



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

Deliverable D1.4

Final report common infrastructures and services

WP1 – Management and coordination

Lead Beneficiary: ELIXIR

WP leader: Niklas Blomberg (ELIXIR)

Contributing partner(s): BBMRI, EATRIS, EMBL-HD, MDC, ECRIN, Instruct, INFRAFRONTIER, EMBL-EBI

Contractual delivery date: 31 May 2020

Actual delivery date: 29 May 2020

Authors of this deliverable: Friederike Schmidt-Tremmel, Niklas Blomberg

Grant agreement no. 654248

Horizon 2020

H2020-INFRADEV-1-2014

Type of action: RIA

Content

Executive Summary	3
Project objectives	4
Detailed report on the deliverable	4
Background	4
Description of work	5
Long term sustainability of individual CORBEL assets tools and services	5
LS RI Strategy Board (formerly BMS RI Strategy Board)	6
Summary of assets	6
Conclusion	6
Delivery and schedule	7
Adjustments made	7
Appendices	8
Appendix 1: Assets and sustainability table	8

Executive Summary

Cutting edge life science research in Europe is carried out by scientists funded nationally, through European coordination programmes (JPI, ERA-NET), and through large public-private partnerships such as IMI. To be truly transformative the life science research infrastructures need to effectively interface with the scientists and projects within these large and diverse user communities as well as the bodies responsible for organising the funding calls.

The project CORBEL is a four-year Research and Innovation Action funded in 2015 by the European Commission to establish a framework of shared services between the ESFRI Life Science (LS RI).

The core purpose of CORBEL is to drive LS RI interoperability, the project aims to operationalise the interfaces, access protocols, data management, and ELSI support so that users can seamlessly access the rich landscape of European biological and medical research infrastructure services. CORBEL enables 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 deliverable summarises the common infrastructure and services established between the Life Science RI within CORBEL together with sustainability plans for the assets produced:

- CORBEL has delivered a set of common services and policies for data, innovation and user access that will underpin the interconnection of the life science RIs. These services, e.g. the joint login service (Life Science AAI) and user access tool (ARIA) will be taken forward through EOSC-Life¹.
- The user projects supported within CORBEL as cross-RI access pathways have been very successful. A set of bilateral agreements between RIs have been developed to capture the learning and facilitate future cross-RI service provision. The user projects have also demonstrated the importance of – and provided – use cases that illustrate how RI can open up research projects to new experiments.
- The Life Science RIs have now published a common website², which will be sustainable financed by all 13 RIs involved and managed by BBMRI-ERIC. This website will be the permanent home of some of the common services developed in CORBEL, like the catalogue of services and the access to training material and webinars, the ELSI helpdesk run by BBMRI and the Innovation Helpdesk run by EATRIS.

An important conclusion from the Final Meeting (2 March 2020, Brussels, see also D2.4³) was that the cross-RI pipelines have been very effective tools in opening up RI services to new user communities; several projects stated that they would not have discovered and accessed services without the interdisciplinary CORBEL calls. A second important conclusion was the need for central RI support to simplify project management and help the users to access the advanced facilities across disciplines; CORBEL has provided added value in promoting access to services, tools, and/or expertise that would otherwise not be available to researchers at their local institutions.

Much of CORBEL's data work will be continued through EOSC-Life, which will address the various data-sharing issues initiated through the project. A particular challenge for the RI is to provide

¹ <https://www.eosc-life.eu/>

² <https://lifescience-ri.eu/home.html>

³ <https://doi.org/10.5281/zenodo.3744803>

solutions for the acquisition and analysis of multi-modal data in projects – this often needs tailor-made solutions.

Project objectives

With this deliverable, the project has reached the following specific objective:

- a) Effectively integrate CORBEL deliverables with long-term planning and strategy of LS RI through LS RI strategy board

Detailed report on the deliverable

Background

The main aim of the cluster project CORBEL (Coordinated Research Infrastructures Building Enduring Life-science Services) is to establish a framework of shared services between the LS RI that positively transforms the efficiency, productivity and impact of European biomedical research.

