Deliverable JIP1-4.4 Revised Sustainability Roadmap
Workpackage 4

Responsible Partner: 9-BfR
Contributing partners: All ORION partners

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ORION SUSTAINABILITY ROADMAP

Executive Summary

The ORION project aimed at establishing and strengthening inter-institutional collaboration and trans-disciplinary knowledge transfer in the area of surveillance data integration and interpretation, along the One Health (OH) objective of improving health and well-being. The question of "How can ORION project results be made available and maintainable in the long run?" was addressed early in the project. The project coordination supported the discussion within and between ORION partner organizations by developing a joint ORION Roadmap framework promoting sustainability. Implementation of specific Roadmap actions started already during the ORION project and will continue after the project ended. This document holds the final "ORION Sustainability Roadmap" that was created on the basis of the joint ORION Pilot evaluation workshop carried out in M39.

One of the main ORION project outcomes is the so-called One Health Surveillance (OHS) Codex, which is a framework supporting the implementation of the One Health paradigm in areas linked to the harmonization of OHS data. This framework was implemented as a continuously updateable online resource (https://oh-surveillance-codex.readthedocs.io). It is founded on four main principles guiding the development and implementation of future One-Health surveillance (OHS): Collaboration; Knowledge sharing; Data interoperability and Communication. Each principle represents an area, where resources to support cross-sector understanding and information exchange will help stakeholders to adopt the One Health paradigm. This structure enabled ORION partners to develop and integrate a broad spectrum of innovative solutions, resources and findings into a consistent overarching framework, including lessons learned from national pilots.

This document give recommendations for the consolidation of the OHS Codex, its components and other ORION results by EJP partners and European veterinary and public health agencies in the future. It will also contribute to the EJP Work Package 7 "Sustainability" aiming at the identification of operational means to sustain long-term research and innovation beyond the duration of the OHEJP.

1. Introduction

For the Integrative Action project ORION the sustainability challenge is relevant in all WPs and almost all tasks. For this reason, a specific project task was assigned to the ORION project coordination to support efforts related to the sustainability of project results, whether conceptual or technical. The process of developing an "ORION Sustainability Roadmap" started in year 1 of the project and resulted in a first Roadmap draft in month 18. Over the remaining course of the project, this initial draft was improved with support from all ORION partners. Finally, the joint ORION Pilot evaluation workshop in M39 was used to integrate results, feedback and end-user comments from the various national ORION pilot studies. These pilot studies supported the operationalization and implementation of ORION results and solutions on a national level and provided crucial feedback for developments still to be accomplished. The final Roadmap document gives specific recommendations on how the "ORION OHS Codex", its components and other project results can be consolidated by EJP partners and European veterinary and public health agencies in the future. This includes, in close collaboration with the overarching EJP WP5 "Science to Policy Translation" and EJP WP7 "Sustainability" strategies for knowledge transfer to responsible entities (e.g. EU reference laboratories, EFSA, ECDC) and international statutory bodies.

2. Scope

Within the ORION project the term "sustainability" refers to the ability to provide (access) and update (keep up-to-date) a specific ORION result after the project end for the short and medium term. For all ORION results, the aspect of "providing (access)" was solved by complying to the FAIR principles. The aspect of "update (keep up-to-date)" however requires in some cases dedicated commitments and resources of certain institutions, persons or active community engagement. The ORION Sustainability Roadmap addresses this aspect by describing result-specific activities planned in the "short-term", i.e. from the point of development in the ORION project until the end of the One Health EJP project, and in the "mid-term", i.e. up to 5 years after the end of ORION project. These planned actions could also be used as input for the EJP WP7 sustainability plans.

