



NeOn-project.org

NeOn: Lifecycle Support for Networked Ontologies

Integrated Project (IST-2005-027595)

Priority: IST-2004-2.4.7 – “Semantic-based knowledge and content systems”

D7.7.2 Evaluation of the FSDAS second prototype and recommendations to research

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Document Identifier:	NEON/2009/D7.7.2/v1.0	Date due:	September 30 th , 2009
Class Deliverable:	NEON EU-IST-2005-027595	Submission date:	September 30 th , 2009
Project start date:	March 1, 2006	Version:	v1.0
Project duration:	4 years	State:	Final
		Distribution:	Public

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This document is a part of the NeOn research project funded by the IST Programme of the Commission of the European Communities by the grant number IST-2005-027595. The following partners are involved in the project:

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FAO

Change Log

Version	Date	Amended by	Changes
0.9	20/10/2009	Claudio Baldassarre	Chapter from 1 to 6
0.91	21/10/2009	Claudio Baldassarre	Chapter 7
0.92	09/11/09	Claudio Baldassarre	Addressed QA comments
0.93	10/11/09	Caterina Caracciolo	Updated contact name for FAO; updated cover page.
1.0	11/11/09	Aneta Tumilowicz	Final QA

Executive Summary

This document evaluates D7.6.2 Fisheries Stock Depletion Assessment System (FSDAS) and makes recommendations for the last future iteration using a set of commonly applied software evaluation methods. These methods verify that the software implements the functionalities and meets the constraints re-described for FSDAS in D7.6.1D7.6.1D7.6.1D7.6.1D7.6.1D7.6.1, and the recommendations provided with the evaluation of FSDAS v1 in D7.7.1. The methods also validate the software by examining whether it generally conforms to software engineering standards for development. Finally the methods examine software from a usability perspective by observing typical users performing supported tasks.

The report found that the FSDAS v2 has significantly improved from its first version, overcoming the interaction issues due to its integration with the NeOn toolkit application environment. The new architecture design has also significantly improved the access to FSDAS functionalities, thus meeting original requirement of light weight applications. The application needs, for its last implementation iteration, to be:

- scalable to a greater amount of data in the knowledge base,
- functionally more robust,
- completed with additional functionalities from the requirement list,
- optimized in the aspects identified by this evaluation.

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1. Background

The Capability Maturity Model (CMM) defines the purpose of validation as being “to demonstrate that a product or product component fulfils its intended use when placed in its intended environment.” [CMM] There are two main areas of software proofing: validation and verification. “Validation demonstrates that the product, as provided, will fulfil its intended use; whereas, verification addresses whether the work product properly reflects the specified requirements. In other words, verification ensures that ‘you built it right;’ whereas, validation ensures that ‘you built the right thing.’”

Deliverable D7.6.2, the FSDAS v2 prototype was produced based on the experience acquired during the implementation of FSDAS v1 (D7.6.1), and by taking in to account the findings of the evaluation process of the same software version (D7.7.1). Its original aim has been reformulated in the light of the latest NeOn project achievements, so to “provide FAO Fishery systems with a semantic framework that implements capabilities to aggregate documents from the Fishery corporate memory, exploiting the fisheries ontologies” (D7.2.3).

The original requirement document (D7.1.1) summarizes the scope and core requirements of the application. We list here those still applicable to the present and next FSDAS development:

- FSDAS users will be mainly officers in FAO Fisheries Department; in this sense, the user classes are all fisheries experts within some domain of fisheries: Fisheries Scientists, Fisheries Managers, Marine Biologists, Oceanographers, Fisheries economists, Fisheries legal experts, Fisheries engineers, Fisheries policy makers.
- Users are able to browse or search fisheries concepts and relations and use them to seek out related concept instances that have been identified using reasoning over the set of fisheries ontologies.
- Users are able to navigate and query concepts, relations and concept instances; to view all concepts, relations and the application interface in the five languages of FAO (when available).
- Users are able to view the digital resources related to the concept instances within the appropriate application on their desktop computer.
- Users are able to input ad-hoc queries, both using free-text and concepts/relationships, suggested by the currently loaded ontology set, that returns either related data instances or related concepts/relationships found in the currently loaded ontology set.
- Data instances returned by a query are grouped according to their related concepts and relationships; it should be possible to re-organize results according to any of the concepts/relationships that were used to select the result.

This deliverable documents the verification and validation activities carried out in the evaluation of FSDAS v2 prototype and makes proposals for its next iteration.

2. Process

This document, in order to fit within the context and scale of this deliverable is based on a simplification of [IEEE 829-1998 Standard for Software Test Documentation](#). Some of the adaptations consist of implementing as deliverable sections, items that the IEEE standard envisages as separate document sets (e.g. test plan set, test specification set, test reporting set). For each section, only the part of the documentation relevant to the pursued purpose is implemented. In some cases a schematic view is given to what otherwise would be a wider document collection, e.g. test case specification documents. The choice to adapt the original IEEE documentation model should not however affect the soundness and completeness of the validation activity. All tests were performed as required to guarantee full support for the next iteration of FSDAS prototyping work.

The document contains 5 main sections:

Test Plan: covers the rationales collected in the period before and after the FSDAS application was delivered, and that led to the specifications of the tests to validate and verify the prototype. This section prescribes also the perspectives under which tests were performed and the parts of the application that required special investigation. The section finishes by covering the objectives of the FSDAS testing.

Test Specification: describes in more detail aspects mentioned in the plan: the requirements to be covered, the features to be tested and the use cases to be verified. The section refers to templates that embed the main properties representative of the tests for use cases; filling the schema for each use case gives a concise view of what would otherwise require more extensive documentation according to the [IEEE 829-1998 standard](#).

Test Reporting: describes the actual implementation of the specified tests.

Conclusions: summarizes test reporting; provides pinpointed improvements to the parts that have been tested and found insufficient with respect to the requirements; gives some qualitative opinions on the evaluated deliverable.

Recommendations: contains advice and suggestions for the next prototype of FSDAS based on the test results and following FAO expectations in terms of functionalities and requirements coverage.