Each of the Life Science RIs participating in CORBEL provides pan-European access to specialised research services, instruments, data, samples and facilities that collectively cover life science research, from basic biology to medical translation. The focus in CORBEL is on the integration of these combined capabilities into the scientific workflow of advanced users, ensuring that the common services developed respond directly to the needs of cutting-edge European science.

These services will facilitate user access to data, samples and instrumentation through common access policies and a shared resource portal, and enable users to manage data across infrastructure boundaries. The CORBEL project has three major goals:

- 1. Forge effective partnerships with user communities.**
- 2. Develop unique solutions to user needs.**
- 3. Implement a portfolio of generic, shared services.**

The Common services and access models were developed via a portfolio of use cases established through open calls. Overall 53 project applications for cross-RI access were evaluated, finally allowing the realisation of 37 interdisciplinary projects (D4.3⁴, D4.4⁵). In addition the Medical Infrastructure Users Forum (MIUF) has brought together EU projects, ERA-NETS, JPIs and other stakeholders to discuss and shape service offerings for transnational health projects (D2.4⁶).

The development of scalable and harmonised solutions cross-RI have delivered a shared quality management strategy⁷, harmonised user access and project review via the ARIA system⁸ and a joint strategy for managing federated user identities for single-sign on access to computational services⁹.

CORBEL has also facilitated user access and service use by delivering a continuously updated shared resource portal¹⁰ and together with NIH Data Commons established simple guidance on data

⁴ <https://doi.org/10.5281/zenodo.3856121>

⁵ <https://doi.org/10.5281/zenodo.3856040>

⁶ <https://doi.org/10.5281/zenodo.3744803>

⁷“A framework for quality management in the biomedical research infrastructures (BMS RIs)”

<https://doi.org/10.5281/zenodo.834332>

⁸ <http://www.corbel-project.eu/open-call/apply-for-access.html>

⁹ <https://wiki.geant.org/display/AARC/CORBEL+LifeSciences+AAI>

management solutions¹¹. These recommendations are now being embedded in user projects and contribute to an “interoperability knowledge hub”¹² that enables users to manage data across domain boundaries. Our recommendations are used by third parties, e.g. ERC data management guidelines¹³ as well as in the recently published EC guidelines for COVID-19 research¹⁴.

Good infrastructure service is ultimately dependent on committed and highly trained operators and CORBEL is also addressing the significant challenge of identifying, attracting and training staff. The project has developed a common competency framework for RI operators, with a particular focus on distributed research infrastructures and mapped the available training courses and e-learning resources in on-course to this framework. CORBEL has also provided a staff-exchange programme and a service focused training programme.

Description of work

The strategy for long-term sustainability of the CORBEL assets rests on two pillars:

1. Sustainability of the tools and services developed will be secured by their adoption by the respective research infrastructures leading the development of the asset in the project
2. Long-term strategic collaboration between the research infrastructures is formalised through the established Life Science RI strategy board

The CORBEL project has also delivered important intangible assets in the form of deepened understanding of RI capabilities, user access models and operating requirements between the infrastructures. These intangible assets can only be sustained through continued collaboration and joint user access. Thus, an important part of the long-term sustainability of RI interconnectedness is user access programmes. The LS RI are, and will continue to, constructively engage with funders to demonstrate the impact and benefit of such programmes to European science¹⁵.

Long term sustainability of individual CORBEL assets tools and services

The CORBEL project was preceded by a previous “cluster project”, BioMedBridges (2011-2015). In BioMedBridges a methodology for sustainability was developed where the partners established a common asset inventory across work packages; the assets were reviewed by the Executive Board and the sustainability of the tools and services developed was secured by their adoption by the research infrastructures involved in the project.

