

Project no. 310806

**Providing a new generation of methodologies and tools for
cost-effective risk-based animal health surveillance systems for the benefit of
livestock producers, decision makers and consumers**

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Deliverable D6.25

Web-based decision support tools

WP6 – Decision making tools for implementing risk-based surveillance

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1 Summary

Design of animal health surveillance systems, the use of correct and relevant statistical methods and algorithms, and the evaluation of these surveillance systems, are tasks that are comprehensive regarding competence, accessibility and efficiency.

Combining all these elements into one online web tool, designed to assist the users throughout all steps of these processes by the use of decision pathways, examples and best practices, would lead to more surveillance being performed, more cost effective use of resources and more accurate information being generated.

The RISKSUR web tools are a one-stop web site for the complete design of animal health surveillance. The web site is both a design tool in it self, but also a portal for accessing more in-depth insight into the field of expertise of animal health surveillance through the use of wikis. The wikis serve a purpose of being the knowledge information bank for the design and evaluation processes, but also serve as educational platforms, as well as platforms for continuous updating of experiences, examples, methods and best practices in this important field.

The RISKSUR web tools are assisting the user to take the right decision. They feature a user-friendly interface, relevant information presented in an understandable format, logical design processes and relevant examples. The first complete presentation of the web tool produced very positive feedback.

The tool guides the user through the design process by only showing the relevant information regarding the current choices. At the same time the user can access additional yet relevant research work and guidance in the wikis.

As the web tool (including the wikis) fill up with more and more surveillance designs, evaluation protocols, examples and best practices, designing animal health surveillance systems and evaluating these will become more and more efficient.

We encourage you to try it out.

2 Objectives

The main objective of WP6 was to translate the frameworks, methodologies and algorithms developed under WPs 1 to 5 into a practical and accessible web-based decision support tool enabling decision makers, industry and the broader scientific community to take advantage of the research outcomes.

The objectives of this work package were to:

- a) Develop low-level functions implementing the analytical methodologies generated in this research, to allow others to use them simply and correctly to plan, design, implement, analyse and evaluate risk-based surveillance systems. Covered in deliverable D6.24.
- b) Develop a user friendly web-based decision support tool that guides through the different components of the evaluation and decision support frameworks linking in the tools including low-level functions relevant at each step of the process. Covered in this deliverable report.
- c) Explore the value of implementing selected tools on mobile devices including use of cloud computing services. Covered in deliverable D6.26

2.1 Tasks in WP6

2.1.1 Task 6.1 Statistical software package

Task description: Develop a statistical software package encapsulating functions for design of surveillance systems, in particular involving risk-based sampling.

This task was completed and reported as deliverable D6.24, hence no description in this report.

2.1.2 Task 6.2 Development of user-friendly accessible web-based decision support tool

Task description: Development of user-friendly accessible web-based decision support tool implementing methodologies for design and evaluation of surveillance systems (with specific reference to risk-based systems) The frameworks and tools developed as part of RISKSUR will be integrated into a web-based decision support system that guides users through the various steps in the design of a risk-based surveillance system. The utility of the software tools will be evaluated by involving end users during the development process.

2.1.2.1 Task 6.2.1 Implement web-based decision support tool

Task description: The evaluation and surveillance design frameworks will be converted into a series of decision trees which will be linked to appropriate methods and tools that can be used to perform relevant tasks. In this way, R functions developed in Task 1, or groups of them, will also be made readily accessible to end users. For these analytical components, the interface will gather the required parameters, and present useful output, including not only statistical values, but, where applicable, graphical output as well. These tools will be developed using an existing proven framework for the web-based delivery of epidemiological software (EpiTools), making development more rapid, and giving users access to a wide range of other complementary epidemiological calculators. The web-based surveillance decision support tool will be made available through a dedicated European portal. Arrangements will be made to ensure that these tools are sustainably hosted and continue to be available after the completion of the project. The utility will be assessed by consultation and training sessions with end users to be organised under WP7.

