [3] submission in terms of the impact strategy of the LEXIS project at its end.

The document commences with the 7 KPIs analysis and latest statistics of each KPI highlighting the numbers that allowed us to achieve the results.

The main part of the document is devoted to report all the pillars of the LEXIS impact strategy that analyse and present any kind of achievement in terms of DEC, Pilot related activities and market analysis. The major focus is on the exploitations' key achievements and activities beyond the project end and the updated preliminary analysis made in Deliverable D9.5 [11], regarding the impact of the LEXIS project on the HPC and big data convergence ecosystem in Europe and the LEXIS Platform positioning.

The final section of this deliverable summarises LEXIS project Open Source results from the LEXIS Platform point of view and includes also relevant Open Source software of the Pilots.

REFERENCES

- [1] LEXIS Deliverable, *D9.6 Report on IPR Management*.
- [2] LEXIS Deliverable, *D9.1 Impact KPI and Metrics Achievement Report and Plan - first version*.
- [3] LEXIS Deliverable, *D9.3 Impact KPI and Metrics Achievement Report and Plan - intermediate version*.
- [4] LEXIS Deliverable, *D2.5 Final Assessment of the Co-Designed LEXIS Architecture*.
- [5] LEXIS Deliverable, *D9.7 Impact on Productivity and Business Process Improvement in Aeronautics*.
- [6] LEXIS Deliverable, *D9.8 Impact on Productivity and Business Process Improvement for Earth*.
- [7] LEXIS Deliverable, *D9.9 Impact on Productivity and Business Process Improvement for Weather & Climate*.
- [8] LEXIS Deliverable, *D7.7 Field Deployment of a Smart Gateway for Collecting, Pre-processing, and Transmitting In-situ Observations*.
- [9] LEXIS Deliverable, *D9.12 Open Call Framework and Stakeholders Engagement on Targeted Large-Scale Pilots - final*.
- [10] LEXIS Deliverable, *D8.4 Roadmap for Further Development of the LEXIS Portal*.
- [11] LEXIS Deliverable, *D9.5 Market Analysis of Converged HPC, Big Data and Cloud Ecosystems in Europe*.
- [12] LEXIS Deliverable, *D9.11 Updated Market Analysis of Converged HPC, Big Data and Cloud Ecosystems in Europe and Positioning of the LEXIS Platform*.
- [13] LEXIS Deliverable, *D2.6 Infrastructure Validation and Assessment Report*.
- [14] LEXIS Deliverable, *D9.2 IPR and Data Management Approach*.
- [15] LEXIS Deliverable, *D3.4 Monitoring System*.
- [16] Xpra Community, "Xpra home page (open-source basis of XRV)," 2018. [Online]. Available: <https://xpra.org>. [Accessed 30 12 2021].
- [17] noVNC Community, "noVNC," 2021. [Online]. Available: <https://novnc.com>. [Accessed 30 12 2021].

A APPENDIX – NEWSLETTER STATISTICS

| NO. | MAIN LEADER | ACTIVITY DESCRIPTION | DATE/PERIOD | TYPE OF AUDIENCE | SIZE OF AUDIENCE |
|------|-------------|---|----------------|---------------------------------|------------------|
| NL12 | IT4I | IT4I Newsletter Q3/2019, page 16-17 | November, 2019 | Scientific Community, Public | 1038 e-mails |
| NL13 | IT4I | IT4I Newsletter Q3/2019, page 16-17 | December, 2019 | Scientific Community, Public | 1300 emails |
| NL14 | IT4I | University Newsletter, article: "IT4Innovations is member of prestigious international organisations BDVA and EUDAT CDI" | October, 2019 | University employess & students | 15000 |
| NL15 | IT4I | University Newsletter, article: "We make our university much more visible on a European and global level", page 25-28 | December, 2019 | University employess & students | 15000 |
| NL16 | IT4I | IT4I Internal Newsletter: Lexis project presentation at SC19 | November, 2019 | IT4I employees | 200 |
| NL17 | IT4I | IT4I Newsletter Q4/2019, page 24, "Supercomputing conference" | February, 2020 | Scientific Community, Public | 1028 e-mails |
| NL18 | IT4I | IT4I Newsletter Q4/2019, page 23, "Supercomputing conference" | March, 2020 | Scientific Community, Public | 1305 e-mails |
| NL19 | IT4I | IT4I Internal Newsletter: Presentation at HiPEAC conference in Bologna | January, 2020 | IT4I employees | 200 |
| NL20 | IT4I | IT4I Newsletter Q2/2020, page 26-27, "New infrastructure to significantly facilitate implementation of the LEXIS project" | July, 2020 | Scientific Community, Public | 1054 e-mails |
| NL21 | IT4I | IT4I Newsletter Q2/2020, page 26-27, "New infrastructure to significantly facilitate implementation of the LEXIS project" | August, 2020 | Scientific Community, Public | 1055 e-mails |
| NL22 | IT4I | IT4I Newsletter Q2/2020, page 11-13, "We have become actively involved in combatting COVID-19" | July, 2020 | Scientific Community, Public | 1054 e-mails |

