Coordinated Research Infrastructures Building Enduring Life-science services
- CORBEL -

Assets and sustainability table

The core purpose of CORBEL was to drive LS RI interoperability: the project aims to operationalise the interfaces, access protocols, data management, and ELSI support so that users could seamlessly access the rich landscape of European biological and medical research infrastructure services. CORBEL enabled the LS RIs to support users throughout the execution of a scientific project: from planning and grant applications through to the long-term sustainable management and exploitation of research data. This table lists sustainability plans for the assets produced within the project:

WP	Asset	Partner responsible	Sustainability Plan
2, 4	LS RI Brochure	DSMZ	CORBEL brochure featuring the services of the LS RIs; distributed at project end.
2, 4	Impact Brochure	DSMZ, EuBI, MDC	A brochure entitled 'For the advancement of science - working with the European Life Science Research Infrastructures' was created describing the need for cross-RI access, highlighting WP4 Open Call success stories, and featuring the LS RIs committed to continue joint access on the basis of bilateral collaborations. Available via https://lifescience-ri.eu/home.html.
2, 4, 7	4 Animations for outreach	BBMRI, EuBI, MDC	4 animated videos are being created as permanent outreach materials regarding the importance of research infrastructures to the scientific community. The topics are on introduction to the services of RIs and the LS RI network of RIs, access to the services and technologies of RIs including WP4 Open Call user success stories, COVID-19 support, and the ELSI Services. The videos feature CORBEL but the topics will reach beyond the end of the project in order to continue to be used by the member RIs.
2, 3, 4, 8	Common website for the Life Science RIs	DSMZ, BBMRI, EuBI, MDC, ECRIN, EATRIS	A new website https://lifescience-ri.eu/ was initiated by DSMZ and continued and further developed by BBMRI staff during the last months of CORBEL and beyond. Certain sections from the CORBEL website such as the WP4 Open Calls and cross-RI access success stories were transferred to the new website, as well as the WP3 Catalogue of Services and the WP8 Innovation Helpdesk.
3	Common	BBMRI,	A long-term collaboration agreement was signed between BBMRI, EATRIS

	services Med RIs	EATRIS, ECRIN	and ECRIN early 2019. A series of workshops were organised in 2019 and 2020 to further develop common services, coordinated user access and plan closer collaboration around quality programmes, training activities and communications strategies. A fast response service for COVID-19 was launched in March 2020, additional combined services are foreseen in late 2020.
3	MIUF Stakeholder Forum	ECRIN	Concept and contacts to be used in new and upcoming projects where RIs are major partners (e.g. B1MG, HRIC will make use of MIUF concept as well as EOSC-Life); the MIUF model establishes a dialogue with funders and medical research communities to capture their expectations and needs in order to implement strategic actions to encourage cross-collaboration and the integration of RIs in complex medical research projects.
3	Clinical Trial Meta Data Registry	ECRIN	The idea and concept of a metadata repository (MDR), relating clinical studies with related data objects, was discussed and refined during the consensus exercise in CORBEL and led to the development of a pilot in the XDC project, which will be further extended and professionalised in the EOSC-Life and EOSC-hub projects.
3.2	MOUSE study slide set	University of Liverpool	The slide set will support the publication and will be made publically available via the COMET Initiative website
3.2	SCORE-IT Study - type 2 diabetes core outcome set study results animation	University of Liverpool	The animation of the study results is publically available via YouTube and hosted on the Comet Initiative's YouTube channel.
3.2	Rapid review of qualitative literature - method	University of Liverpool	The method has been published and is available under an open access license https://drc.bmj.com/content/7/1/e000615
3.3	Consensus Exercise on Data sharing of IPD from clinical trials	ECRIN	The results from the consensus exercise on "Sharing and reuse of individual participant data from clinical trials: principles and recommendations", performed within the CORBEL project (WT 3.3) and published in BMJ Open, 2017, have been incorporated into guidelines and recommendations, currently under development by the RDA COVID-19 Working group. The RDA COVID-19 Working Group will address the development of such detailed guidelines on the deposit of different data sources in any common data hub or platform. The guidelines aim at developing a system for data sharing in public health emergencies that supports scientific research and policy making, including an overarching framework, common tools and processes, and principles that can be embedded in research practice. The guidelines to be developed will address general aspects related to the principles the data should adhere to (FAIR and other principles), as well as specificities related to five thematic and two overarching areas.
3.4	Data	Lygature,	The results of WP3.4 (Data integration and management services for image-