2.1.2.2 Task 6.2.2 Develop on-line documentation

Task description: Documentation, including worked best practice guidelines developed under WPs 2-5 together with examples and tutorials, will be developed and integrated into the web system to ease users understanding of how to use the tools. Initial draft documentation prepared by WP leaders for WP 2, 3, 4 and 5. Edited and standardised by WP6 leader. Implemented in web system by TT and AC under RVC.

2.1.2.3 Task 6.2.3 Implement a multi-lingual interface translated into the main EU languages

Task description: To further enhance access to the surveillance decision support tool, a multi-lingual interface for the web-based system will be developed. A multi-lingual programming interface with UNICODE was used. Dialogue boxes and inputs will be provided as there are different word lengths in several languages. This will allow ready access by scientists across the EU. The system will initially be translated into four of the major languages represented by consortium members, but the translation files will be made available for user-based translation into further languages as may prove necessary.

2.1.3 Task 6.3 Mobile and cloud computing tool development

Task description: To further enhance access to the required tools, this task will explore the value of making specific tools available to users with mobile devices and allow centralised computing and data storage via cloud services. This task is reported on in Deliverable D6.26.

3 Description of the web based decision tool

This section addresses the actual deliveries according to the corresponding tasks in WP6. As the actual deliverable is an online web tool, an overview of the system components is described here, supplemented by screenshots for visualisation. For actual reference one should log on to the system. (Anyone can register as a user).

The system is currently (until mid November 2015) available through this link: [RISKSUR WebTool \(https://stage.tracetracker.com/risksur/site/login\)](https://stage.tracetracker.com/risksur/site/login). After transition to the hosting partner (FLI) the system will be available through this link: www.webtools.fp7-risksur.eu

3.1 Development of user-friendly web-based decision support tool.

The system consists of five parts (Figure 2-1):

1. A tool for designing surveillance systems.
2. A tool for designing components within a surveillance system.
3. A tool for evaluation of a surveillance system.
4. A tool for statistic methods to be utilized in a surveillance system.
5. Administrative tools for the complete package.

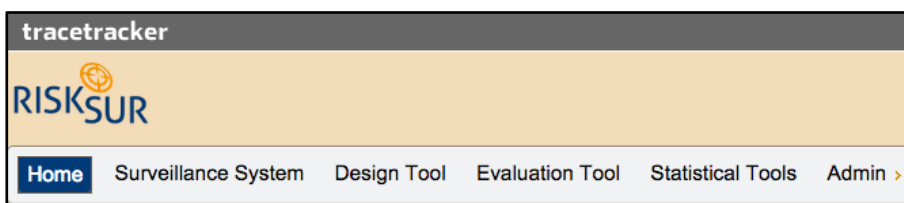


Figure 3-1 RISKSUR main menu

There are three major attributes for the decision support tool:

1. The functionality of the tool includes design and evaluation of surveillance systems.
2. The tool has to be easy to use for all user groups.
3. The use cases and documentation has to be informative, supportive and encourage the user in his work.

3.2 Designing Surveillance System

The surveillance system is necessary for both the Design and the Evaluation tool. The user can design a new surveillance system or choose an existing one. The chosen system will always be shown as active in the uppermost right corner of the screen.

In designing a new surveillance system, the user is guided through a pathway of valid choices, making it ease to design the system.(Figure 3-2)

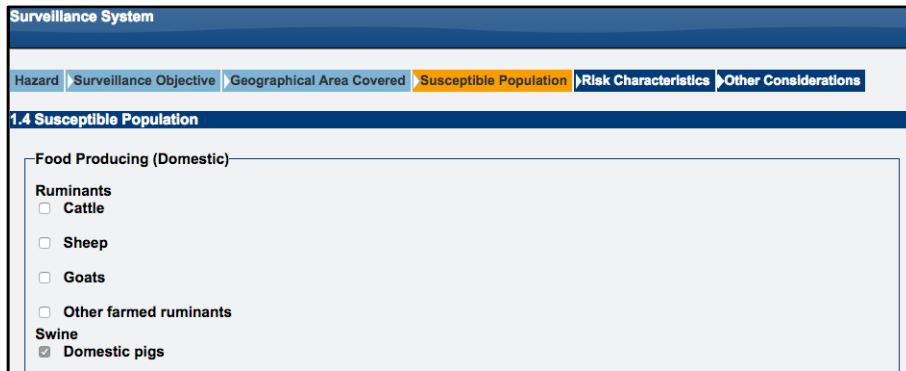


Figure 3-2 Pathway for designing surveillance system

The specific parts of the surveillance system are:

- Describing the **hazard** (disease) to be addressed,
- The **objective** of the surveillance,
- The **geographical area** to be covered,
- The **susceptible population** (the species),
- The **risk characteristics** associated with the above. The risk factors can be described on different levels, like population level, herd level or animal level. An example of population level risk factors is shown in (Figure 3-3),
- Any other considerations associated with the surveillance system.

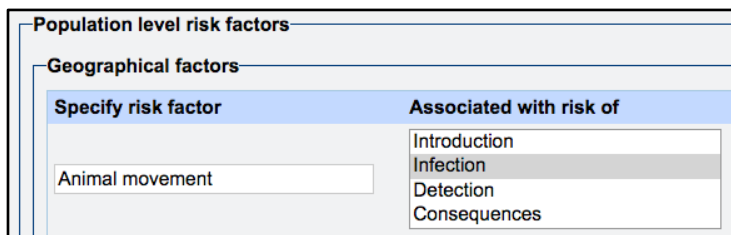


Figure 3-3 Population risk factors

Please visit the [RISKSUR wiki](http://surveillance-design-framework.wikispaces.com/1-Surveillance+system) for a complete description and guidance of the design of surveillance systems. (<http://surveillance-design-framework.wikispaces.com/1-Surveillance+system>)

3.3 Design Tool

After designing the surveillance system, components making up the surveillance system are to be defined. A component is a single surveillance activity used to investigate the occurrence of one or more hazards. Several components make up a surveillance system or a surveillance portfolio depending on whether the occurrence of one or more hazards is investigated.

The user can choose existing components by picking one to edit in the list (Figure 3-4), or make (add) new ones.




Name	Target Species	Target Sector	Geographical Area Covered	Data Collection Point	Study Type	Type of disease indicator	Type of sample collected	Edit
Active surveillance in wild boar	Wild boar	All	Rhineland-Palatinate	At the source (farm, wild life habitat, etc)	Continuous data collection	Antibody detection	Blood / Serum / Plasma	
Passive surveillance in wild boar	Wild boar	All	Rhineland-Palatinate	At the source (farm, wild life habitat, etc)	Passive surveillance	Pathogen detection	Tissue (post-mortem)	
pigs	Pigs	All	dsdf	Abattoir	Survey	Pathogen detection	Ear notch	

Figure 3-4 List of surveillance components

When creating new components, the user enters information about the component (Figure 3-5). “Mouse-over” functionality is implemented to inform the user about the meaning of the specific cell, as well as drop down lists for choosing one of the predefined values (Figure 2-6).

Component Name *	Target Species *	Target Sector *	Geographical Area Covered *	Data Collection Point *	Study Type *	Type of disease indicator *	Type of sample collected *
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Select one ▾	Select... ▾	Select one ▾	Select... ▾

Figure 3-5 Create component

A complete list of all components with all its characteristics and values can be viewed on screen, printed or exported in PDF, CSV or Excel format (Figure 3-7).

Name	Value
Surveillance System	
Surveillance system	CSF wild boar
Hazard name	Classical swine fever
Surveillance objective	Early detection
Active surveillance in wild boar	
Component name	Active surveillance in wild boar
Target Species	Wild boar
Target Sector	All
Geographical Area Covered	Rhineland-Palatinate
Data Collection Point	At the source (farm, wild life habitat, etc)
Study Type	Continuous data collection
Type of disease indicator	Antibody detection
Type of sample collected	Blood / Serum / Plasma

Figure 3-7 Report of surveillance components

Data Collection Point *

Select one ▾

At the source (farm, wild life habitat, etc)

Abattoir

Coordination centre

Artificial insemination centre

Rendering plants

Diagnostic laboratory

Markets

Figure 3-6 Drop down list

Please visit the [RISKSUR wiki](http://surveillance-design-framework.wikispaces.com/2-Surveillance+components) for a complete description and guidance of the design of surveillance components. (<http://surveillance-design-framework.wikispaces.com/2-Surveillance+components>)

3.4 Evaluation tool (EVA tool)

The evaluation tool is a decision making tool for the design of evaluation protocols, by considering questions such as:

- Why do I need/want to evaluate my system?
- What should I assess?
- How can I do the evaluation?