The ORION Sustainability Roadmap is result-specific. Each ORION partner identified their project outcomes that were considered worthwhile to be sustained. This assessment resulted in the following list of ORION project results:

Sciensano:
- New One Health collaborative approaches between AMR surveillance related disciplines and sectors in Belgium (WP2-Epi)

FLI:
- Inventory of surveillance systems and literature (WP2-Epi)
- Report on the Pilot study on surveillance systems for *Toxoplasma gondii* (WP2-Epi)

BfR:
- OHS Codex (WP1)
- OHEJP Glossary framework (WP1)
- OH-CRAC (WP1)
- LOD toolbox (WP3)
- Inventory of OHS methods / tools (WP2-Epi)
- Rash Model (WP2-Epi)

DTU:
- One Health Integration Idea and Inspiration Catalogue & recommendations on OH collaboration (WP2-Integration)
- Improved OH-ness of DANMAP report (WP2-integration)
- Template of OH AMR reporting (WP2-integration)
- Pilot report on how data integration can improve surveillance

SSI:
- Improved OH-ness of DANMAP report (WP2-integration)
- Improved collaboration among all agencies involved in surveillance of *Campylobacter* (WP2-NGS)
- Deepened understanding of surveillance outputs across agencies and collaboration in the process of decision making to improve surveillance based on these results (WP2-NGS)
- Evaluation of a genomic based real-time surveillance of *Campylobacter* (WP2-NGS).
- Cross-sectoral collaboration on setting up a system for routine WGS-based OH surveillance of *Campylobacter* (WP2-NGS)

PHE & APHA:
- Formalised framework for the sharing of human and non-human *Salmonella* sequencing data - Data Sharing Protocol (DSP) (WP2-Epi)
- Joint data analysis function, cooperation and knowledge sharing (WP2-Epi)

NIPH & NVI:

- One Health Sequencing for Surveillance Handbook (WP2-NGS)
- One Health NGS collaboration platform (WP2-NGS)
- *Listeria* pipeline (Github, galaxy toolshed) (WP2-NGS)

RIVM & WBVR:
- Template country map (WP2-Epi)
- Collaboration between WBVR & RIVM concerning hepatitis E surveillance, preparations for joined analysis (WP2-Epi)
- Evaluation of hepatitis E surveillance within each institute (WP2-Epi)

SVA & FOHM
- Health Surveillance Ontology (WP3)
- ExcelRDF tool (WP3)
- Improved OH-ness of Swedish Zoonosis reports (WP3)

3. Result-specific Roadmap

This section provides for each of the results listed above the envisaged actions to achieve short-term and mid-term sustainability:

Sciensano:
New One Health collaborative approaches between AMR surveillance related disciplines and sectors in Belgium

Result is described in detail in the national pilot report available at: https://onehealthejp.eu/?get_group_doc=103/1617807424-Project-Deliverables-ORION-1.pdf

The overarching aim of this study was to promote and implement One Health collaborative approaches between disciplines in Belgium with a focus at activities related to antimicrobial resistance surveillance. Based on a stakeholders analysis, the specific objectives were the following:

- to repertory all stakeholders active and respective activities in antimicrobial resistance and usage in the different sectors (human, veterinary and environment). At the moment, a beta version for evaluation on a Sharepoint is available at: https://collaboration.sciensano.be/sites/E1417/SitePages/Home.aspx (limited access to Belgian stakeholders). It is expected to create a website to make this information publicly accessible.
- to list the stakeholders' expectations
- to create an actor map

Short term action plan:
A publication describing the usefulness of stakeholder analysis for the development of future national One Health antimicrobial reports will be prepared.

Mid term action plan:
Creating a website to make the repertory all stakeholders active and respective activities in antimicrobial resistance and usage in the different sectors in Belgium accessible to all.

FLI:
Inventories of surveillance systems and literature

An inventory of surveillance systems for foodborne and zoonotic diseases in Europe, and associated literature, is publicly available at: https://shiny.fli.de/ife-apps/EJPOrion_WP2Epi/. The surveillance inventory is split into three sections: one for Public Health, one for Animal Health and one for Food and Feed Safety. A fourth section contains a literature database for

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surveillance systems in Europe and beyond. The inventory is hosted on a Shiny Web Application and has intuitive search functions to facilitate recall of required data. Data collected within the inventories, for each of the surveillance systems represented, include those related to the type of information collected within the system and those related to the structure of the system. The inventory provides a fast and effective means of understanding the data collected for zoonotic and food-borne diseases in Europe and will support future endeavors to perform surveillance for zoonotic and food-borne diseases within a One Health framework.