Broadly, the same methodology was adopted in CORBEL. However, it is important to note that a range of factors contribute to the sustainability of tools and services in general, including:

- Embedding of tools/services into the respective communities (including open source development from the beginning, early engagement and training of users and developers)

¹⁰ <http://www.corbel-project.eu/services.html>

¹¹ <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2001414>

¹² <https://www.elixir-europe.org/platforms/interoperability>

¹³ https://erc.europa.eu/sites/default/files/document/file/ERC_info_document-Open_Research_Data_and_Data_Management_Plans.pdf

¹⁴ https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/oa-pilot/h2020-guidelines-oa-covid-19_en.pdf

¹⁵ see e.g. <https://lifescience-ri.eu/home.html>

- Development and promotion of best practice
- Recognition mechanisms for software/tool development as well as maintenance
- Addressing formal requirements such as those related to licensing for data and/or software, or sharing of sensitive data.

In addition, during CORBEL the European Open Science Cloud¹⁶ (EOSC) was launched with the long-term goal of reshaping the European research data landscape as part of the Digital Single Market for Research¹⁷. Recognising these factors the LS RI have adopted a broader approach where partnerships and inclusion in EOSC projects were continuously sought during CORBEL. For instance, LS RI engaged in EOSCpilot to continue to develop access requirements for sensitive data and the “EOSC Dataset Minimal Information model” (EDMI) and in EOSC-Hub for development of cloud and portal access. However, the EOSC-Life project (eosc-life.eu) is the most important of these projects: the key data related assets and outcomes from CORBEL were prioritised by the LS RI strategy board in the development of EOSC-Life and are taken forward by this project (see Table 1).

LS RI Strategy Board (formerly BMS RI Strategy Board)

In 2014 the LS RI (at that point referred to as the BMS RI) - a body for long-term strategic collaboration - formed through a mutual Memorandum of understanding (MoU). The BMS RI Strategy Board (now Life Science RI strategy board, LS RI Strategy Board), comprising the research infrastructures accepted within the Food and Health Domain of the ESFRI Roadmap, was formally tied to the CORBEL project as the strategic advisory group. The LS RI Strategy Board has regularly met under the auspices of CORBEL, including the CORBEL planning retreats and AGMs. The LS RI Strategy Board continues in a similar role for the EOSC-Life project to ascertain alignment of individual RI plans with the development of this life science cluster project.

The LS RI strategy board has had an important role for the long-term sustainability strategy of CORBEL assets: for instance, the common quality management framework (Appendix 1) was initiated at the request of the LS RI Strategy Board and the LS RI Strategy Board formally adopted the policy for publication. Similarly, the development of bilateral service agreements (Appendix 1) has been monitored by the group. The LS RI strategy Board has also requested and accepted the common LS RI branding and website¹⁸.

Summary of assets

The assets developed by the different work packages are listed in the table in Appendix 1.

Conclusion

In summary the CORBEL partners have established an inventory of assets produced during the project, secured the adoption and development of individual sustainability plans for each asset and jointly prioritised developed assets for further collaborative development through the EOSC-Life project. The LS RI Strategy Board has worked well as a mechanism for joint planning and will continue in this role during the EOSC-Life project.

¹⁶ <https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

¹⁷ <https://ec.europa.eu/digital-single-market/en/policies/shaping-digital-single-market>

¹⁸ <https://lifescience-ri.eu/home.html>

Ultimately the long-term sustainability of research infrastructure services depends on the usage and impact of the services in our user communities. Effectively engaging with users and communicating access opportunities is fundamental to the sustainability strategy and the continued development and update of our joint LS RI website¹⁹ () is thus a core component of the joint RI work after CORBEL. The LS RI website was formally launched at the final CORBEL AGM (1 March 2020) and have since then been used to communicate e.g. individual and joint RI actions to support research into the COVID-19 pandemic and upcoming events. The website also hosts our joint catalogue of services to support users in developing research project plans.

