



FNS – Cloud

Food Nutrition Security

Food Nutrition Security Cloud

Deliverable 5.10

FUTURE EXPLOITATION REPORT

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1 Publishable summary

The Food and Nutrition Security Cloud (FNS Cloud) project aim was to launch a first-generation food cloud by federating existing and emerging datasets, which would solve the current fragmentation problems. To demonstrate the integration process undertaken by FNS Cloud Beneficiaries, new data and tools were generated, but also existing ones were further improved and developed throughout the 4-years' project. Those new or enhanced resources varied in their nature (e.g., training materials, videos, software and apps, data repositories, case studies, others) and are considered the main outputs of this project.

This deliverable provides an overview of all work package (WP) 5 outputs, which were developed or further enhanced as part of three different demonstrators that intended to address several distinct topics from the FNS domain, such as Agri-Food, Nutrition and Lifestyle, and Non-communicable diseases (NCDs) and the Microbiome. The Agri-Food demonstrator generated three main case studies: exploitation of the food traceability and metrology search engine for three agri-food chains, food labelling data and reformulation tools, and Total Diet Studies (TDS): risk assessment and occurrence visualisation. Two case studies were developed as part of the Nutrition and Lifestyle demonstrator, which included food intake and consumer behaviour data and dietary intake data in vulnerable populations. The third demonstrator, NCDs and the Microbiome, produced three case studies: healthy diets for healthy microbiome, tool for type-2 diabetes (T2D) and hypertension (HTN) risk assessment and personalised dietary and lifestyle feedback, and alert classification system for food-diet-drug interactions.

Additional services and tools were needed to guarantee the success of all demonstrators. Those resources were mainly developed in WPs 2 and 3 and are also considered part of the main outputs of this project (e.g., FNS Catalogues, Food matching service, FNS Cloud intake dataset assessment tool, FNS Harmony ontology). All these resources have been listed as outputs under the corresponding task they were developed for. Even though they are key for the correct functioning of the demonstrators, these tools and services can be used/accessed as standalone services and/or tools by other researchers or end users.

An exploitation plan for each output has been proposed in this document as part of the post-project exploitation activities, that seek to maintain all tools and resources available to the scientific community and public in general after the conclusion of the FNS Cloud project. Exploitation strategies were defined depending on the characteristics of each output (e.g., uptake by other project, further research, and development [R&D] to be carried out, available for further usage in research studies, others), but all of them should fulfil one requirement, which is to be findable and accessible via the FNS Cloud Catalogues.

Together with the exploitation plan, a comprehensive list of dissemination and communication (D&C) activities and the appropriate intellectual property (IP) strategy for each output have been detailed.



2 Introduction

An exploitation plan should clearly state which are the main project results and how they are going to be exploited after the end of the project. Results can be explained as “any tangible or intangible output of the project, such as data, knowledge and information whatever their form or nature, whether or not they can be protected” (EU Funds, 2021). The main goal of the exploitation plan is to make use of those results for societal, scientific, financial, or even political purposes (Antonopoulos, 2023).

The Food and Nutrition Security Cloud (FNS Cloud) project aim was to launch a first-generation food cloud by federating existing and emerging datasets, which would resolve current fragmentation problems. To demonstrate the integration process undertaken by FNS Cloud Beneficiaries, new data and tools were generated, but also existing ones were further improved and developed throughout the 4-year project. Those new or enhanced resources varied in their nature (e.g., training materials, videos, software and apps, data repositories, case studies, others) and are considered the main outputs of this project.

Those tools and resources were developed during WP4 and later they were completed and tested with end users as part of three demonstrators in WP5. The demonstrators were focused on addressing several distinct topics from the FNS domain, such as, Agri-Food, Nutrition and Lifestyle, and non-communicable diseases (NCDs) and the Microbiome. An overview of each of the demonstrators and their interactions with other WPs is shown in Figure 1.

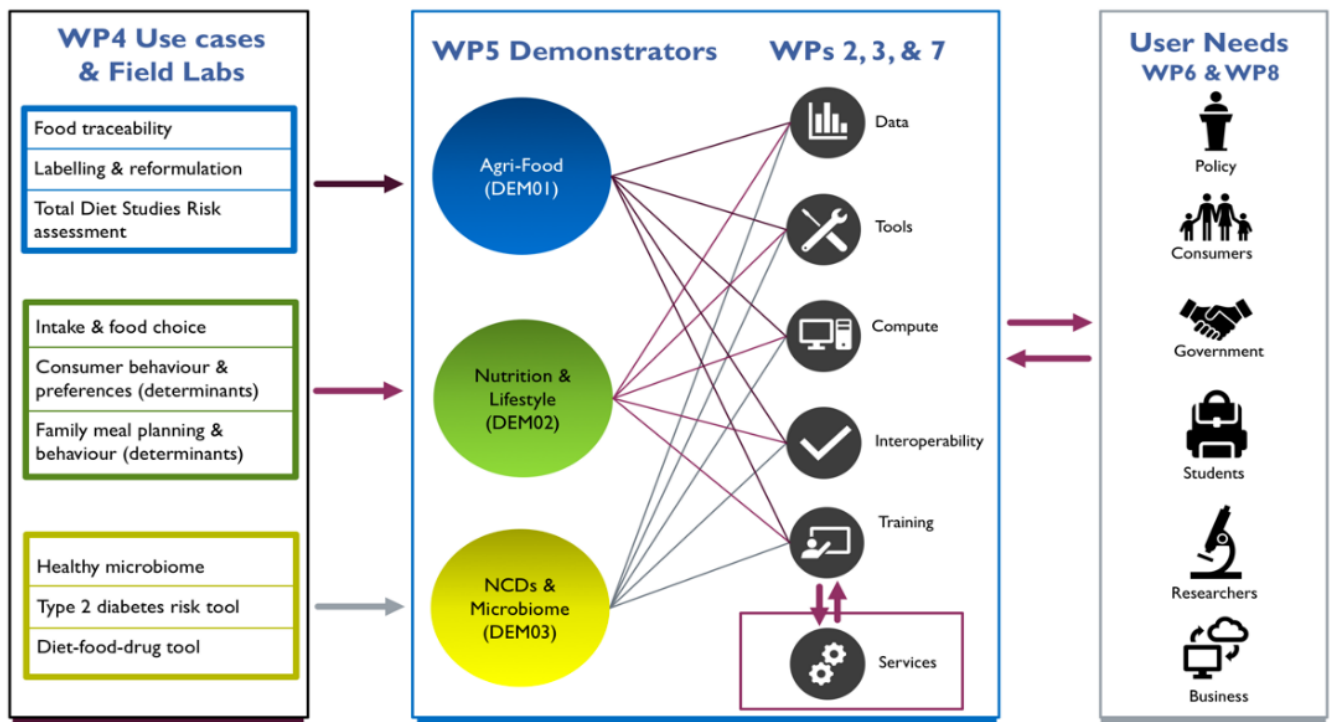


Figure 1. Schematic overview of the development work carried out in WP4 towards the implementation of the demonstrators in WP5 and the different interactions with other WPs as well as potential stakeholders.

As part of the future exploitation plan for all FNS Cloud outputs, partners were encouraged throughout the project to familiarise themselves with and apply the FAIR principles to their resources. The FAIR Guiding Principles for scientific data management and stewardship were first published in 2016 by Wilkinson, *et al.*, which provided a set of guidelines for the publication of digital resources (i.e., datasets, code, workflows, and research objects) with the aim of making them Findable, Accessible, Interoperable and Reusable (FAIR). The adoption of these principles is meant to support those who wish to enhance the reusability of their resources. As indicated by the guidelines’ authors, “the principles



apply not only to 'data' in the conventional sense, but also to the algorithms, tools, and workflows that led to that data" (Wilkinson, et al. 2016).

Keeping those guidelines in mind, partners did not only publish their work and results in several scientific papers in open access journals, but they also uploaded data and metadata to open access repositories and had multiple meetings and discussions with legal partners on how to protect their intellectual property (IP), while facilitating access to the resources to other researchers, end users, and others.

According to the World Intellectual Property Organization [WIPO] (2023), IP refers to *"creations of the mind, such as literary and artistic works; designs; and symbols, names and images used in commerce"*. In the case of Universities and Research Institutes, IP helps researchers to disseminate their knowledge and allows them to potentially use it in the economic sector. Prevention of unauthorised exploitation and compensation for the investment are some of the advantages granted to businesses, and researchers, who protect their innovations, creations, and designs by applying any of the different types of IP (e.g., patents, trademarks, designs, copyrights, or geographical indications). IP rights also offer guarantees to users or consumers (e.g., geographical indications) to identify the origin of the goods concerned (European Commission, 2023). A description of the different types of IP can be found in Appendix 1.

This deliverable presents the full list of outputs from the FNS Cloud project, according to the demonstrator in which they were developed and provides details of how these resources will be exploited post-project, which are the IP strategies chosen for each case and how these results will continue to be disseminated after the conclusion of FNS Cloud. IP protection strategies and post-exploitation plans have been developed together with the demonstrators' partners and WP8 partners. All scientific publications derived from the demonstrators have been/will be made available via open access (OA) repositories (i.e., Zenodo) including their data and metadata. Tools and software will be protected by Copyrights – License – (e.g., Apache 2.0).



3 Demonstrators

3.1 Agri-food demonstrator (5.2)

3.1.1 Exploitation of the food traceability and metrology search engine for three agri-food chains (Task 5.2.1)

The Traceability Search Engine concept was developed as part of the work carried out in WP4, and it was explained in D4.1 as well as in an open access publication (Palocci *et al.*, 2022). The developed model included the examination of three specific food supply chains (olive oil, milk, and fishery products) with the aim of collecting, integrating, organising, and making available data related to each step of those food chains. For every step of each chain, parameters of interest (data) and parameters of influence (metadata) – related to nutritional quality, food safety, transparency, and authenticity – were identified together with their monitoring systems (Palocci *et al.*, 2022). The metrology search engine was developed by using several datasets containing relevant information for those food chains. A list of the different datasets used to support this tool is available in Appendix 2 and a diagram showing how the search engine uses those datasets together with the parameters of Interest as part of the FNS Catalogues is shown in Figure 2.

Usability testing of the traceability and metrology search engine pilot version and its improvement were done as part of the WP5 activities and reported in D5.2. The engine developed allows a graphical representation of the entire food supply chain and the possibility to carry out different types of searches, all while following the FAIR approach.