Due to the combination of different tests and test items, it is not possible to *preset* evaluation criteria that cover the entire testing activity; generally speaking, a success criterion is requirement satisfaction and the extent of use case coverage as presented in [D7.5.1](#). Usability on the other hand is necessarily a qualitative measure that seeks to offer guidance towards future improvement of the user experience. Because of the specificity of requirements and scope, and uniqueness of the application aim, one broadly valid success indicator is that Fisheries' users are able to speed up the collection of data that otherwise need to be retrieved and selected manually from heterogeneity of data format and repositories.

3. Test plan

3.1 Introduction

The plan covers two test perspectives: technical testing and end-user usability. The verification activity sets the ground for end-users ensuring that the application is basically sound and communicates any encountered issues. The second part of testing focuses on validating usability by fisheries domain experts. A task script is used and direct user observation performed using think-aloud protocols. The results of these two groups of effort are then collated and analysed.

3.1.1 Planning Background

The specifications for the FSDAS application have matured in accordance with the increasing understanding that FAO has acquired about the evolving design and capabilities offered by the technologies developed within the NeOn project. In a span of 12 months time, since the delivery of FSDAS v1, and through the production of the first software evaluation document (D7.7.1), FAO was able to provide detailed specifications for the second and next iterations of the application prototypes. In the light of project outcomes and perspectives, FSDAS has evolved in its architecture, client and server design, as well as the adopted technologies from inside and outside the NeOn project. The willing reader can find in [D7.6.2](#) the sections that explain and comment the abovementioned evolution steps. We reduced the functionalities to a core set, to which 8 core use cases form part of the second FSDAS prototype. The future development will focus on their scalability and robustness. A schematic view of the use cases considered to be delivered for the second and final implementation is in [Annex3](#).

3.1.2 Test Objectives

Guided by the experience acquired since the first attempt to define what the FSDAS application should feature, testing targets the following objectives:

- (a) Report on uncovered issues in the second prototype that are relevant to FAO but not envisaged in NeOn.
- (b) Drive prioritization of functionalities development as the result of a realistic schedule of delivery.
- (c) Provide guidelines and recommendations to the third prototype for the developers to improve the next FSDAS release.
- (d) Make suggestions with respect to any of the points in the evaluation criteria that need to be improved during ongoing work for the next release.

3.1.3 References

The following documents were used as sources of information to plan the FSDAS tests:

- [D7.5.1](#): Software architecture for the ontology-based Fisheries Stock Depletion Assessment System.
- D7.2.3: Inventory of fishery resources and information management systems.
- D7.6.1: First Prototype of the Fisheries Stock Depletion Assessment System.
- D7.6.2: Second Prototype of the Fisheries Stock Depletion Assessment System.

- D7.7.1: Evaluation of the FADAS first prototype and recommendations to research.

3.2 Technical test items

The FSDAS application was designed and implemented as a client-server application, hence both halves are part of the test plan.

The client side released for the second version of FSDAS can be further partitioned into the following architectural components:

3.2.1 Interface

User interface access to all functionalities requiring widget elements must be tested. The graphical environment is mainly a target of usability tests to validate if the actual structure and layout are easily accessible by the user classes specified for FSDAS.

3.2.2 Search

Searching functionality is provided as keyword-based search; a look-up mechanism must be tested for ontologies loaded within the application environment.

3.2.3 Query

This is a crucial set of features for FSDAS, hence tests must assure that users have access to mechanisms for retrieving Fishery documents through SPARQL-based search, and that this is correctly interfaced with graphical components. Accessibility, availability and correctness of result items must be tested.

The server side is composed of infrastructure components plus a number of web services consumed by the client side. This application tier is partitioned into the following parts:

3.2.4 Reasoner

This is the core of the server; the OntoBroker inference engine from Ontoprise is the connection cross point between the client and the distributed data sources. It is fed with a pool of ontologies (developed in D7.2.3) for which it builds an internal representation and uses as an interface to the data. Tests must verify this integration with data sources.

3.2.5 Data repository

At this stage of development the data consists of:

- a. Text index of fisheries fact sheets,
- b. An RDF data set generated by a triplification process from the fact sheets.

Tests target the integration of this data source to the inference engine to assure that user queries executed through the reasoner can correctly access the data.

3.2.6 Web Server

Network communication must be tested according to the specifications in D7.5.1, particularly for configurations that consider proxy or firewall settings.

3.3 Technical features tested

In correspondence to the test items listed above from **0 to 0**, below is a list of features that the first prototype of FSDAS is expected to cover:

- The system shall allow authorized users to browse fisheries concepts, attributes and relations.
- The system shall be able to display multiple ontologies, including the relations eventually holding among their referenced elements
- Users shall be able to view the digital resources related to concept instances-
- It shall be possible to view two data sources side by side for comparison.
- Users shall be able to search (look up) for ontological elements in all the ontologies loaded in the system
- Users shall be able to input ad-hoc queries, both using free-text and by highlighting concepts/relationships suggested by the currently loaded ontology set that shall return either related data instances or related concepts/relationships found in the currently loaded ontology set.
- Raw data that is not associated with a proprietary application shall be viewable within the system, and not require the launching of a separate application. This applies specifically to tabular data such as CSV files, hierarchical data such as XML files and HTML files, and image data such as PNG, JPEG and GIF files.
- In this context Boolean logic, phrase matching and query refinement shall be supported by the system.

3.4 Usability features tested

Usability testing focuses on the use cases that are known to be at least partially covered in this first prototype. The following use cases must be tested:

- UC6 Search ontological resource in ontology
- UC8 Browse Taxonomy
- UC11 Query Composition
- UC12 Query for Data related to individual
- UC13 Visualize Data Source related to individual
- UC14 Refine query
- UC31 View data instance summary

3.5 Undelivered items

The following features were not part of the delivered prototype and therefore cannot be tested:

3.5.1 Untested features

- *Users shall be able to view all concepts, relations and the application interface in the five languages of FAO, when available.*
- *Users shall be able to select to rank results based on the rankings filtered by their user type or other annotation data.*
- *Data instances returned by a query shall be grouped according to their related concepts and relationships.*

3.5.2 Untested use cases

The following use cases were not part of the delivered prototype and therefore cannot be tested:

- *UC10 Change language of the ontological resource shown*

3.6 Testing approach

Testing covers two main perspectives and generates two different types of tests: technical and end-user usability. The first covers testing both the server and client side of FSDAS. The initial step is installation inside the FAO information system infrastructure of the server side of FSDAS to make sure that all repositories needed by the application can be successfully integrated and that any client instantiation can correctly communicate with the central server.