	integration services	EATRIS, ECRIN	driven and genomics-driven biomarker studies) have been summarized in a public overview report: https://doi.org/10.5281/zenodo.3628369. Some specific deliverables: The software platform developed for processing preclinical images is accessible following this link: http://www.cim.unito.it/website/research/research_xnat.php. The documentation for the transSMART upload procedures (tranSMART Batch) can be found here: https://github.com/thehyve/transmart-batch/tree/master/docs
3.5	Assessment of transnational biobank sample and data exchange, applied to biomarker identification for pancreatic cancer	BBMRI-ERIC	To field-test transnational biobank sample and data exchange, a pilot experiment was initiated to discover metabolomics and proteomics biomarkers for pancreas cancer. Four biobanks from 4 different countries participated: The Netherlands (LUMC, Leiden, PI and ErasmusMC, Rotterdam), Finland (THL, Helsinki), Estonia (UTARTU, Tartu) and Norway (HUNT, Levanger). Initially, the coordination of sample exchange and data generation caused major delays due to logistical, legal and practical reasons, summarized in a slide deck accessible at https://www.corbel-project.eu/about-corbel/work-packages/wp3-medicaltranslational-research-use-cases.html, and discussed in more depth in https://pubmed.ncbi.nlm.nih.gov/30342241/. The main results of the metabolomics study show that while we identified glutamine and histidine as potential biomarkers of biological interest, a study at this scale does not yield metabolomic biomarkers with sufficient predictive value to be directly clinically useful as prognostic biomarkers. This work has been published as https://doi.org/10.1210/en.2019-00165. A subsequent proteomics study has however identified six potentially interesting protein biomarkers, and the analysis of the validation result, using a different platform is still being completed.
4	Cross-RI Access pipelines	EuBI, MDC	The projects supported in the WP4 Open Calls for advanced research projects in need of on-site, remote or virtual access across two or more of the participating LS RIs established experimental project pipelines across the RIs for integrative approaches and seamless transition from one technology to the next. Together the demand of service combinations led to the network of RI pipelines. 10 RIs have offered their services in the Open Calls (BBMRI, EATRIS, ECRIN, ELIXIR, EMBRC, EU-OS, Euro-BioImaging, INFRAFRONTIER, INSTRUCT, and ISBE). To sustain the established pipelines WP4 has driven the set-up of bilateral collaboration agreements. https://lifescience-ri.eu/collaborative-activities.html
4	Bilateral Collaboration Agreements	EuBI, MDC, EU-OS, INSTRUCT, EMBRC	WP4 has developed a customisable template for bilateral collaboration agreements for joint service provision on the ground of fast-track access, training, staff exchange, joint outreach activities, and identification of funding mechanisms to support user access. Collaboration agreements have been signed between EuBI and EU-OS, EuBI and Instruct, EuBI and EMBRC. Further CAs are currently under development. https://lifescience-ri.eu/collaborative-activities/collaboration-agreements.html
4, 6	Marine	EMBL-EBI	New community ontologies for marine organisms constructed in

	Invertebrate Ontologies in OBO Foundry	and EMBRC	collaboration with WP4 and WP6 are adopted as community standards in the Open international Biomedical Ontology Foundry. These will be used as standard resources for future work and will be supported as community standards across EMBRC enabling data exhange, markup and query.
5	LS AAI	CSC	EOSC-Life project will further develop and deploy the Life Science AAI as a production service. A sustainable governance and funding model of the LS AAI service will be developed during the EOSC-Life project.
5	ARIA	Instruct	ARIA developments developed in the frame of the CORBEL project and harmonising access pipelines to multiple research infrastructures have been adopted as core ARIA functionality and will continue to be used beyond the end date of the CORBEL project. ARIA developments for the needs of the Life Science RI community will continue supported by EOSC-Life WP5. In addition individual infrastructures are entering into agreements with ARIA host Instruct-ERIC to use ARIA for their own infrastructure needs. ARIA is offered as SaaS to these research infrastructures. An ARIA user group has been formed with "power-user" representatives including those from CORBEL infrastructures to continue the process of RI requirements feeding into future ARIA developments. The user group's role is to identify new requirements or improvements and to prioritise these improvements. Those requirements and features prioritised by the user group will be included in the ARIA development plan.
5	RI Quality Framework	INFRA-FRONTIER	The life science RIs organised in CORBEL have collectively agreed on and published the LSRI Quality Management Framework. They continue to cooperate under the principles of the framework in the context of WP8 in the EOSC-Life project.
6	Ontology lookup service	EMBL-EBI	The OLS is now a mature and highly accessed open source ontology access resource which is used internationally and has been accepted as an ELIXIR Interoperability Resource. OLS will continue to be developed for cloud accessibility in the EOSC-Life project and has been adopted by the Human Cell Atlas and several pharma and agrifood companies who are running in house versions.
6	Sickle Cell Disease Ontology	ELIXIR and H3Africa	In collaboration with the H3Africa project we have delivered a new ontology for sickle cell disease focussed on healthcare, diagnosis and treatment of sickle cell disease which is a major health concern in lower- and middle-income countries in Africa. The ontology is available from Ontology Look Up Services and training was delivered for African colleagues contributing to benefits sharing.
6	Image Data Resource	Euro-BioImaging	IDR publishes reference image datasets associated with peer-reviewed publications in the life and biomedical sciences. IDR makes heavy use of the Cellular Microscope Phenotype Ontology (CMPO) developed and enhanced under WP6 to make observed and measured cell phenotypes (changes in shape, cell cycle state, protein localisation, etc) searchable and reusable using a controlled vocabulary. Jupyter notebooks that use CMPO terms to compare cell phenotypes with genetic perturbations have been published and re-used by the community.