As part of the future options to exploit this tool, partners are assessing different options including integration with other datasets, coupling with tools developed in other projects and initiatives, like FoodExplorer from EuroFIR, FoodCASE developed by PMT and FoodTrack developed by JSI. In the case of milk, the possibility to integrate the search engine with the software for the somatic cell counting calculation model is under evaluation. The tool will be taken forward into the Metrofood RI for further development and testing (led by ENEA). The details related to the exploitation plan for this tool are shown in table 1.

Additional information about this task can be found here: <https://www.fns-cloud.eu/demonstrators/food-chains-traceability/>

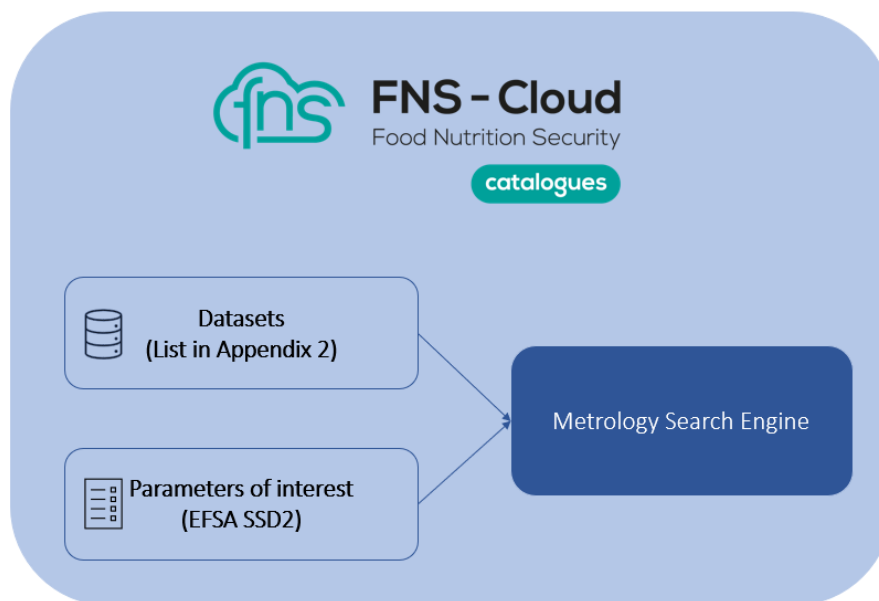


Figure 2. Metrology search engine diagram.



Table 1. Exploitation plan for the traceability search engine

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.2.1	Food traceability and metrology search engine	Food traceability search engine	Software/app	9	ENEA, PMT*	Tutorial	Copyright – License (to be agreed by September, M48)	Food traceability and metrology search engine will be taken over in METROFOOD-RI	METROFOOD-RI must define what will be taken over, then we can define the costs
5.2.1	Food traceability and metrology search engine	Food chain flow information	Know how	NA	ENEA* , other partners	OA publications, talks	Copyright – License (to be agreed by September, M48)	Further development – filling gaps for food chains in METROFOOD-RI and other EU projects coordinated by CREA	NA

*IP owner(s)



3.1.2 Food labelling data and reformulation tools (Task 5.2.2)

This task was focused on compiling a branded food composition dataset from existing European datasets (SI, CH, NL, DE), and collecting two new branded food datasets (SI) using two different approaches. Methodology on compilation and collection of those datasets was explained in D4.2.

Several use cases were developed as part of the WP5 activities, in which three datasets generated in WP4 were used to showcase how they can be useful to answer different research questions. D5.3 described two case studies: Country-to-country comparison, and use of food labelling data for estimation of nutritional composition of branded foods. D5.4 addressed how to exploit branded food datasets collected in Slovenia for monitoring food reformulation (case studies focused on monitoring content of sugars and sweeteners in beverages and content of sodium in foods in the supply chain), and how to support external service providers (case study on branded foods labelling data for supporting external service providers). So far, results from these use cases have been published as research papers¹ in open access journals and have been uploaded to an open repository (Zenodo, <https://zenodo.org/>). Two more publications on the country-to-country comparison and the sodium reformulation use cases are currently being prepared and are expected to be published before the end of the project. The data will be uploaded to appropriate online open repositories.

This task generated a lot of 'know-how' and best practices around the collection of branded food datasets and its use, application, and relevance for different stakeholders, like researchers, consumers, policy makers, food industry, clinical practitioners, app developers, others. Main outputs and the exploitation plan for each of them are detailed in table 2.

A dedicated page for this task has been created in the FNS Cloud website to disseminate its results with the public and other researchers. It can be accessed here: <https://www.fns-cloud.eu/demonstrators/food-labelling-reformulation/>

¹Hafner, E., & Pravst, I. (2021). **The Sharp Rise in the Use of Low- and No-Calorie Sweeteners in Non-Alcoholic Beverages in Slovenia: An Update Based on 2020 Data.** *Front. Nutr.* 8:778178. doi: 10.3389/fnut.2021.778178

Hafner, E., & Pravst, I. (2021). **Evaluation of the Ability of Nutri-Score to Discriminate the Nutritional Quality of Prepacked Foods Using a Sale-Weighting Approach.** *Foods*, 10(8), 1689. doi:10.3390/foods10081689

Pravst, I., Hribar, M., Žmitek, K., Koroušič Seljak, B., Kušar, A. (2022). **Branded Foods Databases as a Tool to Support Nutrition Research and Monitoring of the Food Supply: Insights from the Slovenian Composition and Labelling Information System.** *Front. Nutr.* 8:798576. doi:10.3389/fnut.2021.798576

Hafner, E., Lavriša, Ž., Hribar, M., Krušič, S., Kušar, A., Žmitek, K., Skrt, M., Poklar Ulrih, N. and Pravst, I. (2022). **Verifying the Use of Food Labelling Data for Compiling Branded Food Databases: A Case Study of Sugars in Beverages.** *Front. Nutr.* 9:794468. doi: 10.3389/fnut.2022.794468



Table 2. Exploitation plan for food labelling data and reformulation tools

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.2.2	Food labelling and Reformulation	Branded food composition/ labelling dataset	Data	NA	NUTRIS, RIVM	Scientific publication in Zenodo, talks (EFFoST Dublin & FENS Belgrade)	Sui generis database right	Usage in further research coordinated by Nutris; Available via FNS-Catalogues	NA
5.2.2	Food labelling and Reformulation	Video about branded food datasets	Video	NA	NUTRIS, UWTS*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA
5.2.2	Food labelling and Reformulation	Video about data collection approaches	Video	NA	NUTRIS, UWTS*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA
5.2.2	Reformulation	Monitoring content of sugars and sweeteners in beverages	Database; Know how; Best practice	NA	NUTRIS*	Scientific publication in Zenodo, talks (EFFoST Dublin & FENS Belgrade)	Sui generis database right	Usage in further research coordinated by Nutris	NA
5.2.2	Reformulation	Monitoring content of sodium in foods in the food supply	Database; Know how; Best practice	NA	NUTRIS*	Scientific publication in Zenodo, talks (EFFoST Dublin & FENS Belgrade)	Sui generis database right	Usage in further research coordinated by Nutris	NA
5.2.2	Reformulation	Video about efficient conduction of food supply monitoring in food stores	Video	NA	NUTRIS, UWTS*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.2.2	Food labelling	Use of food labelling data for estimation of nutritional composition of branded foods dataset – country to country comparison	Best practice; Know how	NA	NUTRIS, RIVM, PMT, JSI	Scientific publication in Zenodo, talks (EFFoST Dublin & FENS Belgrade)	Copyright	Usage in further research coordinated by Nutris; Available via FNS-Catalogues	NA
5.2.2	Food labelling	JSI tool for parsing, cleaning, and matching of ingredients to foods with a known nutrient composition**	Software/app	7	JSI*, NUTRIS	Publications, talks, user manual Source codes on Github	Copyright – License (to be agreed by September, M48)	Terms and conditions for further use and validation coordinated by JSI	To be agreed by JSI and to be reported by M48 in D8.4.
5.2.2	Food labelling and text information	FoodCASE data management system***	Software/app	9	PMT*	Talks, user manual	Copyright – License (to be agreed by September, M48)	Further R&D to establish an online branded food database platform / EU projects coordinated by PMT/EuroFIR	FoodCase is currently used by FCDB compilers via a membership scheme with EuroFIR.

*IP owner(s)

**Developed and tested in WP3

***Capabilities explored for branded food data in WP2



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

3.1.3 Total Diet Studies: risk assessment and occurrence visualisation (Task 5.2.3)

The Monte Carlo Risk Assessment (MCRA) tool and the FoodMagnifier app aimed to develop e-services to enable scientific users (e.g., researchers, risk assessors and total diet study [TDS] experts) and non-scientific users (e.g., interested consumers, non-TDS professionals like risk managers) to evaluate and visualise chemical food safety data.

The use of the MCRA tool allows high-end users to use TDS or monitoring data for higher-tier and more complex risk assessments analyses. The new implementations depict the structure of TDS samplings and consider applied stratification strategies, such as regional or seasonal considerations. The tools and services generated as part of this task were implemented and tested in WP4 (see D4.4 for further details) and then further improved and evaluated during WP5 (work was reported in D5.9). The main exploitation outputs from this task are presented in table 3.

The FoodMagnifier online app developed by BfR/PMT during the FNS Cloud project, allows non-scientific users (e.g., interested consumers or risk managers) to use occurrence data from the German pilot TDS to make conscious and informed decisions around food daily, e.g., food purchasing and food choice or to use the tool to get a user-friendly overview about the substance of interest in foods. A diagram showing the connection between FoodMagnifier online app, the FNS Cloud Catalogues and the background dataset is presented in Figure 3.

