# CYBECO

## Supporting Cyber-insurance from a Behavioural Choice Perspective

# D5.3: CYBECO Prototype 1.0

### Due date: M14

**Abstract:**
This report describes the CYBECO Prototype version 1.0.

| Dissemination Level | | |
|---|---|---|
| PU | Public | |
| PP | Restricted to other programme participants (including the Commission Services) | x |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

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# 1 Introduction

The CYBECO Toolbox is a web application that comprises two main modules:

- A Knowledge Base (KB) with cybersecurity and cyber insurance related content. The KB contains hierarchical taxonomies of entities such as cyber-insurance use cases and scenarios (provided by WP4), threats and security controls. All these entities in the KB will be interconnected; for example, a cyber-insurance scenario may include several threats and security controls.
- A Risk Analysis System that provides users with the means to search and test and experiment with a set of Risk Analysis cases.

The following Risk Analysis cases are implemented CYBECO Toolbox 1.0:

- A single SME facing cybersecurity risks: This case is from the perspective of the SME decision-making aiding it to choose the optimal cyber security portfolio and cyber insurance product.
- Risk analysis an SME (insurance company perspective): it aids the decision on whether to insure a particular SME or not.

# 2 CYBECO Toolbox v1.0 Functionality

CYBECO Toolbox is a web application that requires user registration. After registration, an authenticated user can access the KB and the risk analysis module. An unauthenticated user can only access the homepage and the contact page.