The EVA tool allows you to design an appropriate evaluation for your situation, but it is not a tool for actually carrying out an evaluation.

The EVA tool takes you through a four step process:

1. Describe the evaluation context
2. Select the evaluation question
3. Select the evaluation method
4. Review summary of evaluation protocol

The EVA tool, together with the RISKSUR wiki, offer a deep introduction into and description of the various aspects of evaluation of (animal health) surveillance systems.

3.4.1 Evaluation context

The user can create a new evaluation context or choose to select or edit an existing one. A list of existing evaluation contexts is presented (Figure 3-8).

▲ Evaluation name	◇ Surveillance System	◇ Evaluation Question
ASF surveillance in Poland	CSF wild boar	Assess whether one or more surveillance component(s) is/are capable of meeting a technical effectiveness target
CSF in wild boar	CSF wild boar	Assess the costs and effectiveness of surveillance components (out of two or more) to determine which achieves a defined effectiveness target at least cost, the effectiveness needs to be determined

Figure 3-8 Existing evaluation contexts

3.4.2 Evaluation question

To create the evaluation question the user is guided through a pathway assisting the user in his choices (Figure 3-9). The choices the users have made for each step are shown on the right side of the screen. The user always has the option of going back and making adjustments or seeking more clarification through accessing the wiki (the question mark box).

?

What do you want to evaluate?

Evaluate the effectiveness of the system
 To evaluate the strengths and weaknesses of the structure, function and processes of the system

Back

Next

Q: Assess whether one or more surveillance component(s) is/are capable of meeting a technical effectiveness target
A: Evaluate a surveillance system

Q: Are you aiming to evaluate or to re-design surveillance to improve its performance?
A: To evaluate the system

Q: Are you aiming to evaluate or to re-design surveillance to improve its performance?
A: To evaluate the system

Figure 3-9 Evaluation question pathway

3.4.3 Evaluation method

Upon selecting the evaluation method, the user is presented with both an evaluation summary as well as a list of evaluation attributes that are thought to be relevant for the particular evaluation question and surveillance objective (Figure 3-10). The user can select multiple attributes. The next step will then be to choose or create the assessment methods for each attribute, and finally, if applicable, an economic analysis technique.

	Attribute Name ◇	◇ Attribute Description	Attribute ◇ Type	Relevance ◇
<input type="checkbox"/>	Bias	The extent to which a prevalence estimate produced by the surveillance system deviates from the true prevalence value. Bias is reduced as representativeness is increased.	Effectiveness	High
<input type="checkbox"/>	Timeliness	Timeliness is usually defined as the time between any two defined steps in a surveillance system, the time points chosen are likely to vary depending on the purpose of the surveillance activity. For planning purposes timeliness can also be defined as whether surveillance detects changes in time for risk mitigation measures to reduce the likelihood of further spread.	Effectiveness	High
<input type="checkbox"/>	Coverage	Refers to the proportion of the target population that is included in the surveillance activity when using risk-based approaches coverage refers to the proportion of the selected populations included.	Effectiveness	High

Figure 3-10 Relevant evaluation attributes

3.4.4 Summary of evaluation protocol

When all steps are conducted a summary page containing all info is presented, which can be printed or exported (PDF, CSV, Excel). In addition, some advice is presented on how to perform the evaluation and how to report on evaluation results.

3.5 Statistical tool (EpiTools)

As a central component in the RISKSUR web-based decision support tool package, the statistical tool is accessible through a main menu link. The functionality of the tool itself is described in the RISKSUR deliverable D6.24. (RISKSUR D6.24)

3.6 Administrative tools

There is a set of administrative tools accessible for administering for example users, user questions, user options (elements in drop down lists) and user pathways (Figure 3-11Figure 3-11 Admin menu).