For more information about this task, a page in the FNS Cloud website containing the most relevant information has been created. It can be accessed via this link: <https://www.fns-cloud.eu/demonstrators/total-diet-studies/>

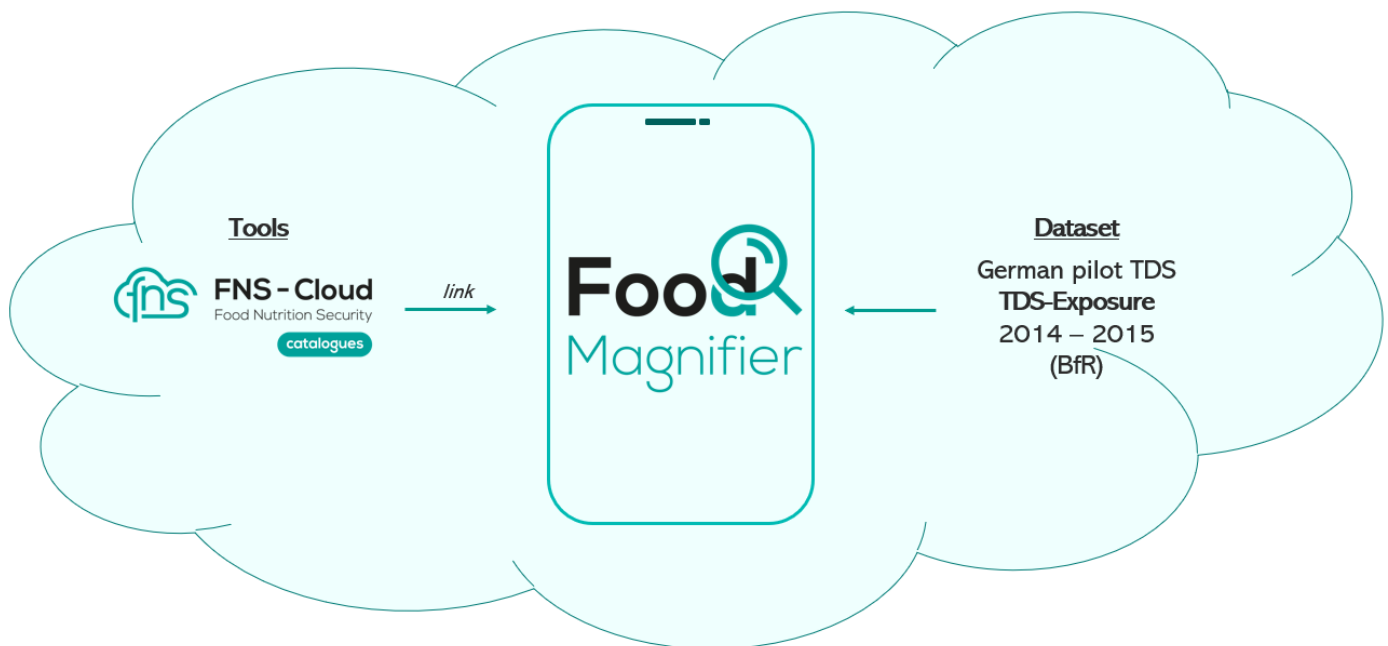


Figure 3. Depiction of the different elements (i.e., tools and datasets) used by the Food Magnifier app.

Table 3. Exploitation plan for MCRA and TDS tools

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.2.3	MCRA exposure assessment accessible via AZURE Cloud	Probabilistic risk assessment using data of TDS studies from three different countries (DE, BE and NL).	Case study	NA	RIVM, BfR, Ugent*	Videos, user manual, reference manual, professional training materials	Terms and conditions	Available via FNS-Catalogues / Further use by EU member states and EFSA. Source code on Github. Coordinated by RIVM.	To be agreed by RIVM and to be reported by M48 in D8.4.
5.2.3	MCRA exposure assessment	FoodExplorer – API	Software/app	6	EuroFIR*, Capnutra	Case study example, user manual	Copyright – License (to be agreed by the end of September, M48)	Available via FNS-Catalogues / Further testing with MCRA testing tool by RIVM/EuroFIR.	To be agreed by EuroFIR/Capnutra and to be reported by M48 in D8.4.
5.2.3	Low-end user app	Food Magnifier	Software/app	9	BfR, PMT*	In-app support (help buttons) user-manual, instruction for data provider	Copyright – License (to be agreed by the end of September, M48)	Availability via FNSCloud Catalogues and by the end of the project at www.FoodMagnifier.eu . Post-project R&D efforts planned depend on further projects. PMT will maintain the app in its current form (without adding new data) with email address as contact.	App will be free of charge. Maintenance by PMT (~6471 EUR/year). Further R&D planned according to raised funds in the future.
5.2.3	Low-end user app	Food Magnifier	Data	NA	BfR*, PMT	In-app support (help buttons) user-manual, instruction for data provider	Sui generis database right	Availability via FNS Cloud Catalogues and by end of the project at www.FoodMagnifier.eu .	NA

*IP owner(s)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

3.2 Nutrition and lifestyle demonstrator (5.3)

The nutrition and lifestyle data demonstrator focused on addressing the following two topics: dietary intake and consumer behaviour data in diverse ethnic and vulnerable populations. Previous work done for this task, under WP4, included the development of a quality assessment framework for FNS Cloud (described in D4.6) and several novel digital tools to collect dietary intake data (see D4.7 for details).

DEM02's main aim was to combine work done in other WPs (e.g., Cloud development in WP2, service development in WP3 and generation of tools and datasets in WP4) to showcase how researchers can access and interact with FNS Cloud resources to answer research questions. Main results from this demonstrator and a detailed explanation of the work carried out to develop the researcher journey will be published in several scientific papers later this year, which will be available via open access journals.

This demonstrator was composed of two subtasks, which are presented next.

3.2.1 Food intake and consumer behaviour data (Task 5.3.1)

Under this subtask, a web based 24-hour recall tool (Foodbook 24) originally developed for Irish population living in Ireland, was adapted (see D4.7) for use in diverse population groups (i.e., Chinese, Brazilian and Polish) in Ireland. Some of the adaptations included adding additional languages and extension of the food list to include foods typically consumed by those population groups. The revamped tool underwent a three-phase testing to make sure it was capturing accurate dietary intake data on those populations (see D5.5). Appendix 3 shows how Foodbook24, and the background datasets used in this demonstrator are connected to the FNS Cloud Catalogues.

UCD is in the process of preparing five scientific papers derived from the work and results from this task. Two of those papers described Foodbook24 development, acceptability, and comparison studies. One of them is focusing on the Polish and Brazilian cohorts, while the other one is focusing on the Chinese cohort. A third paper on dataset quality assessment tool is expected to be ready by October/November 2023. The fourth paper is meant to analyse the data from this demonstrator, and the fifth paper is based on the FFQ mapping that was completed as part of WP4.

3.2.2 Dietary intake data in vulnerable populations (Task 5.3.2)

The aim of this subtask was to collect dietary intake data from a nutritionally vulnerable population composed of older adults (aged 60-65+) living in the UK and Germany using two web-based tools (UK: eNutriFFQ 65+; DE: What I eat [WIE] 60+). The tools were originally developed in previous projects and underwent a series of improvements and changes during FNS Cloud to increase ease of use by nutritionally vulnerable populations, who may have a range of experience and familiarity with technology (see D5.5). A diagram explaining how this demonstrator used eNutriFFQ 65+, What I eat 60+ and a set of background datasets to answer their research question is shown in Appendix 4.

Table 4 summarises the exploitation plan for the above-mentioned outputs and includes additional exploitable results that were developed during WP4 but were not included in this demonstrator.

Further information on these two tasks can be found here: <https://www.fns-cloud.eu/demonstrators/food-intake-and-lifestyle/>



Table 4. Exploitation plan for dietary food intake and consumer behaviour tools

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.3.1	Food intake and consumer behaviour	Diverse Ethnic groups dietary intake dataset (Dublin)	Data	NA	UCD*	Scientific publications (x5), dataset will be stored on the Irish Social Science Data Archive (ISSDA)	Sui generis database right	Usage in future research coordinated by UCD. Available via FNS Catalogues.	NA
5.3.1	Food intake and consumer behaviour	Foodbook24	Software /app	8	UCD, UCC, DCU*	Tool available on catalogues and can be further used upon request; Software published in Github, detailed SOPs for all researcher features; e-learning guides for researcher and participant users; paper on FNS development of tool	Copyright – License (to be agreed by September, M48)	Making the software available to other users – subject to T&C. Source code on Github. Coordinated by UCD.	To be agreed by UCD and to be reported by M48 in D8.4.
5.3.1	Food intake and consumer behaviour	Foodbook24 video	Video	NA	UCD, UWTSD, IFA*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA
5.3.1	Food intake and consumer behaviour	Foodbook24 training material	Training material	NA	UCD, UWTSD*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud Community of Practice	NA
5.3.1	Food intake and consumer behaviour	Dataset quality assessment tool	Software /app	7	ScaleFocus*, UCD, UoR & TUM	Software published in Github, manual, tool on FNS catalogues, academic paper on	Copyright – License (to be agreed by September, M48)	Making the software available to other users coordinated by Scalefocus/UCD	To be agreed by Scalefocus and to be reported by M48 in D8.4.



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs	
						development of the tool				
5.3.1	Food intake and consumer behaviour	Standfood matching tool	Software /app	7	JSI*, UCD	Software published in Github, manual	Copyright – License to be agreed by M48	Making the software available to other users – subject to T&C coordinated by JSI.	To be agreed by JSI and to be reported by M48 in D8.4.	
5.3.2	Dietary intake data in vulnerable populations 65+	Dietary intake (FFQ65+ dataset)	Data	NA	UoR*	Scientific publications (open access), scientific presentations	Sui generis database right	Open data access	NA	
5.3.2	Dietary intake data in vulnerable populations 65+	eNutri 65+ app	Software /app	6	UoR*	Training materials, scientific publications in OA repositories, and presentations	Copyright – License to be agreed by M48	Further R&I; exploring new use cases (e.g., teaching) and making software available to other users, subject to T&C, coordinated by UoR	UoR is seeking funding for maintenance and further development.	
5.3.2	Dietary intake data in vulnerable populations 65+	eNutri 65+ video	Video	NA	UoR, IFA*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA	
5.3.2	Dietary intake data in vulnerable populations 60+	WIE 60+ dataset	Data	NA	TUM*	Scientific publications in OA repositories, further use of the tool upon request	Sui generis database right	Open data access	NA	