Client side testing begins by installing the application to ensure that the application meets non-functional hardware and software requirements. This is followed by the execution of the use cases planned to be delivered for the second prototype; a complete list is given in [Annex 3](#). For each tested use case a validation template is prepared (master copy in [Annex 1](#)) and filled with test results, final conclusions and recommendations to developers.

Along with testing technical and technological aspects of FSDAS, usability is also an item of testing. An evaluation strategy is defined using semi-structured field observation based on task scripts ([Stone et al., 2005](#)) and executed using think-out-loud protocols ([Open University, 2001](#)). It consists of:

- A session script,
- user profile survey,
- series of scripted browsing tasks that covered major functionality,
- logbook to record user remarks and observer comments and
- a post-session questionnaire.

These usability tests are performed as a last step after the soundness and completeness of FSDAS is verified. A task script ([Annex 2](#)) includes typical activities a user might perform with the FSDAS system that cover the delivered use cases. Users are invited to act according to the task script actions and are asked a series of questions at each step.

3.7 Item pass/fail criteria

Due to the combination of different tests and test items, it is not possible to preset a single pass/fail value for the delivered functions; they are instead specified ad-hoc for the test scope, and clearly explained in the relevant sections of this document. Generally speaking, success criterion is requirement satisfaction and extent of use case coverage as in D7.5.1. Usability on the other hand is necessarily a qualitative measure that seeks to offer guidance towards future improvement of the user experience.

3.8 Environmental needs

3.8.1 Hardware

Testing of the *client* side of the application is performed on a computer system meeting non-functional requirements as described in D7.1.1 and amended in D7.1.2:

- Computer system must be equipped with at least 256 megabytes of RAM

The computer system running the *server* side also follows the requirements envisaged in D7.1.1 and amended in D7.1.2:

- Computer system must be equipped with at least 1 gigabytes of RAM

3.8.2 Software

Operating System

The operating system of the computer systems running either the *client* or the *server* of FSDAS can be Windows based or UNIX based machine.

Other platforms

The computer system running the *client* of FSDAS is also equipped with:

- installation of JRE (Java Runtime Edition) version 1.6.0_05

Internet browser

The requirements on the internet browser suitable to run the client of the FSDAS were never made explicit in the previous deliverables. It is preferable that the FSDAS client can be open on the larger variety of web browsers, with a compatibility spanning on browser version from the less recent, to the most up to date.

- The technology adopted to implement the FSDAS client supports the following web browsers and versions: Internet Explorer 6/7/8, Firefox 1+, Google Chrome 2+, Safari 2+, Mozilla 1+, Opera 9+ and Camino 1+.

4. Test specifications

The IEEE standard for software testing envisages a collection of documents that were scaled down to this main section of the deliverable. As mentioned in 0 the tests nevertheless verify the technical soundness, completeness and usability of the prototype.

4.1 Technical assessment

This section deals with verifying that both tiers of FSDAS fulfil the requirements collected and translated to an architectural design. We distinguish evaluation of the client and server side.

4.1.1 Server side testing of FSDAS

The server side is a compound of: a reasoner application, and a data storage application (OntoBroker) that holds the internal representation of Fishery ontologies, a web server (Apache Tomcat¹) upon which to deploy the client web application. Testing focuses on assuring that the two components communicate and that the client connects and functions according to the specification.

4.1.1.1 Perform installation tests of FSDAS server

The server is delivered as one data storage/reasoner application (OntoBroker), and an open source web server (Apache Tomcat), both with their own installation wizard. After performing the installation of OntoBroker, and Tomcat, the instructions in [D7.6.2](#) suggest how to preset other environmental variables. No extra conditions than the ones specified in the installation document were required. The process finalized successfully and the client could be open in a web browser as expected. A few tests were run to ensure that critical functionalities were responding. The results are reported in the form of templates (Annex 4) filled with test outcomes reported in Annex 7 . The only note worth to mention about the server installation is the dependency from a library only available with the Java Development Kit, which bounds the server to use it instead of the Java Runtime Environment. For the development of FSDAS V3 this dependency should be eliminated.

4.1.2 Client side testing of FSDAS

This area is mostly concerned with use case verification, but initial steps insure that client installation follows the procedures described in [D7.6.2](#), considering that hardware and software environmental needs have been satisfied.

4.1.2.1 Perform installation tests of FSDAS client

FSDAS client is packaged and distributed such that the deployment of a single file in the web server (Apache Tomcat), allows all the end-users to connect to it, via any web browser and to start experiencing the main application environment. Hence the client installation phase of the test, is not really intended to execute a “wizard” installation process, but is to assure that the environmental needs are in place to guarantee correct running of the software. For this purpose trials were executed from 3 different computer systems, using Firefox² and Internet Explorer³ web

¹ <http://tomcat.apache.org/>

² <http://www.mozilla-europe.org/en/firefox/>

³ <http://www.microsoft.com/windows/Internet-explorer/default.aspx>

browsers. The results are reported in the form of templates ([Annex 5](#)) filled with test outcomes reported in Annex 6. Other issues met during the installation phase are reported in the recommendations section as points to improve for the next release.

4.1.2.2 Perform use-cases test

Following IEEE recommendations on the structure of test specification documentation a template ([Annex 1](#)) was designed that holds all the properties of concern for client testing. The testing phase was performed on all use cases considered priority and included in the prototype. The results are reported (Annex 8) in templates containing test outcomes. Other issues met during the usage of the client are reported in the recommendations section as important points to improve for the next release.

We can summarize the crucial findings, mentioning that the tests have highlighted functional shortcomings mostly related with the graphic user interface, and retrieval process. The interface suffers from accessibility issues due to unconventional interaction design, and only semi-structured layout. There is also a problem of interaction among dependent graphical components, and some users found the terminology in the interface unusual to their daily job. The retrieval process is affected by poor availability of data that are not enough to provide sufficient domain coverage. More over, as part of the retrieval process, the users will need to be supported in evaluating the quality of result with some form or rating that express the relevance of the returned item, compared to their query.

4.2 Usability assessment

Four users were selected from the FAO Fisheries and Aquaculture department. They were chosen with a view towards potential users of FSDAS. All of them regularly prepare reports, inventories and website content using fisheries data and reference data (e.g. taxonomies). All of them also had some experience with either programming or mark-up languages.