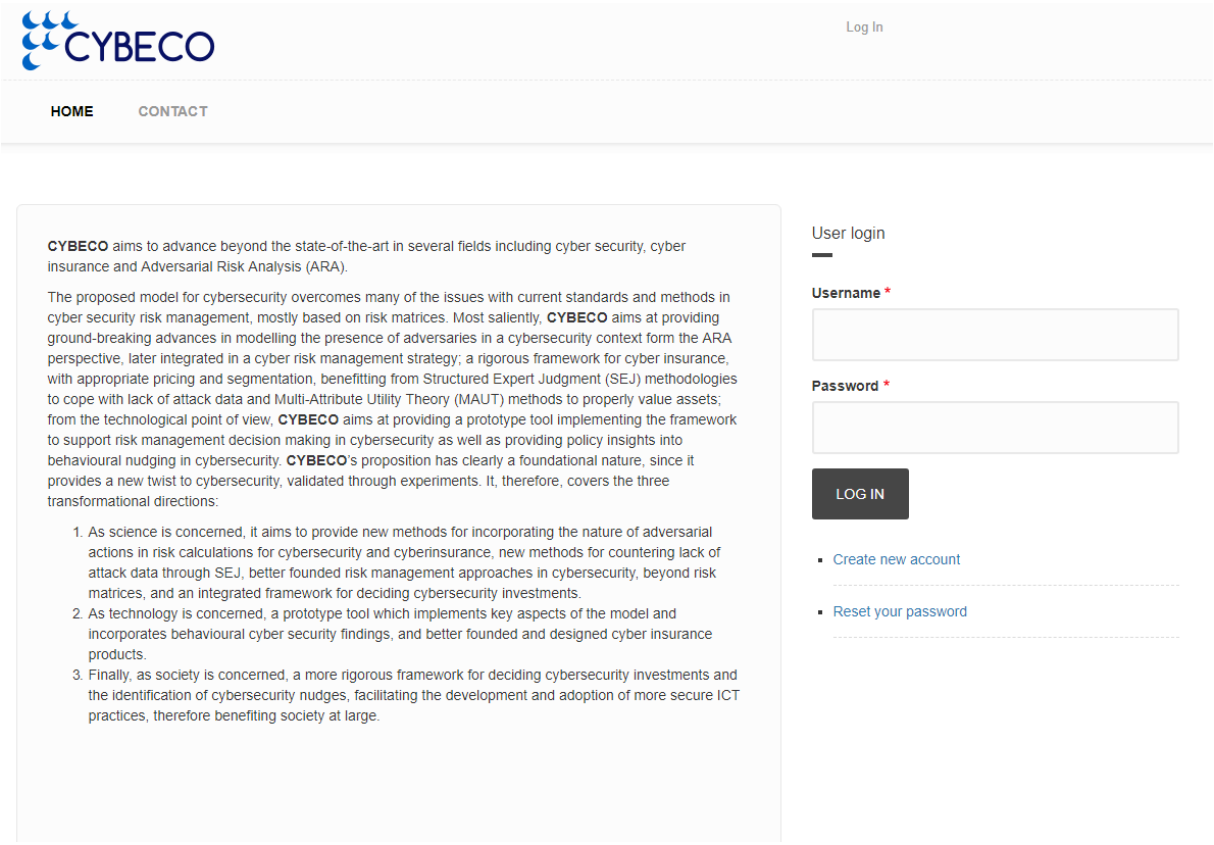


Figure 1 CYBECO Toolbox Homepage

## 2.1 KB Module

This module is used for organizing the CYBECO knowledge base in a structured way, allowing the user to easily navigate through the entries. The KB is organized in a tree like structure, where each branch is a category, which might contain subcategories. In each subcategory the user can find the knowledge base entries that fall under it, or easily go back and choose a different subcategory.

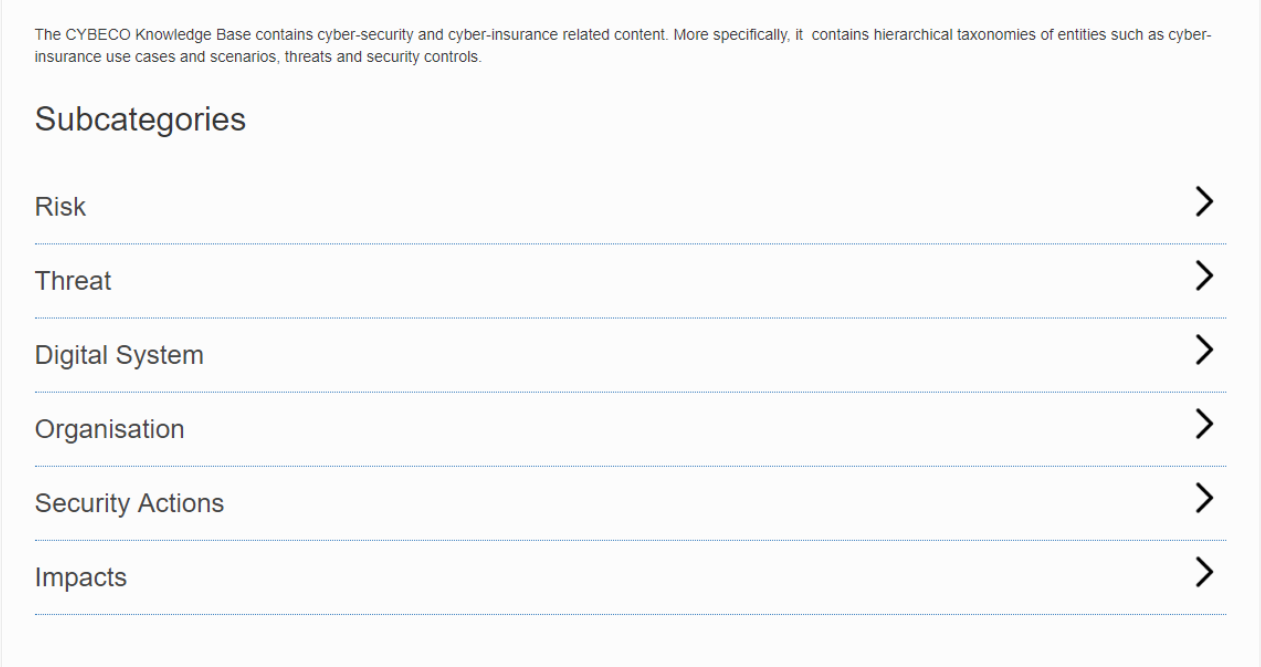


Figure 2 KB Taxonomy

All the knowledge base entries that fall under the same subcategory are grouped together, and the user can easily access them.