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.3.2	Dietary intake data in vulnerable populations 60+	WIE 60+ app	Software /app	7	TUM*	Training materials, scientific publications in OA repositories, and presentations	Copyright – License to be agreed by M48	Further R&I coordinated by TUM; exploring new use cases (e.g., teaching) and making software available to other German speaking users, subject to T&C. Source code on Github.	To be agreed by TUM and to be reported by M48 in D8.4.
5.3.2	Dietary intake data in vulnerable populations 60+	WIE 6+ video	Video	NA	TUM, IFA*	Presentation during Final Launch Event	Copyright	Available in FNS Cloud website and social media accounts	NA
	Family meal planning and behaviour	Nutrients in 19 samples of home-grown green beans	Data	NA	Lifely	Scientific publications in Zenodo including data	Sui generis database right	Usage in future research coordinated by Lifely; available via FNS-Catalogues	NA
	Family meal planning and behaviour	Family taste dataset from testers of the family meal planning tool	Data	NA	Lifely, JSI	Scientific publications in Zenodo including data	Sui generis database right	Usage in future research coordinated by Lifely	NA
	Family meal planning and behaviour	Family meal planning app	Software /app	5	Lifely*, JSI	Manual, marketing plan	Copyright – End User License Agreement (EULA). This EULA will outline the rights and restrictions of the users, including usage, distribution, and modification limitations**	Expanding to other user markets/languages coordinated by Lifely. Available via FNS Catalogues.	5k €/year



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
	Family meal planning and behaviour	Tomappo gardening app	Software /app	9	Lifely*	Manual, marketing plan	Copyright – covered by a proprietary EULA, which allows users to use the app for personal use, but they are not allowed to modify, distribute, or reverse engineer the application**	Expanding to other user markets/languages coordinated by Lifely	NA
	Family meal planning and behaviour	Seed exchange platform	Software /app	9	Lifely*	Manual, marketing plan	Copyright – while an integral part of the Tomappo Gardening App, it falls under the same proprietary EULA as the overall app. This means that all terms governing the usage, distribution, and modification of the Tomappo app also apply to the Seed Exchange module**	Expanding to other user markets/languages coordinated by Lifely	NA

*IP owner(s)

**In terms of IP protection, these EULAs form a key part. Additionally, Lifely also employs several other measures to protect their IP, such as maintaining the confidentiality of their source code, and employing standard cybersecurity measures. They also offer a white-labelling option for the Family Meal Planning App. This allows businesses to rebrand the app while Lifely handles back-end operations. The specifics of white-label use would be governed by a separate licensing contract. This option enhances IP protection by allowing customization without granting access to the underlying source code. Lifely is also open to special licensing arrangements for research purposes. This would allow academic and/or research institutions to use their applications to perform studies, gather data and perform various analysis. The terms of this use, including data privacy and user consent, would be outlined in a separate research agreement to ensure all activities align with ethical guidelines and Lifely's IP protections.



3.3 NCDs and Microbiome demonstrator (5.4)

3.3.1 Healthy diets for healthy microbiome (Task 5.4.1)

The healthy diets for healthy microbiome demonstrator consisted of a human intervention study designed to assess whether specific components of a diet (i.e., bioactive compounds) have an impact (or not) on microbial diversity. Additionally, this demonstrator intended to develop and test methods to help researchers handle and effectively use data coming from multi-domain nutrition and microbiome research studies within FNS Cloud (see D4.8). A graphical explanation of all the tools and repositories used in this demonstrator and how they link to each other is shown in Appendix 5.

Some of the tasks undertaken in this demonstrator include:

- The enhancement of the Libro app created by Nutritics through the integration of FitBit sleep data, and the compilation and integration of bioactive data into Libro.
- Submission of data outputs to public repositories/resources for diet and microbiome studies (e.g., ENA, Mgnify, dbnp, and MetaboLights).
- Listing of all datasets in the FNS Cloud Catalogues.
- Development of tools and resources essential to showcase the demonstrator and its functionalities (e.g., Fairspace and metadata submission form).

For the Microbiome demonstration three diet and health focused research questions were selected to investigate the effect of diets on markers of health, specifically microbiome health. The research journey of answering the three research questions is presented step by step using the tools developed in DEM03 by WP3 and WP5 and can be used for future exploitation purposes. The data flow and tools used in DEM03 are depicted in Figure 4. In addition to the datasets generated in WP4, publicly available datasets, such as those generated by the NIH Integrative Human Microbiome Project (iHMP), were used for further data integration to address the research questions in a more powerful manner.

DEM03: NCDs & Microbiome - Healthy Diets for Healthy Microbiome

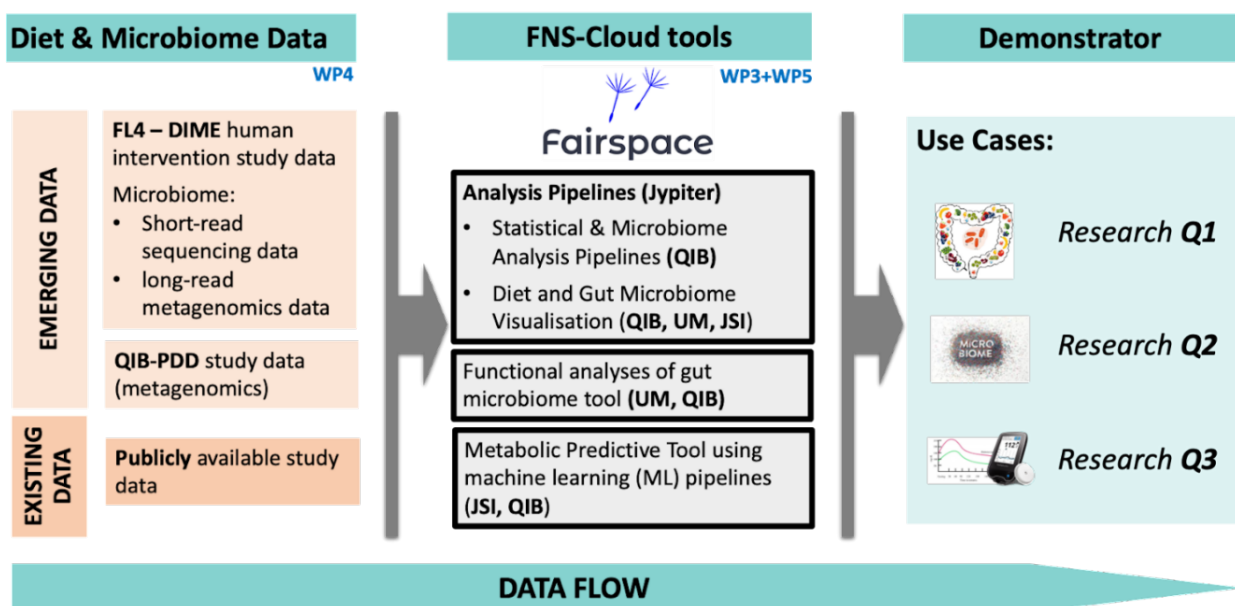


Figure 4. Overview of the data flow and tools used in the healthy diets for healthy microbiome demonstrator.



The FNS-Cloud back-end infrastructure (see Appendix 6) developed for the microbiome demonstrator was based on WP3 work (Scalefocus; see D3.5 for further technical details). With the intention of web services to easily take advantage of this infrastructure, an Application Programming Interface (API) was implemented. Using REST, Uniform Resource Identifiers (URIs) were defined for each identified collection resource stored in the back end, i.e., research project, sample, ontology, etc. Using URIs, the API complies with the FAIR principle for data i.e., findable, accessible, interoperable, and reusable.

All these datasets and resources are part of the exploitable results from this demonstrator. The exploitation plan for each one of them is listed in table 5.

The following page in the FNS Cloud website contains more information about this task: <https://www.fns-cloud.eu/demonstrators/healthy-microbiome/>



Table 5. Exploitation plan for healthy diets for healthy microbiome tools

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.4.1	Healthy diets and microbiome	DIME anthropometrics dataset	Data	NA	QIB*	OA publications and public repositories (PhenotypeDB)	Sui generis database right	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	DIME clinical biomarkers dataset	Data	NA	QIB*	OA publications and public repositories (PhenotypeDB)	Sui generis database right	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	DIME dietary intake dataset for bioactives	Data	NA	QIB*, Nutritics	OA publications and public repositories (PhenotypeDB)	Sui generis database right	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	DIME metagenomics dataset	Data	NA	QIB*	OA publications and public repositories (ENA and MGnify)	Sui generis database right	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	DIME untargeted & targeted metabolomics dataset	Data	NA	QIB*	OA publications and public repositories (MetaboLights)	Sui generis database right	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	DIME mHealth (CGM) dataset	Data	NA	QIB*	OA publications and public repositories (PhenotypeDB)	Sui generis database right	Usage in further research. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	Bioactives dataset (compositional dataset for DIME study)	Data	NA	QIB*, EuroFIR, Nutritics	OA publications and public repositories	Sui generis database right	Available via FNS-Catalogues. Use in Libro App – to be agreed with Nutritics. Further research coordinated by QIB	To be agreed by QIB and to be reported by M48 in D8.4.



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.4.1	Healthy diets and microbiome	eBasis dataset	Data	NA	EuroFIR* , QIB	Membership	License by EuroFIR membership	EuroFIR membership	Covered by EuroFIR
5.4.1	Healthy diets and microbiome	Metadata submission form	Online submission form	NA	ScaleFocus* , JSI, UF & QIB	Users' manual	Terms and conditions	Made available to other microbiome researchers coordinated by QIB/Scalefocus	To be agreed by Scalefocus and to be reported by M48 in D8.4.
5.4.1	Healthy diets and microbiome	Fairspace	Repository	7-8	The Hyve* + QIB and other partners in designing, testing and evaluation	Scientific publications in Zenodo. Users' manual – https://github.com/thehyve/fairspace	Copyright – License (Apache 2.0)	Made available to other microbiome researchers / future EU projects coordinated by QIB/The Hyve. Available via FNS-Catalogues	To be agreed by the Hyve and to be reported by M48 in D8.4.
5.4.1	Healthy diets and microbiome	Libro app	Software/app	7-8	Nutritics* , QIB	Scientific publications in Zenodo? Users' manual?	Copyright – License – (to be agreed by the end of September, M48)	Made available to other food and nutrition researchers / future EU and national projects coordinated by Nutritics/QIB. Available via FNS-Catalogues	To be covered by Nutritics
5.4.1	Healthy diets and microbiome	FNS Harmony Ontology	Know how	NA	JSI, UF*	OA publications and public repositories. Training courses. Coordinated by JSI and UF.	Copyright	Usage in further research coordinated by QIB. Available via FNS-Catalogues	NA
5.4.1	Healthy diets and microbiome	FNS Data curators	Know how	NA	JSI, UF, QIB*	OA publications and public repositories. Training courses.	Copyright	Application of know how in future projects. Training sessions for	To be agreed by UF and QIB and to be reported by M48 in D8.4.



DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
						Coordinated by UF and QIB.		current and new data curators.	

*IP owner(s)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

3.3.2 Tool for type 2 diabetes (T2D) and hypertension (HTN) risk assessment and personalised dietary and lifestyle feedback (Task 5.4.2)

The tool developed by HUA (GR) to assess type 2 diabetes (T2D) and hypertension (HTN) risk and provide personalised dietary and lifestyle feedback consists of several components such as an algorithm to assess the risk of T2D and HTN, an algorithm to provide personalised dietary and lifestyle feedback and a software/web-based app. All these components were developed as part of the WP4 tasks (see D4.10) and later were implemented and integrated into the web-based app in WP5 (see D5.6). A diagram illustrating all these components and their link to FNS Cloud Catalogues is depicted in Figure 5.

The two self-reported models for T2D and HTN risk assessment used by this tool, were generated using data derived from a European cohort of the previous EU-funded Feel4Diabetes study. A combined dataset composed of baseline data from EU-funded Food4Me and Feel4Diabetes studies was used to build the personalised feedback tool. This algorithm can identify dietary and lifestyle factors associated with obesity and central obesity (e.g., waist circumference), that together with other parameters such as age and sex, can provide personalised lifestyle recommendations (i.e., meal plans) to improve weight status.

Part of the activities carried out in WP5, included usability tests with end users (i.e., public, nutritionists, researchers) and FNS Cloud beneficiaries, as well as focus groups. Feedback was collected after each session via questionnaires and improvements based on the suggestions received on how to improve the tool were implemented. The exploitation plan for this T2D and HTN risk assessment tool is presented in table 6.

More information regarding the results from this task can be found here: <https://www.fns-cloud.eu/demonstrators/t2d-and-hypertension-risk/>

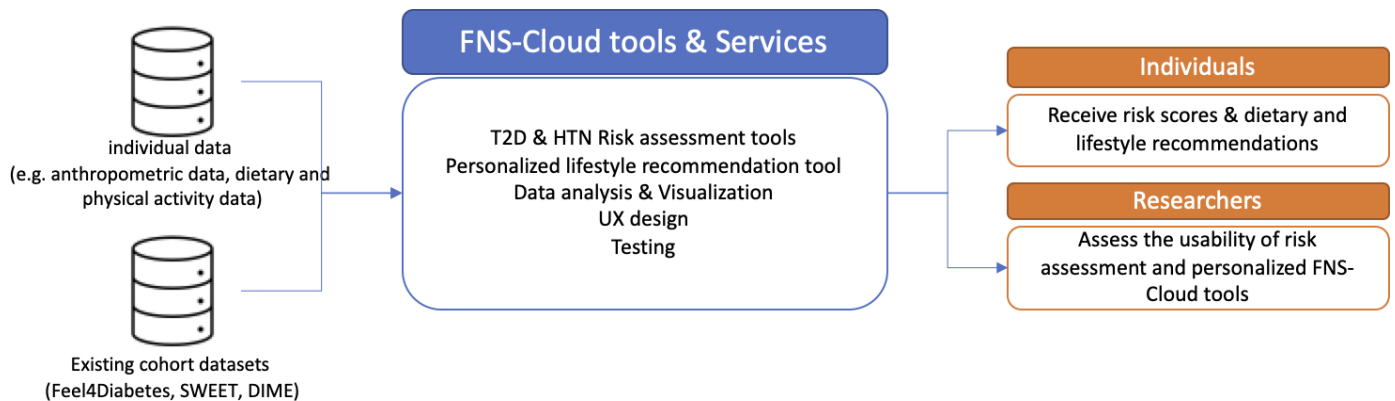


Figure 5. T2D and HTN tool components connection to FNS Cloud Catalogues diagram.



Table 6. Exploitation for T2D and HTN risk assessment and personalised dietary and lifestyle feedback tool

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.4.2	T2D and HTN risk assessment and personalised dietary and lifestyle feedback	T2D and HTN risk assessment tool	Software/app	4-5	HUA*	Software published on Github	Copyright – Licence (Apache 2.0)	Usage in further research/projects & provision as a publicly accessible service coordinated by HUA	The university will cover the hosting costs and the HUA team will commit time to maintain it for as long as there are users to use it

*IP owner(s)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

3.3.3 Alert classification system for food-diet-drug interactions (Task 5.4.3)

The main aim of this task was to create a centralised information portal for food-diet-drug interactions. To achieve that, IMDEA collaborators compiled molecular and text documents with information about food-drug interactions as part of their WP4 tasks, which resulted in the development of the FooDrug database (<http://imdeafoodcompubio.com/index.php/download/>). This database is a high-value resource to find information about food-drug interactions and it is the basis of this demonstrator (see D4.9).

The next step consisted of developing an accessible web tool for user communities interested in gathering information around food-drug interactions. During WP5 activities, the FooDrug tool was completed (<http://imdeafoodcompubio.com/>). Data stored in the FooDrug database can be accessed via an intuitive and user-friendly interface. The tool was tested among three different user communities, who would potentially be interested in exploiting and using the information displayed by the FooDrug web tool as part of their research (e.g., molecular researchers on precision nutrition and researchers interested in food transcriptomic data) and clinical practices (e.g., clinicians, nutritionists, nurses, and pharmacists). Technical development work and usability tests undertaken in WP5 are described in D5.8. A diagram depicting background databases used, tools and resources generated during the project and their connection to FNS Cloud Catalogues is shown in Figure 6.

The exploitable outputs from this task are presented in table 7 along with their exploitation plans.

The following page on the FNS Cloud website provides further details about this task: <https://www.fns-cloud.eu/demonstrators/t2d-and-hypertension-risk/>

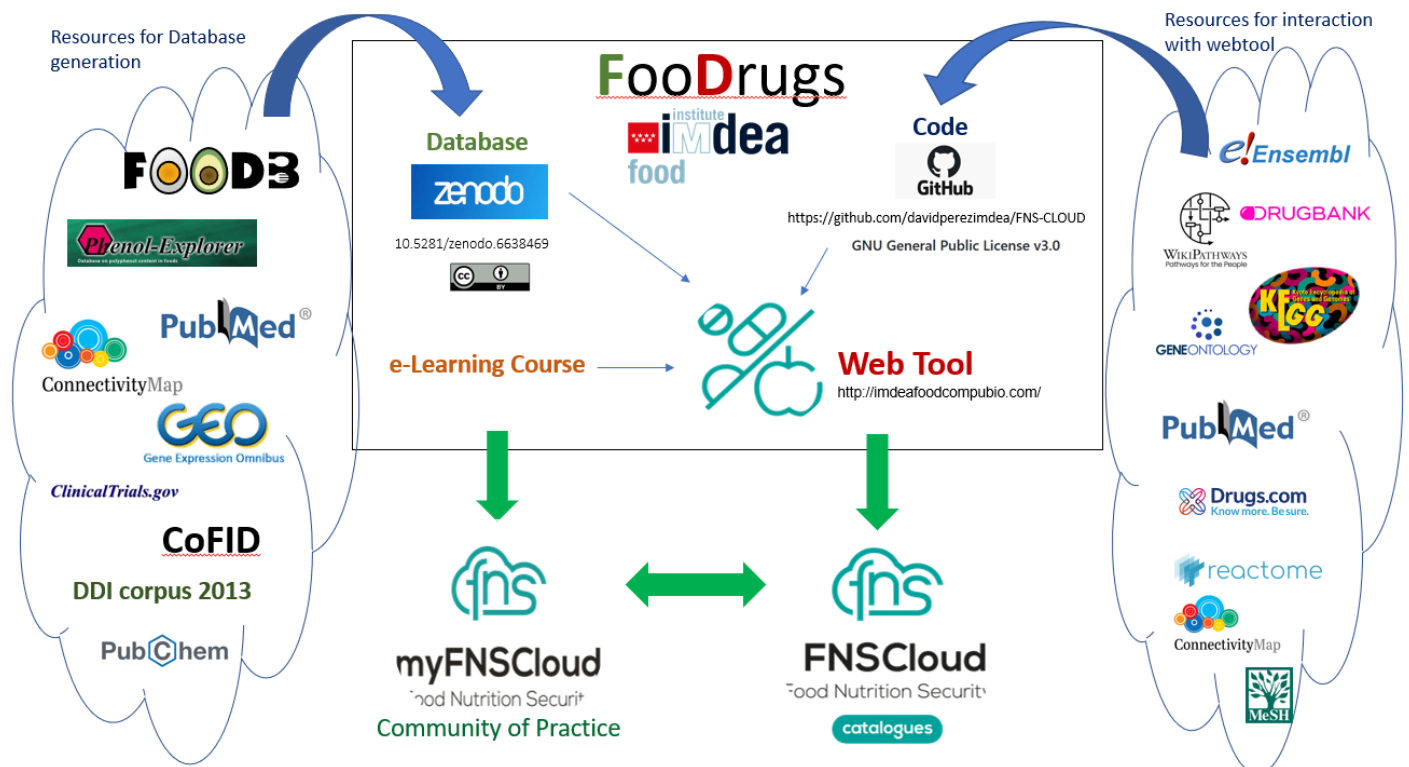


Figure 6. FoodDrugs connection to FNS Cloud Catalogues diagram.