The users were tested over a period of several days at their regular workstations using the same version of FSDAS installed locally in FI information system. All user test templates used to conduct the testing can be found in [Annex 2](#).

4.2.1 User profile

The user profile showed a group of proficient computer users well-versed in working with XML, structured documentation and metadata and taxonomic standards. Some also had programming and database experience:

background:

- The testers group was composed of one Information Management Officer, one Fisheries Information Officer,
- All were biologist by education.
- All worked in the Fisheries and Aquaculture Information and Statistics Programme (FIES)
- Three of them were familiar with FAO fisheries taxonomies and classifications.

application experience:

- One tester regularly used XML editors, all make extensive use of MS-Office, two have experience in maintaining data bases, and one has created one.

- All of the testers have extensive experience in using the computer and developed specific computer skills.
- Two testers have had some experience with programming languages (XSLT, JavaScript).

ontology experience

- The four testers were able to give a definition of what ontology is, and have had light experience in using an ontology editor during NTK training at FAO.

4.2.2 User tasks

All users were given the same set of tasks ([Annex2](#)) and observed as they interacted with the application. Tasks consisted of typical actions such opening the main application, searching for fishery resources, composing queries, identifying resources data. Users were encouraged to state out loud their thoughts on the actions they were performing or thinking of performing. Pertinent remarks were recorded in logbooks by the observer, who also made additional comments based on the observation of their actions.

4.2.3 User post-test questionnaire

Users were given a set of questions ([Annex2](#)) to elicit their overall responses to using the product and gather any suggestions they might have for its improvement. Questions compared FSDAS to other similar applications, asked what was most confusing, what user would change, whether they felt confident about the results, what functionalities seemed missing, error messages, terminology and superfluous features.

5. Test reporting

Based on the tests performed a series of problems emerged that had to do with functionality that was not delivered, functions that were not correctly implemented or functions delivered but with poor usability.

5.1 Technical test report

It is worth recalling that the use cases under verification are only those planned for the first and the second iteration, ordered by priority (see [Annex3](#))

5.1.1 Covered/uncovered requirements ratio

Of the tests performed to verify the delivery of the 8 use cases planned for the first prototype, 7 satisfied the *pass* criteria, one was not delivered and could not be tested (see 0).

5.1.2 Precision of requirement coverage

For all of the use cases that satisfied the evaluation criteria, passed by considering the basic principles for their execution; they were provided with comments to improve the results when they are delivered in the next release.

5.1.3 Software configuration

The configuration of both halves of the application is straightforward when following the instructions provided with the deliverable D7.6.2. The client execution is as simple as connecting to a web URL; the server installation requires an effort commensurate to installing an Apache Tomcat web server, and running a batch/shell file depending of the computer operating system.

5.2 Usability test report

This section is grouped by major evaluation aspects and reports on the difficulties users encountered as they attempted to perform (with some observer guidance) the tasks detailed in [Annex 2](#) which are linked to the more detailed results found in the results of testing and the post-questionnaire Annex 9. Conclusions and recommendations are provided in later sections.

5.2.1 Information retrieval process

- All users needed to perform at least the first 3 tasks to adjust to the GUI components, although they had been introduced to the client during one dissemination event, and prior the execution phase.
- All users did not notice the processing time icon after triggering a request to the system; they assumed the application was unresponsive and continuously hit the request button or did not know what to expect.
- Some user noticed that the information display is too many clicks away from the starting point. They are used, and required a quicker access to information, especially when this is a simple value as for fishery resource name, or code.

5.2.2 Graphic Interface

- The layout of the graphic components caused confusion for majority of users. The identification or localization of GUI elements on screen was not always trivial for users' expected action flow.
- GUI panels dedicated to list items, present hybrid interaction behaviour when it is necessary to show element outside the viewport range. Some of them are provided with pagination effect, as opposed to scrolling for others (e.g. Entity information, Query, and Search Entity Result panels).
- For an application that consider families, genre and species, a flat interface design suggests the idea of a unique retrieval context. One user required to have clearer visual feedback on the scope of his/her information retrieval process.

5.2.3 Confidence in the validity of the returned result set

- Some testers could not find what they expected to be part of the document result set; mainly due to a reduced coverage of the knowledge base implemented for FSDAS v2.
- Some testers, with no specific background in aquatic resources, lacked a term of confidence to assess the validity of the retrieved document.

5.2.4 Help and support

- Lack of inline support, similar to tool tip, which could explain the purpose of similar graphical elements (e.g. buttons, input fields, drop down menus, etc.).
- Lack of Help section.
- Error messages do not offer failure recovery information.

5.2.5 Terminology

- Unconventional usage of terminology for the labels, which sometimes generated ambiguity of interpretation. The label "localname" used to identify the last part of an RDF resource URI, was understood as name "localization" i.e. regional/dialect name.

6. Conclusions

FSDAS v2 has significantly improved from its first version, overcoming the interaction issues due to v1 integration with the NeOn toolkit application environment.

The new architecture design has also significantly improved installation and distribution aspects. The server installation requires one less item (i.e. SQL DB), whose functionalities are served by the OntoBroker component. OntoBroker itself only requires running a batch/shell file depending if Windows or UNIX based machine are adopted. The web server is open source Apache Tomcat available both for Windows and UNIX based machine, and it is straightforward to install and supported by external community. The client installation is as simple as deploying a web application in to the web server; it is performed once for each server and can be accessed on the web by as many clients the server can support. Due to these changes with respect to v1, finally FSDAS meets the original requirement of light weight application, in favour of FI partners provided with minor hardware capabilities.

All test users were generally positive and felt that FSDAS had promise if it were only easier to use, included more resources, and integration between parts of the GUI were improved.

The application suffered from few major bugs and generated some errors. Test users were able to perform only partially the assigned tasks due to technical problems affecting parts of the knowledge base.

In terms of the functionality to be delivered as part of the second version, there was almost a complete coverage of the expected use cases. Some of the use case were although providing only basic support, and need to be made robust and completed with wider range of possibilities.

6.1 Technical summary

While limited in its coverage of data, and on some extent of the possibilities provided by the features, technically the second release of the FSDAS application is a good software delivery, consider the drastic change from its first version.

The actual implementation provides a solid background for the final version. As such, even the functionalities that are actually included will for the next release require improvement.