6	EGA and secure data Infrastructure	ELIXIR	The EGA is an ELIXIR core data resource supported by a mixture of EMBL and EC funds. In CORBEL, the EGA developed additional capability for its authentication and authorisation infrastructure (AAI) and dataset permissions. This was achieved by implementing GA4GH recommendations and standards (e.g. Researcher Passports). This has now been adopted into the core EGA services portfolio for long-term sustainability.
6	Pilot virtual HPC for access to sensitive data	UMCG, ELIXIR-NL	This pilot enables to rapidly stand-up a 'popup' HPC cluster on OpenStack cloud, including bioinformatics tools to serve as sandboxed virtual research environment for sensitive data projects that cannot be on a shared HPC cluster. It has been embraced by UMCG (as part of ELIXIR-NL) as standard service that they now deliver and further developed and used in major H2020 projects including Solve-RD, EJP-RD, CINECA and ELIXIR RD services.
6	MOLGENIS inter-operability tools	UMCG, BBMRI, ELIXIR-NL	The interoperability tools for recoding and harmonisation mapping of multi-centre cohort data developed as part of BioMedBridges and CORBEL (SORTA, MOLGENIS/connect) have been integrate into and sustained available as part of MOLGENIS open source software, which meanwhile has become an ELIXIR recommended interoperability resource. In consequence these tools are part of BBMRI-ERIC Biobank Directory, a MOLGENIS based resource, and MOLGENIS harmonisation platform, a catalogue for multi-centre cohort research used in H2020 LifeCycle, EUCAN-connect, Longitools and ATHLETE projects
6	Chemistry Resources	EU-OPEN-SCREEN	The UniChem tool continues to be a key part of the chemistry infrastructure and will continue to be supported and developed by the team, supported with funding from EU/IMI, the Wellcome Trust and other sources. The name recognition capability developed in part under CORBEL is already being used in several other projects.
6	SARS-CoV-2 DataHubs	EMBL-EBI	The SARS-CoV-2 Data Hubs provide tools and services that connect data providers with the appropriate ELIXIR Core Data Resources for their data, including the EGA and ENA. Data are therefore sustained indefinitely through core infrastructure. Data standards developed as part of SARS-CoV-2 Data Hubs operations are sustained in the appropriate repositories and catalogues and enjoy sustained deployment within ENA, EGA and BioSamples. Presentation of the data mobilised by the SARS-CoV-2 Data Hubs is effected by the COVID-19 Data Portal, for which enabling developments have been focused on elements of technology (such as EMBL-EBI Search) that will be sustained in an ongoing way as part of core institutional infrastructure.
7	ELSI Helpdesk	BBMRI	https://lifescience-ri.eu/collaborative-activities.html An update of the ELSI section of the BBMRI website is underway in order to ensure that all relevant ELSI information for the LS RI community can be easily found and accessed, especially as part of the ELSI Knowledge Base and ELSI Helpdesk pages. An improved search and filter function is being developed, and all relevant webinars and materials uploaded to YouTube or Zenodo and linked through with appropriate tags.
8	Innovation Helpdesk	EATRIS	The Helpdesk will remain open for enquiries, staffed from the EATRIS business development desk. An EATRIS innovation email account will take

9	CORBEL		the place of the CORBEL innovation account. Guidelines, best practice guides, presentations, publications and (downloadable) template legal documents will be available on the Life Sciences RI website. Material from the workshop on best practices in public-private research collaboration will be retained for possible future events. Links to and exchange of best practices with other projects such as EOSC-Life and ENRIITC will be enacted.
9	CORBEL Webinar series	EMBL-EBI	Webinar recordings will be preserved on the CORBEL website and linked to the CORBEL YouTube channel will be available on the LS RI website. Webinars organised in collaboration with EOSC-Life will also be available on the EOSC-Life website, with a link to the CORBEL YouTube channel.
9	Training courses and training materials	EMBL-EBI	Many of the training courses that were developed and run during the CORBEL project have been integrated into partner and third party training programmes e.g. "Data Visualisation for Biology: A Practical Workshop on Design, Techniques and Tools" is now part of EMBL-EBI training programme, "Machine Learning for Image Analysis" has been adopted into the EMBL course and conference programme, the "User Research & Service design" module has been further developed and is now an integral part of the EMBL-EBI & EMBO core facility management courses, and the Innovation training will be continued in the EATRIS training programme. A number of training topics will be continued in the EOSC-Life training programme (e.g. Aria, Quality Management).
9	CORBEL competency framework	EMBL-EBI	The CORBEL competency framework will be maintained and publicly available on the EMBL-EBI Competency mapper webpage. The Competency Mapper is a web-based tool to support the creation and sustainable management of competency frameworks.