Table 7. Exploitation plan for FooDrug tool

DEMO code	DEMO name	Name of result	Result type	TRL	Background contributions	D&C plan	IP protection strategy	Post-project exploitation plan	Future service maintenance costs
5.4.3	Alert classification system for food-diet-drug interactions	FooDrug database	Database	NA	IMDEA*	Entry on Zenodo, FNS-Catalogues. A publication in progress	Copyright – License – Creative Commons Attribution 4.0 International	Usage in further research coordinated by IMDEA. Available via FNS-Catalogues	0 € in the current version. New updates and developments will require budget (although we are trying to automate all the processes)
5.4.3	Alert classification system for food-diet-drug interactions	FooDrug code	Code	NA	IMDEA*	Published on Github. Entry on Zenodo, FNS-Catalogues	Copyright – License – GNU General Public License v3.0 only	Development of new functionalities coordinated by IMDEA. Available via FNS-Catalogues	0 € in the current version. New updates and developments will require human resources
5.4.3	Alert classification system for food-diet-drug interactions	FooDrug database	WebTool	8-9	IMDEA* , EuroFIR, UM	Entry on FNS-Catalogues. A publication in progress. Presented in different conferences	NA	Usage in further research and development of new functionalities & products coordinated by IMDEA. Available via FNS-Catalogues.	0 € in the current version. New updates and developments will require human resources
5.4.3	Alert classification system for food-diet-drug interactions	FooDrug e-Learning course	E-Learning Course	NA	IMDEA* , UWTSD, EuroFIR	Pending discussion with UWTSD	Pending discussion with UWTSD	Usage in teaching activities coordinated by IMDEA/UWTSD	0 € in the current version. New updates and developments will require human resources

*IP owner(s)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863059.

4 Other FNS services, ontology, and other outputs

In addition to all WP5 outputs, a set of services and other outputs, mainly developed in WP2 and WP3, have been listed in the tables above. Those services and resources are very important pieces for some of the demonstrators but can also be used/applied independently in different research settings. Therefore, a brief description of those tools and services is presented next.

All the FNS developed services are standalone web applications or services that can be accessed through the FNS-Cloud Catalogues (developed in WP2) under “tools or services”, respectively. The tools developed are strongly integrated with the back-end infrastructure and the Metadata API described in the microbiome demonstrator. Additionally, guidelines have been prepared to be used after the end of the project for the potential integration of new services (see D8.4).

The FNS services that are available include:

- Food matching service: data pre-processing, food matching, and calculation of ingredient quantities and missing nutrient values (JSI; WP3).
- Metadata Extraction Service & submission form: it is used to query data from external bioinformatics data repositories. Currently the service supports querying the European Nucleotide Archive (ENA) and retrieving metadata about existent research data (Demo 3 on microbiome data). The Metadata Submission Form is a web-based tool which is used to enhance microbiome studies from the European Nucleotide Archive (ENA) with food and nutritional intake data. The tool also provides the ability to submit intervention information about the study based on the intervention subdomain of the FNS Harmony Ontology.
- Data Analysis Pipeline: The Microbiome data analysis pipeline to support the microbiome demonstrator (JSI/QIB). Two integrative data analysis pipelines to functionally analyse and visualize metabolomic, transcriptomic and metagenomic data. Data from the Metabolights and MGnify databases will be selected by the user with the metadata capture framework in Fairspace. Thereafter, the data can be analysed with the dedicated analysis pipeline. All three pipelines will be available from the FNS catalogues.

The following tools have also been developed (in WP3) and used in the demonstrators:

- Metadata enrichment tools: a collection of software tools for Fairspace metadata enrichment. Roughly these are of two kinds: (I) based on automated data scraping: the meta-data Web scraping tool, and (II) based on machine-learning and large language models: the topic modelling and keyword extraction (Scalefocus).
- FNS-Cloud Intake Dataset Assessment Tool: supports researchers in the process of evaluating if a given dataset in the FNS-Cloud catalogues: can be used for answering a specific research question and has been used in Demo 2 (UCC).

Another key output from the FNS Cloud project is the FNS-H ontology and the data curators. Ontology design is a crucial aspect of knowledge representation and organization, aiming to create a structured framework that captures the concepts, relationships, and properties within a specific domain. The FNS-H ontology has been developed by JSI/UF using the Protégé ontology editor (<https://protege.stanford.edu/>), and is composed of six modules (see D3.5). Each model contains the conceptualization of certain part of the food, nutrition and security domain and have been developed with the specific domain experts:

- Microbiome data (QIB/UM).
- Food components including branded foods (EuroFIR/Nutris).
- Bioactive data (QIB/EuroFIR).
- Dietary interventions (UCC/Our/UM/Capnutra).
- Product identifiers (<https://www.gs1.org/>).

The developed ontology is available via several sources:

- GitHub repository: <https://github.com/panovp/FNS-Harmony>
- Ontology PURL: <https://purl.org/fns-h>
- BioPortal Ontology Repository: <https://bioportal.bioontology.org/ontologies/FNS-H>



5 Dissemination and communication strategy

A comprehensive Dissemination and Community Engagement Plan (DCEP) was developed by WP6 partners (see D6.3), which covered all aspects related to dissemination and communication (D&C) activities undertaken during the entire project duration. This DCEP included a stakeholder analysis, a description of all activities carried out in cooperation with other initiatives, a summary of activities, and a list of all other dissemination and community engagements (e.g., peer-reviewed papers, social media, talks at conferences, others). Any post-project D&C activities will use this plan and most of its guidelines as reference.

Over the last four years, FNS Cloud partners produced 20+ peer-reviewed papers and more are expected to be published after the end of the project. This will bring new opportunities for researchers to present their work and results at international conferences and other events and platforms. All scientific publications have been uploaded to Zenodo, following the FAIR principles, and facilitating access to a broader science community and the public in general. Any post-project publications must be added to Zenodo or any other open access repository as well.

Several social media accounts and channels (e.g., Instagram, Facebook, Twitter, LinkedIn, Youtube) have been created to disseminate FNS Cloud work and results. Efforts carried out during the last two years of the project, have led to an increase in followers, 'likes', and interactions on the different accounts and posts. A considerable amount of effort is put in the planning of the social media campaign; therefore, the number of posts and interactions are expected to decline after the end of the project. Nevertheless, all accounts will remain open, active and will be managed by EuroFIR AISBL (BE).

In parallel, D&C partners revamped the FNS Cloud website ([Homepage – FNS-Cloud](#)) by updating and adding new content, and by changing the layout and design. Changes were made based on feedback provided by other project beneficiaries and on comments and suggestions provided by European Commission (EC) reviewers on how to improve the website. Additional resources have been further improved towards the end of the project, which include the FNS Catalogues ([FNS-Cloud Catalogues \(fnscloud.eu\)](#)) and the Community of Practice (CoP) – myFNSCloud ([Food Nutrition Security \(myfnscloud.eu\)](#)). The former provides direct access to all resources generated and used during the project to other researchers, while the latter offers a space for knowledge exchange and interaction to all CoP members.

Part of the plans moving forward after the end of the FNS Cloud project, is to keep the CoP running and to increase the number of members that participate in this community. A good opportunity to promote the CoP and to engage more people with this community will be the FNS Cloud Final Launch Event that will take place on the 12-13 September 2023 in Brussels, Belgium ([FNS-Cloud Final Event | EuroFIR AISBL on Glue Up](#)). This event will be open to researchers, food industry, policy makers, healthcare professionals and public in general, who have a particular interest in FNS topics and that would benefit themselves from using some of the tools developed during the project.

Additional resources (i.e., videos, manuals, training materials, e-learning courses) have been prepared to facilitate understanding and usage of those tools. The CoP will provide access to all those complimentary resources with the aim to promote its application in further research activities.



6 Conclusions and next steps

The FNS Cloud partners successfully generated new and further enhanced existing tools and resources that were used in three demonstrators to showcase how fragmentation issues in the FNS domain can be overcome, creating the first-generation cloud solution for food data. The extensive and varied list of outputs presented in this deliverable show how complex and broad the FNS field is, proving that multidisciplinary teams are very much needed to create solutions that can have an impact on the way FNS data is produced, shared, and re-used by others.

A lot of work still needs to be done around the FAIR principles and its application among the scientific community. FNS Cloud project led important efforts in this regard, first, by focusing on informing its own project beneficiaries about the FAIR principles and how their tools and resources could achieve a certain level of FAIRness, and second, by approaching a wider group of researchers and scientists to talk about this topic.

IP protection of the tools and resources developed and improved during the project was another key aspect that required support and guidance from experts. Most researchers are not familiar or used to deal with this matter and do not fully understand how important it is for the scientific community and for society, that any knowledge generated by them can be shared and applied in further research or in other aspects of life (e.g., medical practices, policy makers, food industry). Misinformation and lack of legal assistance hinder any attempts to share research outputs (e.g., data, tools) with other researchers or with the public to avoid unauthorised exploitation of those creations. FNS Cloud addressed this issue by running several trainings on IP protection and by having a dedicated team of experts helping researchers find the best IP solution for their inventions. Additional support and continuous training on the implementation of legal interoperability and FAIR data principles is still "urgently" required by the research community.

All databases that were generated during the project can be protected via sui generis database rights, like for example all the databases that came out of the DIME Study. Those databases usually do not have any future costs associated, which is not the case for other resources like software, apps, and other tools as they require constant maintenance and support to keep them running. In some cases (e.g., FoodMagnifier) preliminary costs (€6500/year approx.) have been estimated but majority of those resources still need to clarify their future maintenance costs. Those costs will be agreed by September 2023 and will be reported in D8.4.

Next steps for project partners after the end of FNS Cloud include to look for and try to secure additional funding to maintain and continue to develop the project's outputs. A sustainability plan will be designed by WP8 partners, which explains how all the resources generated by FNS Cloud will be kept live and running and for how long (see D8.4). For some of the tools, a more in-depth market analysis and business model might be needed. Strengthening ties with other initiatives (i.e., Blue Cloud, FNH-RI, Metrofoods) is also part of the future, which will help to establish potential collaborations with other institutes and/or companies and to keep disseminating FNS Cloud resources. As indicated previously, more scientific papers will be published after September 2023, exploitation of those publications and their content will also be part of the D&C strategy to keep FNS Cloud in the loop.

The importance of the FNS-H ontology and data curators has been recognised as a future need and the first steps to develop FNS data curator experts has already been taken as part of this project. A list of potential data curators has been prepared and it can be found in Appendix 7.