Going into specific issues:

- Enlarge the knowledge base of FSDAS by including more data sources than only the fact sheets collection considered for v2.
- Ensure application robustness in the cases when the server crashes for too many users connected, or too many queries triggered.
- Improve user interaction, by redesigning interface layout, and behaviour of the graphical component involved during a process retrieval task
- Provide the application with help support, especially in form of tool tip and comments for most crucial graphical elements (e.g. button, input fields).
- Make the terminology more suitable for intended FI user classes.

6.2 Usability summary

FSDAS v2 has significantly improved from its first version, overcoming the interaction issues due to v1 integration with the NeOn toolkit application environment. This reflects on the deep differences of usability problems encountered in FSDAS v2 when compared to v1. The testers did not have

any problem in recognizing menus or buttons between NeOn toolkit and FSDAS, nor to find their way among an excess of widgets that have nothing to do with the scope of the FSDAS application. In the same time dedicated to the v1 test, testers had more space to try the capabilities of the FSDAS.

The major shortcomings highlighted by the usability test, concern the layout of the interface, the interaction among dependent graphical components, accessibility of information, terminology used in the interface, and user support.

A side effect of running a usability test with FI expert is to prove the reliability of FSDAS also in term of the functionalities offered, if FSDAS presents any bugs, or unexpected behaviour, unknown to developers.

The following tables take the problems noted during user testing and formulate them as a series of issues and proposed solutions.

6.2.1 Information retrieval process

Issue	Proposed solution
When the result list is displayed, it is not intuitive that each list item is a link to the data provenance.	Make more explicit the possibility to click on a list item with an icon, or with the extended URL to the factsheet.
The keyword based search does not allow search Latin names	Make available the index of Latin names for each entities of the knowledge base that have one.
There is difference of result retrieved when search with the keyword "atun" and "atùn"	Make the index of names of the entities in the knowledge base invariant with respect to the charset used.
The information listed in the "Entity information" panel are randomly shown every time an entity is selected	Make the order of listed property static, and grouping together similar properties like all names, all codes etc.
When the user search with keyword "seabass" or "bass" he/she has two different set of result	Improve the indexing algorithm
User gets no result when he/she forgets to check the query	Do an automatic check when the input field is not empty.
When selecting "Land Area" and "Water Area" taxonomy the "Query Widget" displays queries through properties which do no apply neither to Land or Water domain	Reproduce the same behaviour for "Land Area" and "Water Area" that is shown when selecting either "FAO Specie" or "Aquatic Resource" taxonomy.
When selecting "Land Area" and "Water Area" taxonomy any query triggered throws a message of exception	Fix this to a normal functioning condition that is shown when selecting either "FAO Specie" or "Aquatic Resource" taxonomy.
User does not get any result for misspelling the input.	Support with either drop down list or auto-completion of the input text
User does not get any result for the search	Remove case sensitive from any

shows case sensitive behaviour	search functionality based on input text.
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6.2.2 Graphic Interface

Issue	Proposed solution
“Enter” key does not trigger search request	Enable “Enter” key as alternative to clicking the interface button to trigger the query process.
“Entity information” panel is too small to catch the attention of the user when seeking for selected entity information.	Have the “Entity information” panel self adapting to the screen size.
“Entity information” panel is visually detached from the “Entity search” panel, and does not catch the attention of the user when seeking for selected entity information.	Move the “Entity information” panel in the middle of the screen.
The window that opens to display the fact sheet from the selected result item is neither displaceable on the screen, nor resizable, nor is possible to reduce it for later usage.	Give the window displaying the fact sheet the behaviour of any other window in the system.
The elements of the taxonomy only expand if the arrow on the left end of each item is clicked.	Make the taxonomy element expand also when the text is clicked.
It is not clear for all users how to close the window displaying the fact sheet from the selected result item.	Provide the window displaying the fact sheet with a button to close it.
The animation showing that the system is processing before providing a query result is not visible.	Display the animation displaying ongoing processing, at the centre of the screen.
It is not always clear that the “send query” button triggers the search as prepared in the “Query widget”.	Enable “Enter” key or move the “send query” button in a place that follows more naturally the user action flow.
The “Entity information” panel has pagination of the listed items, differently from all other panels that have a scrollbar when the number of items exceeds the one allowed by the panel size.	Provide the “Entity information” panel with scrollbars
The “Taxonomy” panel pushes the “Entity Information” panel out of the screen, when the user expands the tree nodes.	Provide the “Taxonomy” panel with vertical scroll bar
The “Taxonomy” panel displays items names on two lines when they are too long to be contained in the panel size	Provide the “Taxonomy” panel with horizontal scroll bar
When clicking on a root element in the	The item in the list should be

“Taxonomy” panel, the information about included Oder, Family and Species generates a long list of property with coded values difficult browse.	clustered together.
User feel lost of all the possible query possibilities he/she is presented ad once.	Give more contexts to the interface so that the user is naturally driven through it. Use for example tabs, explanatory text, and simplified design (e.g. Google style)

6.2.3 Confidence in the validity of the returned result set

Issue	Proposed solution
Some testers could not find what they expected to be part of the document result set.	Augment the data being part of the knowledge base.
Some testers, with no specific background in aquatic resource, lacked a term of confidence to assess the validity of the retrieved document.	Introduce a form of rating/scoring the result so that is visible to the user the

6.2.4 Help and support

Issue	Proposed solution
When no checkbox is selected in the “Query Widget” the error message displayed does not give hints to solve the problem.	Provide a meaningful message to drive the user to check at least one item in the “Query Widget” panel.

6.2.5 Terminology

Issue	Proposed solution
Trailing the property names with “has” is confusing for all the users not used to ontological terminology.	Use label that are more suitable for FI user classes.

7. Recommendations

The following recommendations are offered as guidance for the development of FSDAS V3. They are based on the evaluation conclusions as well as the result of discussions and decisions taken during the October 2009 NeOn plenary meeting in St. Goar (Germany).

7.1 Functional improvements

Improve on the points presented in the technical summary; each of those points refers concisely to aspects that the developers need to read in detail in the use case test templates in Annex 8 which cover fully the results for each tested case. Developers should also refer to the usability issues reported in section [6.2](#) and in testing results and post-test questionnaire [Annex 8](#). For readability, not every issue is included in this section.

The following action items are grouped by broad functional area.