| | | | | | |
|-------------|------|--|-----------------|--|-------------------|
| NL23 | IT4I | IT4I Newsletter Q2/2020, page 11-13, "We have become actively involved in combatting COVID-19" | August, 2020 | Scientific Community, Public | 1055 e-mails |
| NL24 | LRZ | LRZ Newsletter: User-friendly Data Transfer for HPC, HPC-Cloud-Big-Data-Convergence System to benefit scientists, industry and society | April, 2020 | Scientific Community, Public, LRZ/BADW employees | web |
| NL25 | LRZ | LRZ Newsletter: User-friendly Data Transfer for HPC, HPC-Cloud-Big-Data-Convergence System to benefit scientists, industry and society | April, 2020 | Scientific Community, Public, LRZ/BADW employees | 3000 emails + web |
| NL26 | LRZ | LRZ Newsletter: Big Data goes on a journey, innovative, distributed cloud and high-performance computing systems, forest fire forecast simulation | September, 2020 | Scientific Community, Public, LRZ/BADW employees | web |
| NL27 | LRZ | LRZ Newsletter: Big Data goes on a journey, innovative, distributed cloud and high-performance computing systems, forest fire forecast simulation | September, 2020 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |
| NL28 | IT4I | BDV Newsletter - article: LEXIS project announces the Open Call from October 2020 | September, 2020 | Scientific Community, Industry, Public | - |
| NL29 | LRZ | LRZ-Special-Newsletter to SC20: LISTENING, LEARNING, SHARING KNOW-HOW, Poster presentation "Using the LEXIS Cloud/HPC Platform for forest fire prevention & prediction workflow" | November,2020 | Scientific Community, Public, LRZ/BADW employees | web |
| NL30 | LRZ | LRZ-Special-Newsletter to SC20: LISTENING, LEARNING, SHARING KNOW-HOW, Poster presentation "Using the LEXIS Cloud/HPC Platform for forest fire prevention & prediction workflow" | November,2020 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |
| NL31 | IT4I | IT4I Internal Newsletter: Interim review and presentation of the new video | July, 2020 | IT4I employees | 198 |
| NL32 | IT4I | IT4I Internal Newsletter: Digital forum TERATEC 2020 | October, 2020 | IT4I employees | 200 |

| | | | | | |
|------|------|---|----------------|--|---|
| NL33 | IT4I | IT4I Internal Newsletter: LEXIS project has a new blog | November, 2020 | IT4I employees | 199 |
| NL34 | ALL | LEXIS Newsletter November 2020 | November, 2020 | Scientific Community, Industry, Public | ~250 + LEXIS web page |
| NL35 | IT4I | IT4I Newsletter Q3/2020, Digital foru TERATEC 2020, page 3 | DECEMBER,2020 | Scientific Community, Public | 203 emails (english), 1044 emails (Czech) |
| NL36 | IT4I | IT4I Newsletter Q3/2020, Platforms for scientific workflow execution, page 20 | DECEMBER,2020 | Scientific Community, Public | 203 emails (english), 1044 emails (Czech) |
| NL37 | IT4I | IT4I Internal Newsletter: LEXIS project has a new blog | NOVEMBER,2020 | IT4I employees | 199 emails |
| NL38 | IT4I | IT4I Internal Newsletter: LEXIS booth at SC20 | NOVEMBER,2020 | IT4I employees | 197 emails |
| NL39 | IT4I | IT4I Internal Newsletter: LEXIS Newsletter and ETP4HPC handbook | DECEMBER,2020 | IT4I employees | 199 emails |
| NL40 | ALL | LEXIS Newsletter March 2021 | March, 2021 | Scientific Community, Industry, Public | ~250 + LEXIS web page |
| NL41 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | March 2021 | Scientific Community, Public, LRZ/BADW employees | web |
| NL42 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | March, 2021 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |
| NL43 | IT4I | IT4I Newsletter Q4/2020, page 4 | February, 2021 | Scientific Community, Public | 1025 emails |
| NL44 | IT4I | IT4I Newsletter Q4/2020, page 23 and 24 | February, 2021 | Scientific Community, Public | 1025 emails |
| NL45 | IT4I | IT4I Newsletter Q4/2020, page 4 | March, 2021 | Scientific Community, Public | 194 emails |
| NL46 | IT4I | IT4I Newsletter Q4/2020, page 23 and 24 | March, 2021 | Scientific Community, Public | 194 emails |