The CORBEL project has effectively demonstrated that the transnational access calls for projects to access combinations of research infrastructure services have been very effective in opening up RI services to new user communities (see D2.4²⁰). Remarkably, several user projects presenting at the final CORBEL AGM stated that they would not have discovered and accessed RI services outside their core domain without the interdisciplinary CORBEL calls. A second important conclusion from CORBEL is that central RI project management support is critical for users to access the advanced facilities across disciplines. Thus, CORBEL has fulfilled the ambition to develop the joint access to services, tools and data management required by cutting-edge European research projects: collectively the LS RIs established a sustained foundation of collaborative scientific services for biomedical research in Europe. CORBEL has demonstrated the opportunities provided by embedding the combined infrastructure capabilities into the scientific workflow of advanced users. Thus, continued collaboration to provide and seek mechanisms to expand on the joint service pipelines is a key priority for the LS RI. The now well established LS RI Strategy Board provides a mechanism to achieve this.

Delivery and schedule

The delivery is delayed:

No

Adjustments made

None

¹⁹ <https://lifescience-ri.eu/home.html>

²⁰ <https://doi.org/10.5281/zenodo.3744803>

Appendices

Appendix 1: Assets and sustainability table

Table with detailed sustainability of major assets²¹:

WP	Asset	Partner responsible	Sustainability Plan
2, 4	LS RI Brochure	DSMZ	CORBEL brochure featuring the services of the LS RIs; distribute at project end. Review updates under auspices of LS RI strategy board, fund possible update through RI budgets as appropriate
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 . Review updates under auspices of LS RI strategy board, fund possible update through RI budgets as appropriate
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 Helpdesk. The videos will feature CORBEL but the topics will reach beyond the end of the project in order to continue to be used by the member RIs. Review updates under auspices of LS RI strategy board, fund possible update through RI budgets as appropriate
2, 3, 4, 8	Common website for the Life Science RIs	DSMZ, BBMRI, EuBI, MDC, ECRIN, EATRIS	Website https://lifescience-ri.eu/ initiated by DSMZ and continued and further developed by BBMRI staff during the last months of CORBEL and beyond. Input will be sought from all RIs. Certain sections from the CORBEL website such as the WP4 Open Calls and cross-RI access success stories will be transferred to the new website, as well as the WP3 service catalogue and the WP8 Innovation Helpdesk. Review updates under auspices of LS RI strategy board. BBMRI-ERIC cover website operations, fund major updates through RI budgets as appropriate.
3	Common services Med RIs	BBMRI, EATRIS, ECRIN	A long-term collaboration agreement was signed between BBMRI /EATRIS/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

²¹ Living version of the table can be found on the CORBEL Google drive here:

<https://docs.google.com/spreadsheets/d/1mst-36zL9O5o0abq02DulZlzmfGLi29d3DI2Iidv5PE/edit?usp=sharing>

			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 (https://hub.crmr.org/ozw/onezone/i#/public/harvesters/fc478eb554b192b93220246ac10cc652chf9), which will be further extended and professionalised in the EOSC-Life and EOSC-hub project.
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 http://www.comet-initiative.org.uk
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. https://www.youtube.com/watch?v=kzgLECS0wso
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 (https://bmjopen.bmj.com/content/7/12/e018647), 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 integration services	Lygature, EATRIS, ECRIN	The results of WP3.4 (Data integration and management services for image-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 (transSMART 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, INSTRUMENT, 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, INSTRUMENT, 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 Invertebrate Ontologies in OBO Foundry	EMBL-EBI and EMBRC	New community ontologies for marine organisms constructed in 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 exchange, 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. Future reviews and updates (if necessary) will be part of EOSC-Life
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 (https://idr.openmicroscopy.org) 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 or https://www.bbmri-eric.eu/services/elsi An update of the ELSI section of the BBMRI website is underway in order to ensure that all relevant ELSI information for the BMS 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 Help Desk will remain open for enquiries, staffed from the EATRIS business development desk. An EATRIS innovation email account will take 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 web site https://lifescience-ri.eu/collaborative-activities.html . 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 (https://www.corbel-project.eu/webinars.html) and a 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	<p>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 EOOSC-Life training programme (e.g. Aria, Quality Management).</p>
9	CORBEL competency framework	EMBL-EBI	<p>The CORBEL competency framework will be maintained and publicly available on the EMBL-EBI Competency mapper (https://competency.ebi.ac.uk/) webpage. The Competency Mapper is a web-based tool to support the creation and sustainable management of competency frameworks.</p>