7.1.1 Information retrieval process

- Enrich the data forming part of the knowledge base by including either another data collection beside FI fact sheet, or by extracting more data from the factsheet that were not part of the FSDAS v2
- Allow the user to perform a keyword-based search more flexibly without constraining either on the language or on the charset or keyword case.
- Consider to fix the problem of having properties meaningful for the domain, of “Land Area” and “Water Area”.

7.1.2 Graphic Interface

- Improve the GUI layout providing that the graphic components can be easily identified for their purpose and are intuitively selected in the process of information retrieval
- Uniform the behaviour of all GUI elements.
- Show more evidence that the system is processing while the user is waiting for query result
- Provide evident visual feedback of each possible query capability provided to the system.

7.1.3 Confidence in the validity of the returned result set

- Provide an alternative way of assessing result set validity to the users who do not have specific background in aquatic resource,

7.1.4 Help and support

- Provide inline support, similar to tool tip, which could explain the purpose of similar graphical elements (e.g. buttons, input fields, drop down menus, etc.).

- Provide a help section.
- Display error/warning messages useful to the user to solve the encountered issue.

7.1.5 Terminology

Adopt a terminology which is more familiar to the targeted user of FSDAS application, instead of a terminology closer to ontological domain

List of Acronyms used in this deliverable

API	Application Programming Interface
CMM	Capability Maturity Model
CSV	Comma Separated Values
DBMS	Database Management System
FAO	Food and Agriculture Organisation of the United Nations
FI	Fisheries Department, FAO of the UN
FIES	Fisheries and Aquaculture Information and Statistics Programme
FSDAS	Fisheries Stock Depletion Assessment System
GIF	Graphics Interchange Format
HTML	HyperText Markup Language
IEEE	Institute of Electrical and Electronics Engineers
JPEG	Joint Photographic Experts Group
JRE	Java Runtime Edition
OWL	Web Ontology Language
PNG	Portable Network Graphics
RAM	Random Access Memory
XML	Extensible Markup Language

References

- [CMM] Capability Maturity Model, <http://www.sei.cmu.edu/pub/documents/02.reports/pdf/02tr011.pdf>
- [D6.1.1] Requirements on NeOn Architecture, <http://www.neon-project.org/ACollab/drafting/revisions.php?id=257>
- [D6.1.2] Report on user requirements v2, <http://www.neon-project.org/ACollab/drafting/revisions.php?id=862>
- [D6.2.1] Specification of NeOn reference architecture and NeOn APIs, <http://www.neon-project.org/ACollab/drafting/revisions.php?id=489>
- [D7.1.1] FSDAS Requirements, http://www.neon-project.org/ACollab/get_file.php?id=475
- [D7.1.2] FSDAS Revised Requirements, http://www.neon-project.org/ACollab/get_file.php?id=1152
- [D7.2.3] Fisheries Ontologies, http://www.neon-project.org/web-content/images/Publications/neon_2009_d723.pdf
- [D7.5.1] FSDAS Architecture, http://www.neon-project.org/ACollab/get_file.php?id=1019
- [D7.7.1] Evaluation of the FSDAS second prototype and recommendations to research, http://www.neon-project.org/web-content/images/Publications/neon_2008_d771.pdf
- [D7.6.1] FSDAS v1, <http://secse.atosorigin.es:10000/FSDAS-Client/FSDAS2.4+NTK1.1.1-B588.zip>
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- [IEEE] IEEE (1998) Standard for software test documentation, IEEE Computer Society.
- [UID] Stone D., Jarrett C., Woodroffe M., and Minocha S. (2005) User Interface Design and Evaluation, Morgan Kaufmann.
- [UIE] Open University (2001) M873 User Interface Design and Evaluation: Evaluation, Milton Keynes, Open University.

Annex 1 – Template report for the use cases testing

Use Case Identifier	
Use Case Description	
Title	
Requirements specification	
Input Specification	
Output Specification	
Special procedural requirements	
Intercase dependencies	
Pass/Fail	
Special Criteria	
Result	
Comments	

Template fields' description

1. Use Case Identifier: the sequential numbering given to use cases since D7.1.2
2. Use Case Description
 - a) Title: the name associated with the use case number
 - b) Requirement Specification: the excerpt(s) from the user requirements list that the use case is aimed to cover
3. Input specification: the input used in the testing phase
4. Output specification: the output produced in correspondence to the input specification
5. Special procedural requirements: specification of any particular preparation for an optimal execution of the use case.
6. Intercase dependencies: dependency of this test from another in the list
7. Pass/Fail
 - a) Special criteria: the condition(s) that is(are) not explicit when commonly understanding the test
 - b) Result: the actual response of the test PASSED/FAILED
 - c) Comments: the list of comments that are related to the execution of the test; they can include good and bad points about the use case.

Annex 2 – Usability testing templates

FSDAS User test instructions

Dear John Doe,

Thank you for agreeing to be part of the user testing of the first prototype of the Fish Stock Depletion Assessment System (FSDAS). I'll be reading from a script to insure that each user session is conducted in a similar way.

The purpose of this user session is to observe users interacting with the system using a pre-prepared set of tasks in order to help us evaluate it. This user session is not meant to test or grade your skills as a computer user in any way so you should not feel embarrassed or under pressure to perform or answer any questions in a particular way.

This session will consist of the following activities:

- A brief survey on your background.
- Accessing FSDAS.
- Description of the purpose of FSDAS.
- A set of tasks to evaluate the current usability of FSDAS.
- A post-questionnaire to evaluate the current usability of FSDAS.

Let's go ahead and begin with the survey.

[Administer survey]

Now that we've completed the survey let's launch FSDAS.

[Have user access FSDAS client application.]

Now that FSDAS has launched let me give you some background on its purpose. FSDAS is a system that uses fisheries concepts and the relationships between those concepts to perform searches for fisheries resources coming from various fisheries information systems. This is the second prototype and it uses a wider set of concepts compared to the first version, but still only one information source – FIGIS fact sheets. In the future it will use more concepts and dense network of relations, plus access more datasources than just factsheets.

I will ask you to perform a series of tasks. During each task I'll record your remarks and some information about your experiences.

[Follow task script and complete logbook for each task as indicated]

Now that you've performed the tasks, I would like to ask you a series of questions about the experience.

[Administer post-questionnaire]

That's it. Thank you for your time.