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8 Appendices

8.1 Appendix 1: Description of the different types of IP strategies

IP strategy type	Description
Patents	A patent is an exclusive right granted for an invention. A patent provides the patent owner with the right to decide how -or whether- the invention can be used by others. In exchange for this right, the patent owner makes technical information about the invention publicly available in the published patent document (WIPO, 2023).
Copyrights	Copyright is a legal term used to describe the rights that creators have over their literary and artistic works. Works covered by copyright range from books, music, paintings, sculpture and films to computer programs, databases, advertisements, maps and technical drawings (WIPO, 2023).
Trademarks	A trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises. Trademarks date back to ancient times when artisans used to put their signature or “mark” on their products (WIPO, 2023).
Industrial designs	An industrial design constitutes the ornamental or aesthetics aspect of an article. A design may consist of three-dimensional features, such as the shape or surface of an article, or of two-dimensional features, such as patterns, lines, or colour (WIPO, 2023).
Geographical indications	Geographical indications or appellations of origin are signs used on goods that have a specific geographical origin and possess qualities, a reputation or characteristics that are essentially attributable to that place of origin. Most commonly, a geographical indication includes the name of the place of origin of the goods (WIPO, 2023).
Trade secrets	Trade secrets are IP rights on confidential information which may be sold or licensed. The unauthorised acquisition use or disclosure of such secret information in a manner contrary to honest commercial practices by others is regarded as an unfair practice and a violation of the trade secret protection (WIPO, 2023)
Sui generis database	The sui generis protection of databases applies if a substantial investment was made in obtaining, verifying, and presenting its contents. A substantial investment is to be understood as a financial and/or professional investment, which may consist in the deployment of financial resources and the expending of time, effort and energy made in obtaining and collecting the contents (European Commission, 2023) ² .

² [Europe - Frequently Asked Questions \(europa.eu\)](https://european-council.europa.eu/media/en/press-summaries/Pages/2023/02/16.aspx)

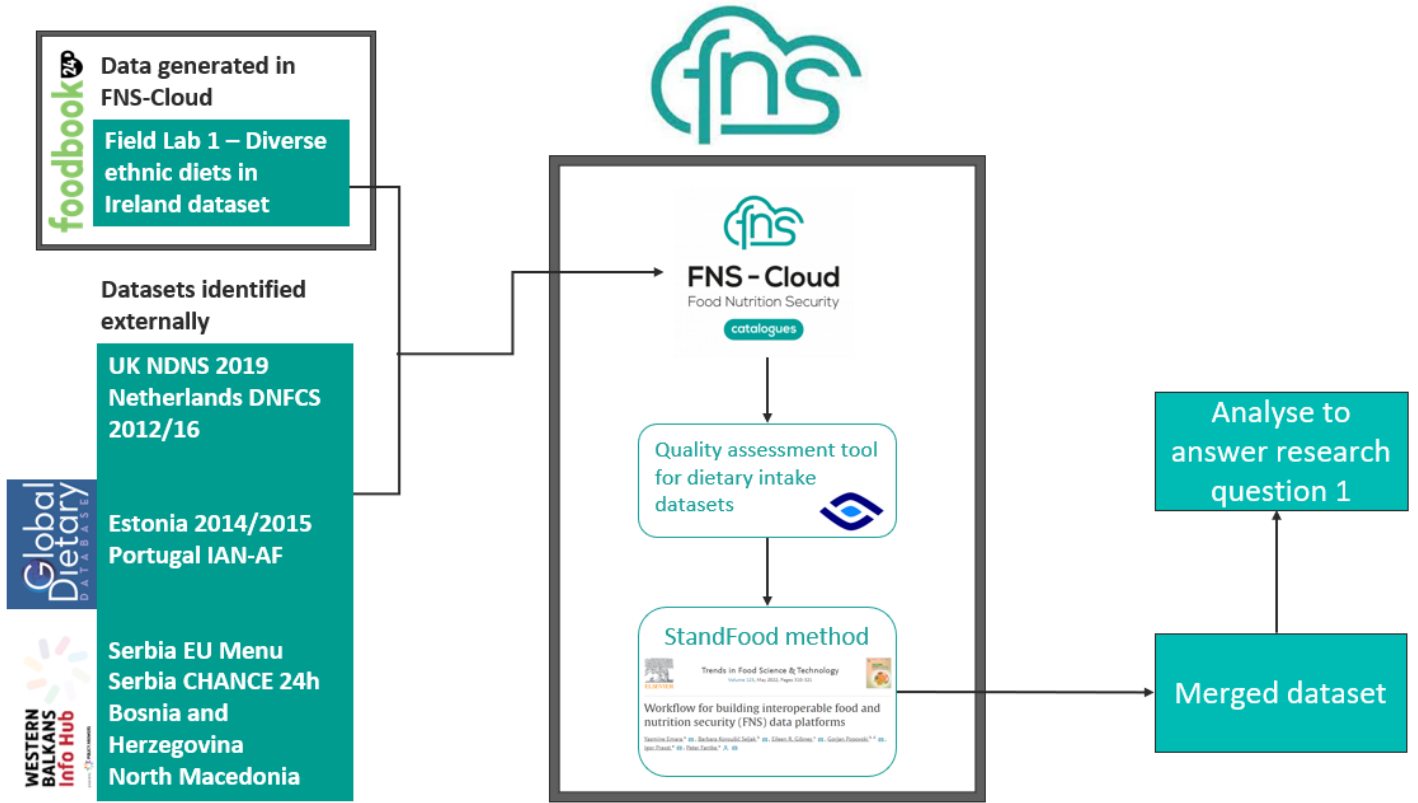


8.2 Appendix 2: List of datasets used to support the metrology search engine (T5.2.1).

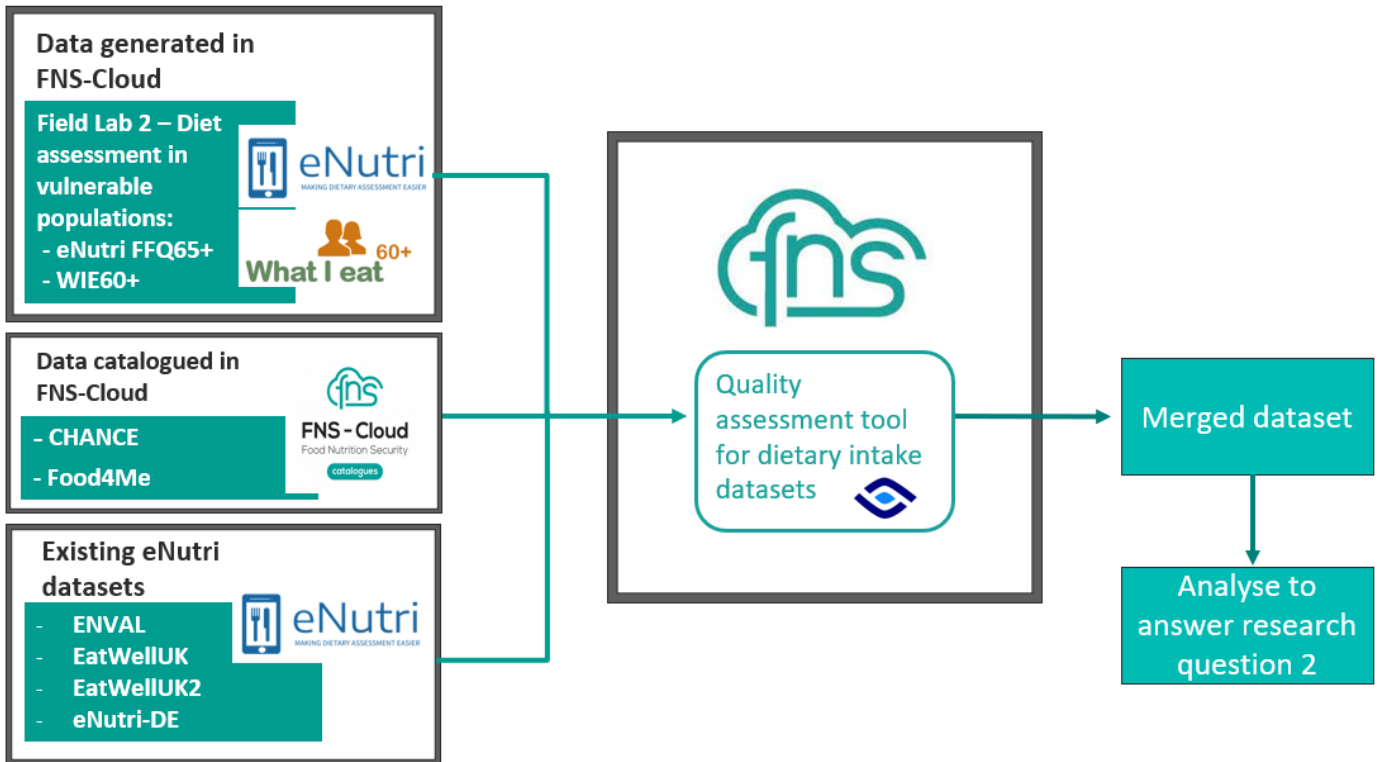
Dataset	Owner	Data access status
EuroFIR Food composition datasets	EuroFIR	Freely available during the project and future access will need to be agreed
Bioactive data (eBasis/ePlantLIBRA)	EuroFIR	Freely available during the project and future access to be agreed with EuroFIR, currently by membership scheme
Dataset-milk-Slovenia	JSI	External data with restricted access (only for use within FNS Cloud).
LFCT-AUTH/ATR-FTIR spectroscopic dataset	AUTH	External data with restricted access (only for use within FNS Cloud).
LFCT-AUTH/virgin olive oil phenol composition	AUTH	External data with restricted access (only for use within FNS Cloud).
LFCT-AUTH/radical scavenging activity of virgin olive oil phenols	AUTH	External data with restricted access (only for use within FNS Cloud).
NEVO Dutch food composition database	RIVM	External data with restricted access (only for use within FNS Cloud).
Isotopic data	FEM & JSI	External data with restricted access (only for use within FNS Cloud).
CNR_ISPA_Salmon mass spectrometric data	CNR	External data with restricted access (only for use within FNS Cloud).
Other datasets submitted by CNR – 20 in total	CNR	External data with restricted access (only for use within FNS Cloud).
Slovenian branded food database	CNR	External data with restricted access (only for use within FNS Cloud).
Contaminants_simplified_SSD2_BE-FPS_Nickel-FNS	UGent	External data with restricted access (only for use within FNS Cloud).
CoFID Composition of Food Integrated Dataset for the UK	Public Health England/QIB	/ Open access via link from QIB Department of Health and Social Care (DHSC)
FoodB	Genome Canada, Genome Alberta	Available as open access
Phenol-Explorer	Institute National du Cancer (FR), Unilever	Available as open access