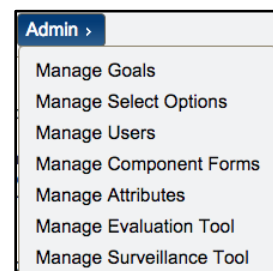


Figure 3-11 Admin menu

3.6.1 Manage Goals

Here the administrator can create, edit or delete surveillance objectives.

3.6.2 Manage Select Options

Here the administrator can create, edit or delete user options in drop down lists. There is a specific section for each of the Surveillance System, Design Tool and EVA Tool.

3.6.3 Manage Users

Here the administrator can create, edit or delete users. A specific role can be assigned to each user. Users can register themselves by accessing the “register” link on the RISKSUR web site. Users are asked for entering a username, an email address and a password. In case of forgotten password, the user can request a new password, upon which an email-link for resetting the password is sent to the user (Figure 2-12).

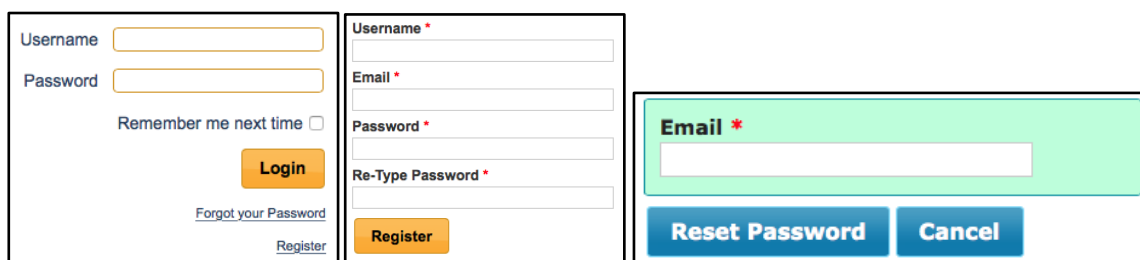


Figure 3-12 Login page, user registration, reset password

3.6.4 Manage Components Form

Here the administrator can create, edit or delete form elements in the Design Tool.

3.6.5 Manage Attributes

Here the administrator can create, edit or delete evaluation attributes, as well as relations between attribute and the assessment methods.

3.6.6 Manage Evaluation Tool

Here the administrator can create, edit or delete all elements in the EVA Tool. This covers the management of the:

- Evaluation context form
- Evaluation questions
- Evaluation attribute relevance
- Evaluation assessment methods
- Economic evaluation methods
- Evaluation method & question link
- Economic analysis techniques

3.6.7 Manage Surveillance Tool

Here the administrator can create, edit or delete all elements in the EVA Tool. This covers the management of the wizard (pathway) and the drop down options.

3.7 Online documentation

The online documentation is implemented in the system at several levels. There are some overlaps between the different levels, mainly to assist users in the use of the online tools. This section describes how the documentation is implemented, both to ease the use of the tools and to support clarification, consideration and understanding of the decisions the tools are supposed to support.

3.7.1 Ease of use

Ease of use has been a prioritized task in the development. Several techniques (functionality and implementation) are used to ensure a user friendly interface.

3.7.1.1 Wizards

Both in the Surveillance tool and EVA tool the user is guided through the application by the use of wizards (follow a pathway). The wizards ensure that only relevant information is presented to the user.

3.7.1.2 Mouse-over

Mouse-over is a technique that allows explaining specific cells in the application. When the mouse pointer is moved to a cell, an information box gives guidance for that particular cell.

3.7.1.3 Context dependent information

Throughout the whole web tool the user is presented with information about how to use the tools, explanation of the context and a summary of steps already performed. The different pages are quite information rich in order to guide the user to perform the best decisions possible.

3.7.2 Examples, tutorials and best practice guidelines

Two wikis were created for the design framework and for the evaluation framework. These wikis are independent of the web tool, but are accessible through hyperlinks throughout the application. The wikis will be updated continuously as new examples and use cases become available.

Best practice guidelines are also implemented in the web tool as descriptions of questions, attributes, assessments and methods (especially in the EVA Tool).