FSDAS User Survey	userID _____
background	
1. What is the official title of your position at work?	_____
2. In what fisheries domains do you have experience?	_____
3. In what fisheries domains do you currently work?	_____
4. Are you familiar with fisheries reference data, classification systems, etc.? If so, which ones?	_____
application experience	
5. What applications do you commonly use for work?	_____
6. How would you rate your level of computer experience?	_____
7. Do you know any programming languages?	_____
8. Do you know any mark-up languages?	_____
9. Have you ever built a web site?	_____
10. Have you ever created a relational database?	_____
ontology experience	
11. Describe what an ontology is:	_____
12. Have you ever used an ontology editor such as Protégé?	_____

FSDAS Task Script

1. Access FSDAS web client at http://168.202.54.19:8085/FSDAS_web/fsdas.zul
2. Perform a keyword based search for fish specie and retrieve its CodeAlpha3.
3. Select FAO Specie taxonomy find the “Euphausia superba” Crostacea.
4. Select FAO Specie taxonomy and find the CodeAlpha3 for the “Euphausia superba” Crostacea.
5. Select FAO Specie taxonomy and perform at least 3 queries, one of which obtained combining two or more single queries
6. Inspects query results, and visualize data provenance (i.e. the factsheet containing the data required)
7. Close the window showing the factsheet.
8. Select Water Area taxonomy and perform at least 3 queries, one of which obtained combining two or more single queries.
9. Select Land Area taxonomy and perform at least 3 queries, one of which obtained combining two or more single queries.
10. Select FAO Aquatic Resource taxonomy and perform at least 3 queries, one of which obtained combining two or more single queries.

FSDAS Logbook

Userld			
Place	Work		
Role of computer	Work		
Date	2008,		
Operating system	XP		

Task description no.:		Screen name:
Script	User's remarks	Observer's comments:
(when screen appears) <ul style="list-style-type: none"> • Do you know what to do next? • Do you recognise what to do, or did you have to ask what to do? • What are you trying to do? • Looking at the system response, do you think you made the correct choice? 		

Post-user test questionnaire	UserId:_____
1. Compared to other browsing / searching applications what are your general comments when comparing FSDAS?	
2. What aspects of the interface were the most confusing?	
3. What aspects would you change?	
4. Did you feel confident of the validity of the results?	
5. What functionalities or views seemed missing?	
6. If you received any error messages, did they help you to interpret the problem and resolve it?	
7. Was the terminology used in the actions familiar to you? Did it follow the conventions of other workflows you have experienced? If not, what was different?	
8. Did you ever feel lost while performing the tasks? When and where?	
9. Do you feel the system could assist you in your regular work tasks?	
10. Were there features that seemed superfluous?	

Annex 3 - List of FSDAS use cases

Use Case	High Priority	Medium Priority	Low Priority	Second Iteration
1 Login	x			
2 Logout	x			
3 Register	x			
4 Modify Profile		x		
5 Modify User Account	x			
6 Search ontological resource in ontology	x			
7 Search for related ontological resources	x			
8 Browse Taxonomy	x			
9 Change language of the interface	x			
10 Change language of the ontological resource shown	x			
11 Query Composition	x			
12 Query for Data related to individual	x			
13 Visualize Data Source related to individual	x			
14 Refine query	x			
15 View ontological resource annotation	x			
16 View Data Source Annotation			x	
17 Email results			x	
18 Propose ontology modification		x		
19 Add to favourites		x		
20 Save session		x		
21 Generate RSS feed from current query				x
22 Annotate retrieved document with comments on quality			x	
23 Index enrichment against ontology(ies) domain model			x	
24 Annotate retrieved document with comments			x	
25 Select ontologies to use for browsing documents or web pages				x
26 Use ontology to support browsing				x
27 Identify trend				x
28 Compare data by reporter				x
29 Discover ontology				x
30 Filter ontology				x
31 View data instance summary				x
32 Re-group/rank data resource by annotation				x

Annex 4 – Template report for the FSDAS server installation

PC type	
Software equipment	
Web Server	
Java Development Kit	
Hardware equipment	
Processor on board	
RAM on board	
Pass/Fail	
Result	
Comments	

Template fields' description

1. Pc type: desktop or laptop computer system
2. Software equipment
 - a) Web Server: the web server used to deploy FSDAS client as war file; this is single valued to Apache Tomcat.
 - b) Java Development Kit: the version of the JDK currently resident on the computer system
3. Hardware equipment
 - a) Processor on board: the CPU frequency powering the computer system
 - b) RAM on board: the amount of random access memory powering the computer system
4. Pass/Fail
 - a) Result: the actual response of the test PASSED/FAILED
 - b) Comments: upgrade/update of any of the above items.

Annex 5 – Template report for the FSDAS client installation

PC type	
Software equipment	
Internet Browser	
Java Runtime Environment	
Hardware equipment	
Processor on board	
RAM on board	
Pass/Fail	
Result	
Comments	

Template fields' description

1. Pc type: desktop or laptop computer system
2. Software equipment
 - a. Internet Browser: the software used to access internet and browse the resources; it can be any http client e.g. Firefox, Internet Explorer etc.
 - b. Java Runtime Environment: the version of the JRE currently resident on the computer system
3. Hardware equipment
 - a. Processor on board: the CPU frequency powering the computer system
 - b. RAM on board: the amount of random access memory powering the computer system
4. Pass/Fail
 - a. Result: the actual response of the test PASSED/FAILED
 - b. Comments: upgrade/update of any of the above items.