Short term action plan:

The EJP Matrix project will take over responsibility for the maintenance and update of the inventory, ensuring its existence and accessibility beyond the completion of the ORION project. The results of the study will be published in peer-reviewed journals. Furthermore, presentations at national and international conferences (ASM 2021, planned: ASM 2022, DACh Epidemiology 2021, SVEPM, ISVEE) will leave published and accessible records of the Inventory.

Mid term action plan:

The code underlying the Shiny Web application will be suitably modified and made publicly available. In this way, the intellectual time expended on creating this code will be sustainably available for others to benefit from.

It is also the intention to present the inventories to European international bodies responsible for health surveillance and disease control programs, such as ECDC and EFSA, who may see utility in the inventories and adopt them into their portfolios.

Report on the national pilot study on surveillance systems for *Toxoplasma gondii*

The pilot study was designed to test our ability to extract information from the inventories, the ease of entering data into the inventories, and the applicability of the inventories using *T. gondii* as the test subject. To address the objectives of the study literature databases were systematically searched for surveillance systems for *T. gondii*. The result of this literature search was used to test the inventories as well as to analyze risk factors for *T. Gondii.*

Short term action plan:

The results of the study will be published in peer-reviewed journals. Furthermore, presentations at national and international conferences (confirmed: ASM 2021, planned: ASM 2022, DACh Epidemiology 2021, SVEPM, ISVEE) will leave published and accessible records of the pilot study.

BfR:

OHS Codex

The OHS Codex has been described in detail in an open-access scientific publication (https://doi.org/10.1016/j.onehlt.2021.100233).

Short term action plan:

The OHS Codex was designed as an open community framework that was implemented as a "Read-the-docs" online document available at: https://oh-surveillance-codex.readthedocs.io/. As a community resource, the OHS Codex will continuously evolve and adapt to the needs of the OH community in the future. The instructions on how to contribute with new content are provided in the online OHS Codex document. In order to further extend and maintain the OHS Codex once the ORION project finalizes, a collaboration plan was established with the EJP MATRIX project. For this purpose, an OHS-Codex steering board has been created involving both partners from ORION and MATRIX to jointly continue working on the OHS Codex. Furthermore, the OHS Codex will be listed as an OH resource in the future Surveillance and Information Sharing Operational Tool (SISOT database) of WHO/FAO/OIE (release date

envisaged for 2021). In order to promote the use of the OHS Codex, a paper was published in the One Health journal[1].

Mid term action plan:

The long term maintenance of the OHS Codex requires continued community engagement and commitment. It is planned to integrate the OHS Codex into the list of resources that will be maintained by institutions or co-operations that the EJP WP7 "Sustainability" establishes to institutionalize One Health in Europe, e.g. the Med-Vet-Net Associations.

OHEJP Glossary framework

The One Health EJP Glossary framework is a collection of resources that promote the cross-sector communication under the One Health framework. It is integrated into the OHS Codex under the collaboration principle: https://oh-surveillance-codex.readthedocs.io/en/latest/2-the-collaboration-principle.html#ohejp-glossary

Short term action plan:

The OHEJP Glossary can be accessed via the following website https://foodrisklabs.bfr.bund.de/ohejp-glossary/ and will be maintained by the EJP MATRIX project and by BfR. This includes also the maintenance of administrative software solutions generated with the KNIME Analytics Platform. These KNIME workflows specifically support glossary content editors and curators. Furthermore, an article describing the OHEJP Glossary development and the results achieved has also been published[2]. An additional paper about the technical infrastructure will be prepared. Another KNIME based solution in the framework is the "Glossaryfication Web Service" : (https://knime.bfr.berlin/knime/webportal/space/EJP_ORION/TextProcessingTechnology/Glossaryfication-Service). A publication describing its development process and technical specifications has been submitted to a peer reviewed journal and was presented at the ASM Satellite Workshop 2021.