3.8 Multi-lingual interface

The web tool has implemented a multi-lingual support through translation files. At the present moment a French language version is under implementation. The support of other languages is a relatively straight forward task, adapted through a language file.

However, as most of the examples, tutorials and best practice guidelines resides in the English language in the wikis, and the wikis are integrated in the web tool (as part of the online documentation), language inconsistencies could occur when the user accesses the wikis.

4 The development process

4.1 Timing

The structure of the project was sequential, where the actual web development came late in the project. This made the development process vulnerable for delays in earlier deliveries that the development process depends on. In this project there were delays in early deliveries, but this was compensated by intensifying the latest stage of the development.

4.2 Architectural design

Architectural design built on standards for information handling, process design and communication, can make system development very efficient. Standards for process design, information exchange etc. often offer good guidelines both regarding information elements, structure of information flow, data modelling and user acceptance. Such standards are often the common denominator across industries and widely adopted. One such portfolio of standards is accessible through GS1 (an organization that owns the barcode specifications used in global trade).

4.3 Prototyping by Excel

Microsoft Excel was used for prototyping the Design Tool. Despite the lack of proper architectural design including a data model, the Excel prototyping was very helpful for the development process. Excel is an excellent tool for prototyping as many users know Excel and are capable of designing both the desired functionality and the graphical appearance. A functional and visual prototype are very valuable in development projects, as it both puts the users need in focus and at the same time creates a fundament for bridging the gap between the user and the developer; few users understand coding and few developers understand the expert field of the user.

4.4 Application Life Cycle Management

Every application has its life cycle. These processes are normally:

- Requirements management (covered in the project)
- Software architecture management (covered in the project)
- Application development (covered in the project)
- Application management
- Change management
- Incident management
- Release management
- Service and support management

As many of these life cycle elements take place after the development phase, a funding for these elements will need to be addressed. This could be achieved by different business models like a subscription fee for

advanced users or corporations, by implementing a freemium model (free basis, pay for more functions) or by adding other value adding payable services.

Regarding the RISKSUR online web tools, they will be hosted by FLI, whereas the remaining stages in the lifecycle will be handled by the developer, financed by the consortium for the first 12 months after the project end. This will ensure proper bug-fixing, changing or adding new functionality and user support.

4.5 Web-team

Throughout the development period, a dedicated web-team has been performing several critical tasks, amongst:

- Ensuring that all essential functions are transferred from the WPs 1-5.
- Ensuring that all design aspects from the Excel prototype are transferred.
- Acting as QA for ensuring user-friendliness.
- Acting as a test team for all above issues.

The team has established a good communication with development, both regarding documentation, feedback on development and releases and through frequent web-meetings. The team, representing both the design framework and the evaluation framework, was crucial for the intense development period from month 32-36 in the project.

4.6 Rapid releases

Both in order to utilize the web-team and to ensure proper progress of development, short sprints were chosen, mainly weekly. The downside of such frequent development and release cycle is that the test regime was less prioritized. The upside is, however, that feedback on development becomes very close and direct. For the last period of the project this has been a necessity.

4.7 Test regime

In this project, the normal test regime has been prioritized down in order to speed up the delivery process. This might have increased the risk for unnoticed bugs in the application or in the operating environment. However, the intense user testing probably compensated for some of this higher risk as this testing represented a more holistic approach.

5 Discussion and conclusion

The main objective of this work package was to create a practical and accessible web-based tool that would let decision makers, industry actors and other scientists take advantage of the research outcomes from work package 1 to 5.

The tools are, as of the time when this report is written, not yet accessible for the broad user community, so in order to decide whether this objective is fulfilled or not, we would let the feedback from the presentations on the final RISKSUR project meeting indicate the status:

- The web tool is very easy.
- The process (pathway) is very useful, even experts learn from it.
- It forces you to think.
- Good to have this level of info (much and relevant information in a structured presentation).
- The EVA tool is the real value add of the RISKSUR project.
- The design tool is easy to use and implement into surveillance activities.
- The tools (including the frameworks) gives tangible results.
- The tools reduce the gap between what users expects and what they get.
- The tools also detect non-optimal (inefficient) surveillance systems.
- The web tools, including the wikis, is an easy to use guidance that is very helpful.