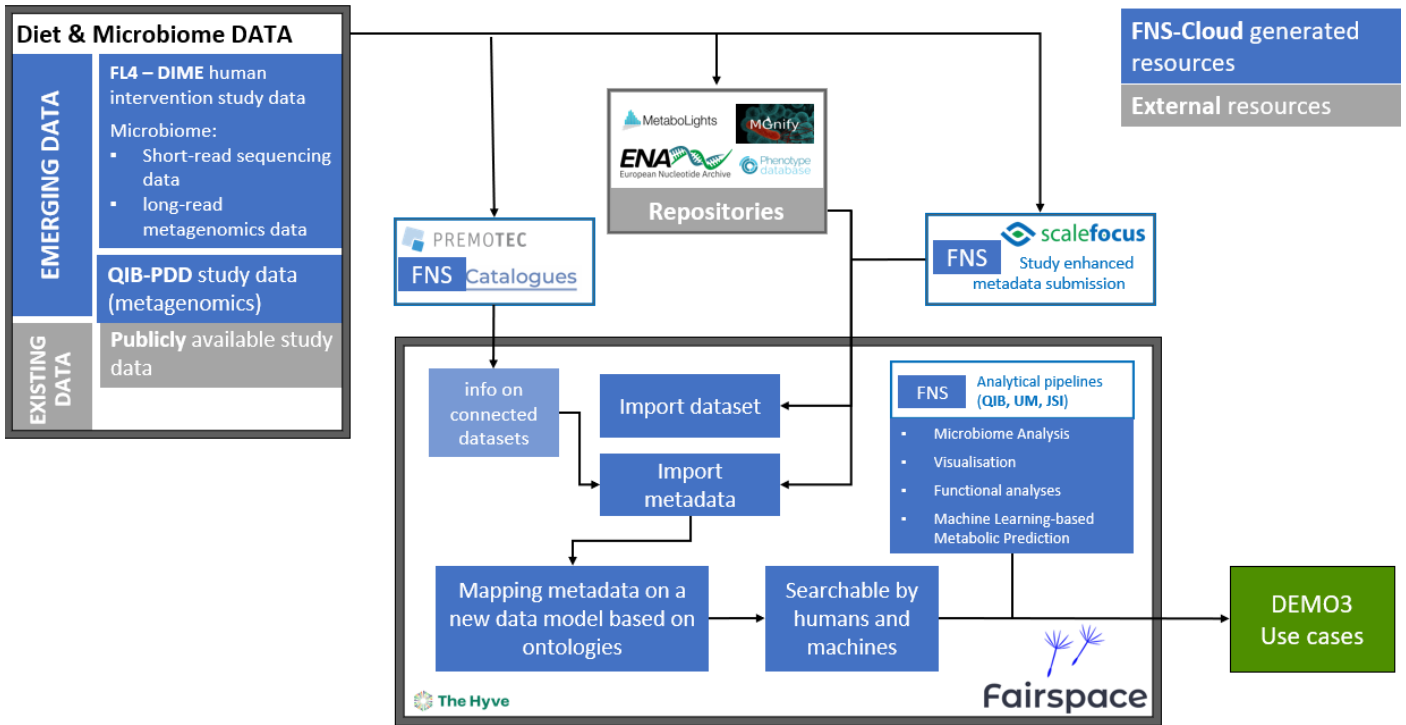
8.3 Appendix 3: Foodbook24 connection to FNS Cloud diagram (T5.3.1).



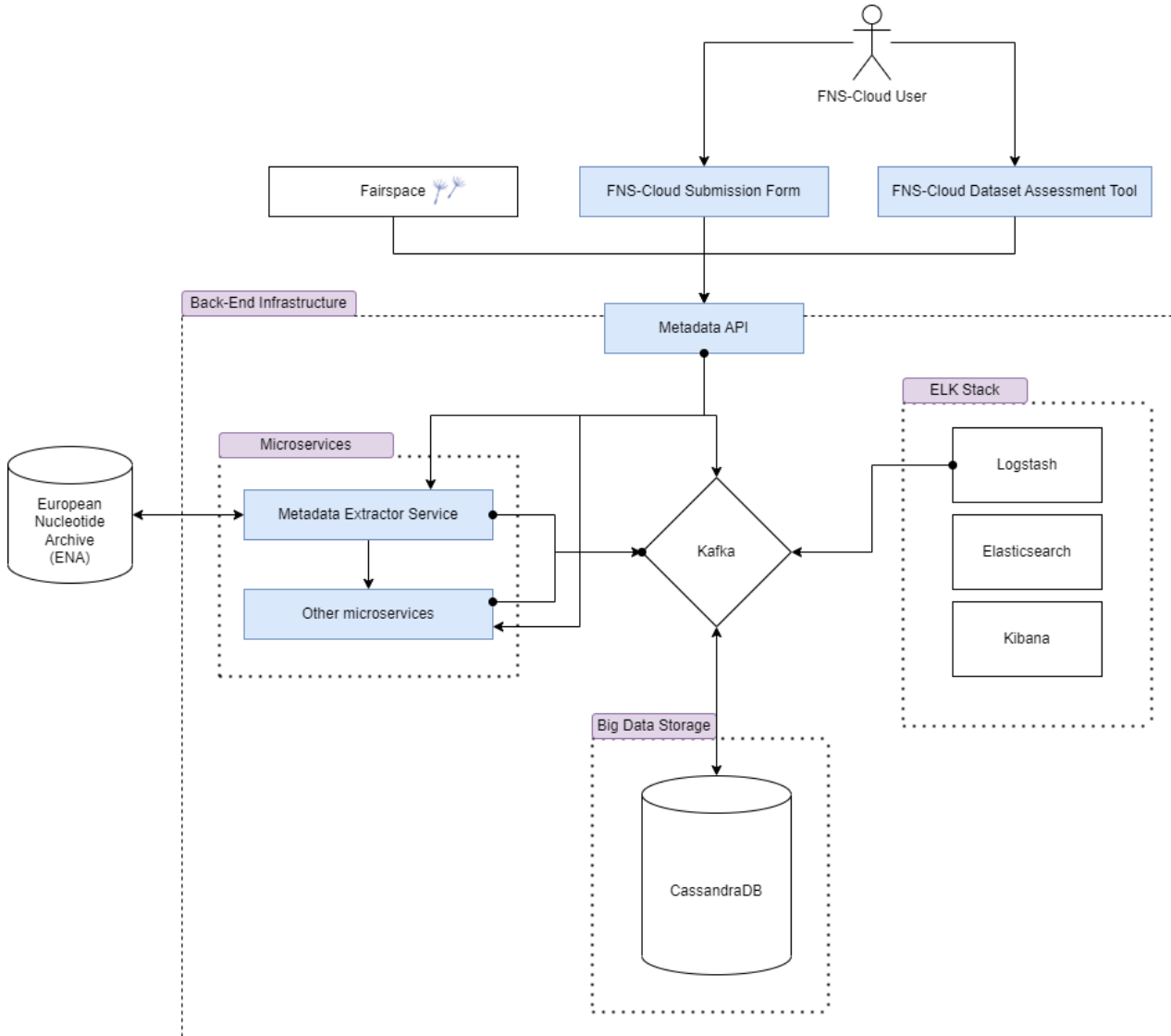
8.4 Appendix 4: eNutri65+ and What I eat 60+ connection to FNS Cloud Catalogues diagram (T5.3.2).



8.5 Appendix 5: Data, tools and external resources brought together in the healthy diets for healthy microbiome demonstrator (T5.4.1).



8.6 Appendix 6. FNS-Cloud back-end infrastructure developed for the healthy diets for healthy microbiome demonstrator (T5.4.1).



8.7 Appendix 7: FNS Harmony ontology data domain experts (WPs 3 & 5).

	Senior			Junior		
	Domain expert	Institution	Email	Domain expert	Institution	Email
DEM01						
<i>Food traceability</i>	Dr Claudia Zoani	ENEA (IT)	claudia.zoani@enea.it			
<i>Food labelling</i>	Dr Igor Pravst	NUTRIS (SI)	igor.pravst@nutris.si			
	Dr Luca Bucchini	Hylobates (IT)	lucabucchini@hylobates.it			
<i>TDS/MCRA</i>	Jacob van Klaveren	RIVM (NL)	jacob.van.klaveren@rivm.nl			
	Gerda van Donkergoed	RIVM (NL)	gerda.van.donkergoed@rivm.nl			
DEM02						
<i>Food composition - nutrients</i>	Paul Finglas	QIB (UK)	paul.finglas@quadram.ac.uk	Dr Liangzi Zhang	QIB (UK)	liangzi.zhang@quadram.ac.uk
	Susanne Westenbrink	RIVM (NL)	susanne.westenbrink@rivm.nl	Dr Hana Musinovic	EuroFIR (BE)	hm@eurofir.org
<i>Food composition - bioactives</i>	Dr Maria Traka	QIB (UK)	maria.traka@quadram.ac.uk	Dr Hana Musinovic	EuroFIR (BE)	hm@eurofir.org
<i>Food composition - other</i>	Dr Luca Bucchini	Hylobates (IT)	lucabucchini@hylobates.it			
<i>Food composition – branded foods & ingredients</i>	Dr Igor Pravst	NUTRIS (SI)	igor.pravst@nutris.si	Dr Hana Musinovic	EuroFIR (BE)	hm@eurofir.org
	Dr Karl Presser	Premotec (CH)	karl.presser@premotec.ch	Anna Zolynia	Premotec (CH)	anna.zolynia@premotec.ch
<i>Food consumption, intakes & lifestyle</i>	Prof. Eileen Gibney	UCD (IE)	eileen.gibney@ucd.ie	Dr Michelle Weech	UoR (UK)	m.weech@reading.ac.uk
	Prof. Julie Lovegrove	UoR (UK)	j.a.lovegrove@reading.ac.uk	Dr Laura Bardon	QIB (UK)	laura.bardon@quadram.ac.uk
DEM03						
<i>Diet & microbiome</i>	Dr Maria Traka	QIB (UK)	maria.traka@quadram.ac.uk			
	Prof. Duccio Cavalieri	UF (IT)	duccio.cavalieri@unifi.it			
<i>NCDs</i>	Prof. Yannis Manios	HUA (GR)	manios@hua.org			
<i>Food-drugs interactions</i>	Dr Enrique Carrillo	IMDEA (ES)	enrique.carrillo@imdea.es			