| | | | | | |
|-------------|------|---|-------------|--|-----------------------|
| NL47 | IT4I | IT4I Internal Newsletter: LEXIS Open Call | March, 2021 | IT4I employees | ~ 200 emails |
| NL48 | IT4I | IT4I Internal Newsletter: Presentation of the LEXIS project at ODTU METU | March, 2021 | IT4I employees | ~ 200 emails |
| NL49 | IT4I | IT4I Internal Newsletter: LEXIS project innovations at Innovation Radar | March, 2021 | IT4I employees | ~ 200 emails |
| NL50 | IT4I | IT4I Internal Newsletter: LEXIS newsletter no. 2 | April, 2021 | IT4I employees | ~ 200 emails |
| NL51 | ALL | LEXIS Newsletter June 2021 | June, 2021 | Scientific Community, Industry, Public | ~250 + LEXIS web page |
| NL52 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | april, 2021 | Scientific Community, Public, LRZ/BADW employees | web |
| NL53 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | april, 2021 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |
| NL54 | LRZ | LRZ Newsletter: Research data from the cloud, Wanted – Data projects for supercomputing | May, 2021 | Scientific Community, Public, LRZ/BADW employees | web |
| NL55 | LRZ | LRZ Newsletter: Research data from the cloud, Wanted – Data projects for supercomputing | May, 2021 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |
| NL56 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | June, 2021 | Scientific Community, Public, LRZ/BADW employees | web |
| NL57 | LRZ | LRZ Newsletter: Wanted – Data projects for supercomputing | June, 2021 | Scientific Community, Public, LRZ/BADW employees | 3000 emails+web |

| | | | | | |
|-------------|------|--|--------------------|--|-----------------------|
| NL58 | ALL | LEXIS Newsletter October 2021 | November 10, 2021 | Scientific Community, Industry, Public | ~250 + LEXIS web page |
| NL59 | IT4I | IT4I Newsletter Q1/2021: Open Call of the LEXIS project | June 4, 2021 | Scientific Community, Public | 235 emails |
| NL60 | IT4I | IT4I Newsletter Q1/2021: Open Call of the LEXIS project | June 4, 2021 | Scientific Community, Public | 1031 emails |
| NL61 | IT4I | IT4I Newsletter Q2/2021: The new video of the LEXIS project + Presentation of the LEXIS project at iRODS | July 16, 2021 | Scientific Community, Public | 268 emails |
| NL62 | IT4I | IT4I Newsletter Q2/2021: The new video of the LEXIS project + Presentation of the LEXIS project at iRODS | July 15, 2021 | Scientific Community, Public | 1014 emails |
| NL63 | IT4I | IT4I Newsletter Q3/2021: Interview with Jan Martinovič about the LEXIS project | September 14, 2021 | Scientific Community, Public | 994 emails |
| NL64 | IT4I | IT4I Internal Newsletter No. 19: The session at DATA WEEK 2021 | May 14, 2021 | IT4I employees | ~ 200 emails |
| NL65 | IT4I | IT4I Internal Newsletter No. 22: Presentation of the LEXIS project at iRODS | June 4, 2021 | IT4I employees | ~ 200 emails |
| NL66 | IT4I | IT4I Internal Newsletter No. 23: Interview with Jan Martinovič about the LEXIS project | June 11, 2021 | IT4I employees | ~ 200 emails |
| NL67 | IT4I | IT4I Internal Newsletter No. 24: LEXIS project at Forum Terratec 2021 + The new video of the LEXIS project | June 18, 2021 | IT4I employees | ~ 200 emails |
| NL68 | IT4I | IT4I Internal Newsletter No. 25: LEXIS project at ISC 2021 | June 25, 2021 | IT4I employees | ~ 200 emails |
| NL69 | IT4I | IT4I Internal Newsletter No. 26: LEXIS project at ISC 2021 + LEXIS Newsletter 3 | July 2, 2021 | IT4I employees | ~ 200 emails |
| NL70 | IT4I | IT4I Internal Newsletter No. 27: Technical progress meeting | July 16, 2021 | IT4I employees | ~ 200 emails |
| NL71 | IT4I | IT4I Internal Newsletter No. 38: LEXIS F2F meeting | October 22, 2021 | IT4I employees | ~ 200 emails |
| NL72 | IT4I | IT4I Internal Newsletter No. 41: LEXIS project at SC21 | November 12, 2021 | IT4I employees | ~ 200 emails |

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|-------------|------|--|----------------------|----------------|--------------|
| NL73 | IT4I | IT4I Internal Newsletter No. 42: LEXIS project at SC21 | November 19, 2021 | IT4I employees | ~ 200 emails |
| NL74 | IT4I | IT4I Internal Newsletter No. 43: LEXIS newsletter no. 3 | November 26, 2021 | IT4I employees | ~ 200 emails |

Table 11 LEXIS project - newsletter statistics