The major takeaway from the feedback is that the web-based tools have fulfilled the main objective of the work package.

The tool is very easy to use and guides the user through the process by only showing the relevant information regarding the current choices. At the same time the user can access additional yet relevant research work and guidance in the wikis.

As the web tool (including the wikis) fill up with more and more surveillance designs, evaluation protocols, examples and best practices, designing surveillance systems and evaluation protocols will become more and more efficient.

Implementing both surveillance design, evaluation protocols and statistical packages, in one web-site, structured and user friendly for users is a comprehensive task, as these three fields of expertise are neither easily accessible nor common knowledge.

Our conclusion is that the implementation of the web tools has proven that this was achievable.

6 References

RISKSUR D2.8 (april 2015) Framework and tools for the design and evaluation of surveillance strategies for early detection.

RISKSUR D4.16 (April 2015) Description of frameworks to inform the design of surveillance systems for efficient case finding and disease frequency estimation for endemic disease as well as for multi-objective surveillance systems.

RISKSUR D5.18 (Juli 2015) Evaluation framework and methods for economic assessment.

RISKSUR D5.19 (September 2015) Protocols for standardised data collection for the evaluation of novel surveillance designs.

RISKSUR D5.20 (April 2015) Case study selection for economic evaluation framework development and validation.

RISKSUR D5.21 (September 2015) Evaluation criteria for evaluation of the novel surveillance designed developed within RISKSUR project.

RISKSUR D5.23 (October 2015) The EVA tool, a decision tool for the economic evaluation of animal health surveillance.

RISKSUR D6.24 (January 2015) R package of functions for risk-based surveillance.

7 Annex - Methods used for development

This chapter describes in short the development methodologies used by TT during the project.

7.1 SCRUM and Kanban

SCRUM is an iterative and incremental agile methodology. The method encourages close collaboration between team members and focuses on quick deliveries that responds to emerging requirements. In TT SCRUM is implemented through a web tool from Atlassian (JIRA). Kanban (order size of 1) is used to ensure tasks are handled in a prioritized manner, and that there's as little inefficient time in development as possible. Kanban is one method of organizing work tasks within SCRUM.

7.2 Short sprints

Development has been organized in very short sprints, mainly on a weekly basis. This rapid development is made possible by breaking down the work into small achievable tasks, in combination with frequent user feedback.

7.3 Prototyping

“One picture says more than thousand words”. This also accounts for visual prototypes, enriched with the required functionality. Excel was used for prototyping.

7.4 User testing

User involvement is often a critical task in software development. In the project people from other WPs have acted as users in the testing of the application. They were users that both know the mission of the tool and have a clear view of how the tool should meet that mission.

7.5 Test regime

TT has both an environment consisting of applications and databases in different stages to support the development and testing regimes, and a test regime that consists of developer's test, functionality test, operating test, systems test and finally users test. Parts of this regime have been utilized in the development process.

7.6 Description of the development environment

This is the components used during the latest stage of development of the on-line web-tool (Figure 7 1).

	RISKSUR	Epitools
Webserver requirements		
	Ubuntu 14.04	Ubuntu 14.04
	Apache 2.4.7	Apache 2.4.7
	MySQL 5.4.44	MySQL 5.4.44
	PHP 5.5.9	PHP 5.5.9
	libapache2-mod-php5	libapache2-mod-php5
PHP modules		
	php5-json	php5-json
	php5-apcu	php5-apcu
	php-http	php-http
	php-pear	php-pear
	php5-intl	php5-intl
	php-bcmath	php-bcmath
	php5-mcrypt	php5-mcrypt
	pecl / propro	pecl / propro
	pecl / raphf	pecl / raphf
	pecl_http	pecl_http
Development tools		
	A Good IDE such as PHPStorm, NetBeans or Eclipse	A Good IDE such as PHPStorm, NetBeans or Eclipse
	A Good MySQL client such as Workbench, phpmyadmin or SQLyog	A Good MySQL client such as Workbench, phpmyadmin or SQLyog
Other requirements		

Figure 7-1 Components in the web tool solution