Mid term action plan:

It is planned to maintain the OHEJP Glossary framework with internal resources from BfR.

OH-CRAC

The One Health Consensus Report Annotation Checklist (OH-CRAC) has been described in detail here: https://oh-surveillance-codex.readthedocs.io/en/latest/5-the-dissemination-principle.html#one-health-consensus-report-annotation-checklist-oh-crac

Short term action plan:

OH-CRAC is intergrated into the OHS-Codex and is further available as an online tool under the RIGOR platform (https://aflex.vrac.iastate.edu/checklist/?t=OH-CRAC). This service is hosted by the Iowa State University and maintained by its Virtual Reality Applications Center. A manuscript with a detailed description of OH-CRAC and its application scenarios will be published in a peer-reviewed journal. As part of the EJP MATRIX project the OH-CRAC idea will be further promoted to the relevant German or international agencies, e.g. the German Federal Office of Consumer Protection and Food Safety (BVL), EFSA and ECDC.

Mid term action plan:

It is planned to maintain OH-CRAC as part of future international initiatives and projects that promote data standardization and harmonized information exchange formats. It will also be

1 Filter et al. (2021). One Health Surveillance Codex: promoting the adoption of One Health solutions within and across European countries. One Health, 12, 100233. doi:https://doi.org/10.1016/j.onehlt.2021.100233
2 Buschhardt et al. (2021). A one health glossary to support communication and information exchange between the human health, animal health and food safety sectors. One Health, 13, 100263. doi:https://doi.org/10.1016/j.onehlt.2021.100263

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promoted as a resources that can be maintained by institutions or co-operations that the EJP WP7 "Sustainability" establishes to institutionalize One Health in Europe.

LOD toolbox

The One Health Linked Open Data (LOD) toolbox is a collection of resources supporting the adoption of the Health Surveillance Ontology (HSO) for linked data generation. All tools demonstrate relevant application scenarios of HSO in the context of One Health Surveillance data: https://foodrisklabs.bfr.bund.de/one-health-linked-data-toolbox/
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Short term action plan:

The LOD toolbox will be further developed and promoted in BfR internal research projects and in international collaborations and projects, e.g. the RAKIP Initiative, the EJP MATRIX project. It was presented at ASM2021 Satellite Software Fair and a publication is in preparation. The KNIME workflows and web services will be integrated into the OHS Codex.

Mid term action plan:

It is planned to integrate the knowledge on automatized LOD generation and usage into the BfR-internal research data management concept. It is also planned to continuously promote the adoption of the LOD idea in future collaborations and projects with international stakeholders like EFSA.

Inventory of statistical methods for surveillance / tools

Surveillance and monitoring systems require dedicated statistical methods for planning and for analysis of data collected during surveillance or monitoring. An online database was set up, which provides the following information for the those methods: a serial identification number, the name of the method, the short description of the method, the type of the method (web page, R package, software tool), the focus the method covers,
a link to the method (if available), further literature and original publications, and example applications (if available).
The database information name, short description, and main purpose are used to assign one or more relevant statistical methods to a specific question. The view can be narrowed down by filtering the columns (e.g., by entering "exposure assessment" in the search mask under the main purpose column).
The worked-out examples in R make it easy to get started with the analysis. The provided R scripts can be downloaded and executed locally (this requires local installation of R and execution in the development environment in RStudio if it is an R package). The individual analysis steps can be followed using the application examples, which creates a better understanding of the process. In addition, the scripts can serve as a template for independent analyses with one's own data, thus relieving the user of a lot of paperwork.
A comparison of the user's own processing status with the linked literature deepens the understanding of the method, checks the correctness of the individual analysis steps, and provides an insight into the critical discussion of the method in the statistical literature. In addition, the user receives information on how the method is presented in scientific journals and what information needs to be compiled and presented. The database is a "living document" that is continuously being expanded.

Short term action plan:

It is planned to publish the results in peer reviewed journals and on national and international conferences.