Annex 6 – Result of FSDAS client installation

PC type	Desktop
Software equipment	
Internet Browser	Mozilla Firefox v3.5.0
Java Runtime Environment	1.6.0_06
Hardware equipment	
Processor on board	Intel Pentium4 3.20Ghz
RAM on board	2 Gigabytes
Pass/Fail	
Result	Passed
Comments	a) FSDAS is rendered correctly with Mozilla Firefox

PC type	Laptop
Software equipment	
Internet Browser	MS Internet Explorer
Java Runtime Environment	1.6.0_06
Hardware equipment	
Processor on board	Intel Pentium Mobile 2.00 GHz
RAM on board	512 Megabytes
Pass/Fail	
Result	Passed
Comments	a) FSDAS is rendered correctly with Internet Explorer

Annex 7 – Result of FSDAS server installation

PC type	
Software equipment	
Web Server	Apache Tomcat
Java Development Kit	1.6.0_06
Hardware equipment	
Processor on board	Intel Pentium4 3.20Ghz
RAM on board	2 Gigabytes
Pass/Fail	
Result	Passed
Comments	<p>a) There is a dependency of the FSDAS on library contained only in the JDK, and force it to work only with it instead that JRE.</p> <p>b) There is a dependency on the version of the JDK that has to be 1.6.0_06 otherwise the application is unable to boot.</p>

Annex 8 – Result of FSDAS use cases test

Use Case Identifier	UC-6
Use Case Description	
Title	Search ontological resource in ontology
Requirements specification	Users shall be able to search (look up) for ontological elements in all the ontologies loaded in the system
Input Specification	
User input	Name (or substring) of the element to look up: <i>seabass</i>
Output Specification	
Screen display of query result	List of ontological elements (Concept, Property, Instance) that match the user query
Special procedural requirements	
n/a	n/a
Intercase dependencies	
n/a	n/a
Pass/Fail	
Special Criteria	n/a
Result	Passed
Comments	<ul style="list-style-type: none"> a) The search should not be case sensitive, or depending on the charset used (e.g., “atun” and “atùn”). b) The search returns different result set if the keyword “bass” or “seabass” is used; the second set is richer than the first. c) Although there exists Latin names as property of the knowledge base instances, they are not indexed, hence cannot be used as search keyword

Use Case Identifier	UC-8
Use Case Description	
Title	Browse Taxonomy
Requirements specification	<p>The system shall allow authorized users to browse fisheries concepts, attributes and relations.</p> <p>The system shall support several modes of viewing ontologies:</p> <ul style="list-style-type: none"> - Rubber-band - Hierarchical
Input Specification	
n/a	n/a
Output Specification	
n/a	n/a
Special procedural requirements	
n/a	n/a
Intercase dependencies	
n/a	n/a
Pass/Fail	
Special Criteria	n/a
Result	Passed
Comments	<ul style="list-style-type: none"> a) The panel displaying the taxonomy increase its height each time a new node is expanded, pushing the “Entity information” panel out of the visible widow size b) The nodes of the taxonomy only expand if the little arrow on the left end of each tree item is clicked. c) The labels of the nodes, that are longer that the panel width, are displayed in two lines, giving the effect of an extra tree node.

Use Case Identifier	UC-11
Use Case Description	
Title	Query composition
Requirements specification	Users shall be able to input ad-hoc queries, both using free-text and by highlighting concepts/relationships suggested by the currently loaded ontology set
Input Specification	
User input	User select to input a value in any of the input field presented in the "Query widget", according to which property he/she decides to search upon. User can decide to have multiple properties selected by checking/unchecking each one in the interface. Ex. hasBatimetryMin >10 <i>and</i> hasBatimetryMax < 300
Output Specification	
Screen display of query result	The "Query Result" panel list all the elements of the knowledge base that are positive to the query criteria
Special procedural requirements	
Check the property to be included as search criteria	The user needs always to check those properties that he/she intends to use for his/her search.
Intercase dependencies	
n/a	n/a
Pass/Fail	
Special Criteria	n/a
Result	Passed
Comments	a) It is useful to have a mechanism to autocheck the properties for which the user has input a non null value

Use Case Identifier	UC-12
Use Case Description	
Title	Query for data related to individual
Requirements specification	Users shall be able to query for data instances part of the knowledge base
Input Specification	
User input	see UC-11
Output Specification	
The list of result	The "Query Result" panel list all the elements of the knowledge base that are positive to the query criteria
Special procedural requirements	
n/a	n/a
Intercase dependencies	
UC-11	Query composition
Pass/Fail	
Special Criteria	n/a
Result	Passed
Comments	<ul style="list-style-type: none"> a) For "FAO Specie" and "FAO Aquatic Resource" taxonomies, not all the properties return a result when expected. This is probably due to reduced data present in the knowledge base. b) For "Water Area" and "Land Area" the application throws a message of exception. c) Some input field (e.g., hasFAO3AlphaCode) are case sensitive, when it is not particularly useful. There is no possibility of ranking or clustering the item in the result set

Use Case Identifier	UC-13
Use Case Description	
Title	Visualize data source related to individual
Requirements specification	Data instances linked to proprietary applications such as DOC and PDF are URL link
Input Specification	
n/a	n/a
Output Specification	
The source of the data	A window displaying the fact sheet of the resource selected among the result set items
Special procedural requirements	
Select one item from the list of result	The user has to click on any item in the list of result to see the source of data (i.e. the fact sheet) opening in a new window.
Intercase dependencies	
UC-12	Query for data related to individual
Pass/Fail	
Special Criteria	n/a
Result	Passed
Comments	<ul style="list-style-type: none"> a) The window displaying the factsheet prevents any action with the main FSDAS interface until it is closed. This forbids to collect multiple factsheet for later consultation b) The window displaying the factsheet cannot be displaced around the screen, preventing to at least interact visually with the mains FSDAS interface, to check the validity of the result obtained from the query

Use Case Identifier	UC-14
Use Case Description	
Title	Refine query
Requirements specification	See UC-8, UC-12
Design specification	See UC-8, UC-12
Input Specification	
See UC-7, UC-12	See UC-8, UC-12
Output Specification	
See UC-7, UC-12	See UC-7, UC-12
Special procedural requirements	
See UC-7, UC-12	See UC-8, UC-12
Intercase dependencies	
n/a	n/a
Pass/Fail	
Special Criteria	Re-perform both type of search narrowing or widening search scope
Result	Passed
Comments	<ul style="list-style-type: none"> a) The execution of this use case is possible by changing the value of the search field in the perspectives (panels) of both types of searches.

Annex 9 – Usability testing post-task questionnaire summary

- There are too many possibilities presented at once, I didn't know where to start from
- I didn't know where to look to read the information of the selected resource, after the search
- What do I do next?
- I don't know how to assess the validity of the result because I have aquaculture background.
- I couldn't find what I was expecting to find in the result set.
- I understood "localname" as the name used in some region for the same specie.
- A help section is definitively needed.
- I figured out that I forgot to check the query I wanted to run, but the error message did not help me very much.
- I can understand the potentiality of FSDAS and I would like that also aquaculture domain was covered as part of the knowledge base.
- I find FSDAS very useful in cases when I need to collate data, verify them or have some support to generate reports