Mid term action plan:

The database itself was implemented with a Shiny Web app, which was developed by the partner FLI. Until the application is taken over by the BfR, the information provided by the FLI on the medium-term availability of the software applies.

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The database software will be used by BfR itself to continue its content, the method collection of statistical procedures of monitoring and surveillance. This ensures the maintenance of the database beyond the end of the project.

Furthermore, contact can be made from outside the BfR to the database operators in order to have methods entered. The contact addresses are stored in the data management plan (DMP) of the ORION project and will be updated if necessary. The FAIR principles will be followed. These activities are guaranteed for the short and medium term.

Rasch Model

Within WP2-Epi (WP2-T3-ST5) we aimed at developing a tool to quantify the extent to which actors follow OH ideas in zoonosis control, i.e. to quantify the OH-ness of their approaches. The Rasch model belongs to the class of latent trait models that investigate how to quantify underlying latent variables using observable categorical data (the so-called items).Here, we are concerned with the One Health idea, specifically the extent to which actors involved in zoonotic disease control, for example, follow this idea. The quantification is important because it will be shown that by applying the One Health approach one achieves better results in the prevention, detection and control of zoonoses. The quantification needs the chosen specific approach because OH-ness cannot be measured directly.

Short term action plan:

The code (python) and a description of the implemented Rasch model will be available on Github.

The Rasch model will be presented at national and international conferences, a publication is in preparation.

Mid term action plan:

Will be further developed to include additional statistical procedures, as python Bayesian statistics package PyMC3 develops further. During this period the code and the manual can be requested from the developer. Contact is given in the ORION DMP.

DTU Food:
One Health Integration Idea and Inspiration Catalogue & recommendations on OH collaboration

The One Health Integration Idea and Inspiration Catalogue has been published and integrated into the OHS Codex. The publication is available here:
https://orbit.dtu.dk/files/183620811/Rapport_One_Health_Integration_in_Surveillance.pdf

Short- and mid-term action plan:
No further actions needed.

Improved OH-ness of DANMAP report

The newly designded DANMAP reports were published and are available at: www.danmap.org
A report on the national pilot project contributing to the improved OH-ness of the DANMAP report was published in the WP2-Integration deliverable available from the EJP Zenodo portal:
https://zenodo.org/communities/ohejp

Short- and mid-term action plan:
No further actions needed.

Template of OH AMR reporting

The template of OH AMR reporting has been included into the OHS-Codex (https://oh-surveillance-codex.readthedocs.io/en/latest/5-the-dissemination-principle.html#national-ohs-report-templates)

Short- and mid-term action plan:
No further actions needed.

Data integration to add value to surveillance

The report on a national pilot how cross-sector data integration can improve surveillance has been integrated into the WP2-Integration deliverable available from the EJP Zenodo portal: https://zenodo.org/communities/ohejp

Short term action plan:
A peer-reviewed publication is in preparation.

Mid term action plan:
The implementation of the developed solutions into the National Action Plan for *Campylobacter* in Denmark will be promoted.

SSI:
Improved OH-ness of DANMAP report

Published and available at: www.danmap.org
The national pilot project report includes further details.

Short- and mid-term action plan:
No further actions needed.

Improved collaboration among all agencies involved in surveillance of *Campylobacter*

Short term action plan:
Campylobacter action group set up with participation from SSI.
Meetings with regular intervals with presentation of results and decision making.

Deepened understanding of surveillance outputs across agencies and collaborate in the process of decision making to improve surveillance based on these results

Short- and mid-term action plan:
Results from real-time surveillance will be shared regularly. A seminar was conducted with participation from all stakeholders: Control of *Campylobacter* in broilers - knowledge sharing between industry, universities and agencies.

Evaluation of a genomics based real-time surveillance of *Campylobacter*

All sequences are publically available from Data published in peer-reviewed journals (Joensen et al. 2020. Whole-genome sequencing to detect numerous *Campylobacter jejuni* outbreaks and match patient isolates to sources, Denmark, 2015-2017. Emerging Infectious Diseases Vol. 26 (3). Joensen et al. 2021. Whole Genome Sequencing Data Used for Surveillance of *Campylobacter* infections in Denmark, 2019: Detection of a large Continuous Outbreak. published in Eurosurveillance).

Short- and mid-term action plan:
No further actions needed.

Cross-sectoral collaboration on setting up a system for routine WGS-based OH surveillance of *Campylobacter*

Short term action plan:

A new normal has developed during ORION and there is continued and ongoing "real-time" comparison of sequences between sectors.

A new shared WGS data analysis platform is in the process of being set-up.

A new research project in collaboration with the major chicken abattoirs on using WGS to examine the diversity and transmission within/between chicken flocks, farms, etc. will be carried out (national funding)

PHE & APHA:

Formalised framework for the sharing of human and non-human *Salmonella* sequencing data - Data Sharing Protocol (DSP) AND Joint data analysis function, cooperation and knowledge sharing

Short-term action plan:

Finalisation of data sharing agreements and core operational documents with Data & Information Governance Units in both agencies.

Sign-up of APHA and PHE to formal data sharing Memorandum of Understanding (MoU) reflecting the processes included in the Data Sharing Protocol (DSP).

Mid-term action plan:

Sharing of *Salmonella* sequence data and isolate metadata will continue on a routine basis as described in the MOU and DSP developed within the ORION project, and annual review of the DSP (as part of cross-agency working group terms of reference; see below) to ensure that it continues to be fit-for-purpose.

Collaboration between PHE and APHA will continue, in particular to address knowledge sharing around genomic epidemiology, modelling and best approach to joint data analysis.

A framework will be established for cross agency working groups, with production and agreement on e.g. terms of reference, scope, membership, meeting schedules (to be at a specified frequency on an annual basis), etc.

National food safety authorities will be directly involved in the assessment and response to surveillance data outputs on a formalised structured basis. Details of this approach will be agreed by an expert multi-disciplinary working group involving experts from the animal health, public health, food safety and environmental health domains and documented in a separate protocol specific to risk management actions arising from joint human/ non-human sequencing data sharing and analysis.

It is recognised that each institute has varying experience in particular data management and analysis techniques that are relevant to ongoing collaboration. The approach of designating discipline champions, as already instituted in APHA, will be extended to both organisations to facilitate transfer of domain expertise between agencies (e.g. modelling, molecular epidemiology, bioinformatics).

The number of personnel involved in data sharing within each agency will be increased to ensure that the data sharing processes and networks are resilient to organisational change. Formal guidance (e.g. standard operating procedure and/or desk instructions) will be produced for the relevant agency quality assurance frameworks and logging systems (for internal audit purposes).

Data surveillance outputs and reports provided to cross agency expert working groups and risk assessment bodies are currently based on phenotypic surveillance data only. The approach to production of these outputs will be enhanced with additional genomic based analysis to give a more contextual and robust interpretation where possible. The outputs will

incorporate the surveillance data produced and jointly analysed by both agencies where appropriate and aimed at policy makers, risk assessors and risk managers.

The data sharing agreement, protocols and knowledge exchange developed for *Salmonella* will be extended to other major One Health pathogens as appropriate.

NIPH & NVI:
One Health Sequencing for Surveillance Handbook

The Sequencing for Surveillance Handbook has been established as a community updateable resource with the base text on Github, and display through ReadTheDocs. We have created and included guidelines for how others can contribute to the document. The Handbook has also been included into the OHS Codex.

Short-term action plan:
For short-term maintenance, we have reached an agreement with the BeOne project that the work on the handbook will continue in that project.

Mid-term action plan:
In the mid-range perspective we will explore if this work could form a basis for the work that is going on in PHA4GE (https://pha4ge.org/)

One Health NGS collaboration platform

We have established a platform that allows for sharing and joint analysis of NGS data. We will be continuing this work with establishing rules for further collaboration.

Short- and mid-term action plan:
This work will continue and be carried on by the institutes for the foreseeable future.

Listeria pipeline (Github, Galaxy toolshed)

We have created a listeria plugin for IRIDA. This plugin will be shared via Github and via the Galaxy toolshed.

Short- and mid-term action plan:
This will be maintained by the institutes for the foreseeable future.

RIVM & WBVR:
Template Country map

Surveillance of a disease/pathogen often includes several institutes and/or departments. Within the pilot study hepatitis E, a template was made, named Country Map, to describe and visualize institutions, projects and data flows. This template consists of a Visio-document and an Excel-document. With the Country Map the existing but also currently missing links between institutes, data sources and data streams are visualized.

Short- and mid-term action plan:
The country map can be found on Zenodo, making it open access and also available after closing the ORION project. (https://doi.org/10.5281/zenodo.4767400)

Collaboration between WBVR & RIVM concerning hepatitis E surveillance

The two Dutch participants within ORION strengthened their collaboration regarding HEV surveillance as an element of a pilot project. Several meetings have taken place, and first steps for joint analysis of human and veterinary HEV data are made.

Short- and mid-term action plan:

Both institutes have existing hepatitis E surveillance in place which will be continued. The elaboration during ORION has helped to strengthen and incorporate the collaboration within the surveillance, although the corona-pandemic has slowed it down. As soon as the capacity is back to normal, the started joined analyses will continue. The steps already taken will also help to build and strengthen contacts with other institutes in the field of *hepatitis E.*

Evaluation of hepatitis E surveillance within each institute

Both institutes evaluated their surveillance programmes leading to recommendations for improvement.

Short- and mid-term action plan:

Both institutes have existing hepatitis E surveillance in place which will be continued and recommendations for improvement from the evaluation will be incorporated.

SVA and FoHM:
Health Surveillance Ontology

The availability of the ontology in the future is assured by its hosting in two addresses considered to be permanently available: in the permanent address https://w3id.org/hso, conferred by the W3C Permanent Identifiers Community Group; and as part of the Open Biological and Biomedical Ontology (OBO) Foundry (http://www.obofoundry.org/ontology/hso.html).

The resources listed above ensure that the version of the ontology available at the time the ORION project finishes is forever available to users who have already adopted this knowledge model. In light of evolving knowledge, however, the updating and growing of the ontology will depend, and for any ontology, on the establishment of a community of users committed to its evolution. In the case of HSO, the establishment of such a community has been promoted through the following mechanisms:

1) HSO's inclusion in the OBO Foundry, which ensures that it is part of a larger community of ontology users in the biomedical field
2) HSO mapping to commonly used terminologies, such as EFSA Standard Sample Description (SSD) (https://www.efsa.europa.eu/en/data/data-standardisation)
3) Linking of HSO to complementing ontologies, such as the Genetic Epidemiology Ontology, the Ontology of Biomedical Investigations, and in particular the Animal Health Ontology, which will continue being developed within the Global Burden of Animal Diseases (https://animalhealthmetrics.org/), a large scale project.
4) The active contribution of HSO developers, during the ORION project years, into networks of ontology development such as the one supported by Livestock Data for Decisions (https://www.livestockdata.org/).

Short- and mid-term action plan:
No further actions needed

ExcelRDF tool

This tool is available in GitHub (https://github.com/RealEstateCore/ExcelRDF), meaning that users can both download the tool for use, as they can access the codes to maintain and update the tool in the future. The tool was developed in collaboration with a major project in Sweden (Real Estate Core), and the use of this tool within the Real Estate private sector will also drive the need for maintenance and update of the tool.

Short- and mid-term action plan:
No further actions needed

Improved OH-ness of Swedish Zoonosis reports

The OH-pilot carried out in Sweden established a framework for collaboration during annual production of "Surveillance of infectious diseases in animals and humans in Sweden". While the development of the framework relied on extra meetings arranged with ORION budget, the pilot resulted in the construction of a workflow that is more efficient for authors, and therefore has been fully incorporated into the participating institutions as the new *modus operandi*.

Short- and mid-term action plan:

No further actions needed