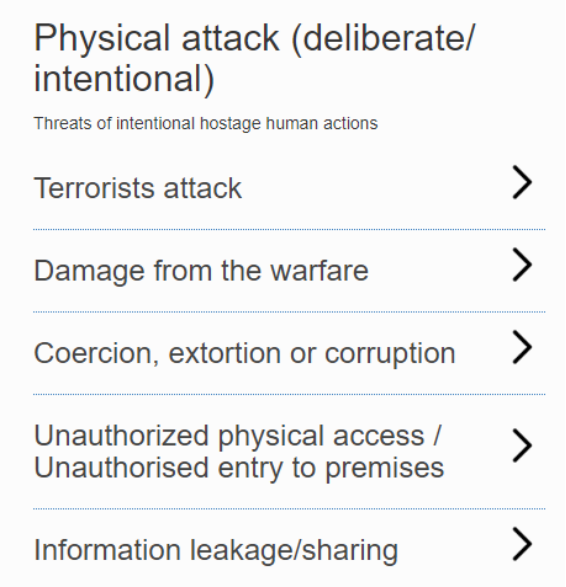


Figure 3 Taxonomy subcategories

Each entry provides a description of the term, and any related terms appear below it, allowing the user to click on them in order to see their more detailed description.

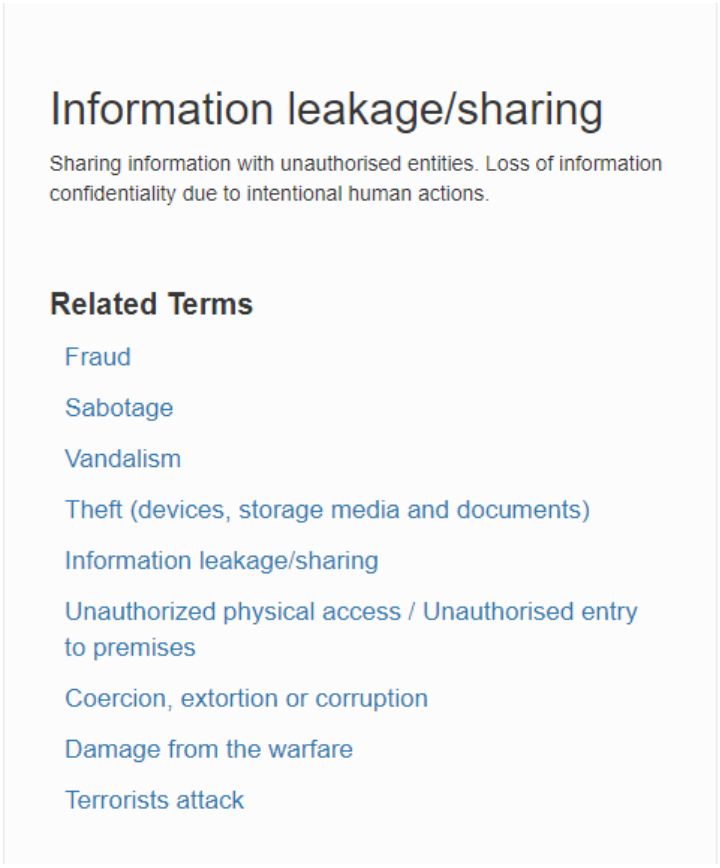


Figure 4 KB Term and related terms

The menu breadcrumb provides a path that appears on the top of the page for the logged-in users and assists with the navigation through the pages, by enabling the users to easily navigate to the parent elements.


Figure 5 Breadcrumb menu

The KB search engine provides the search functionality with autocomplete which makes it easier for the user to search for terms.

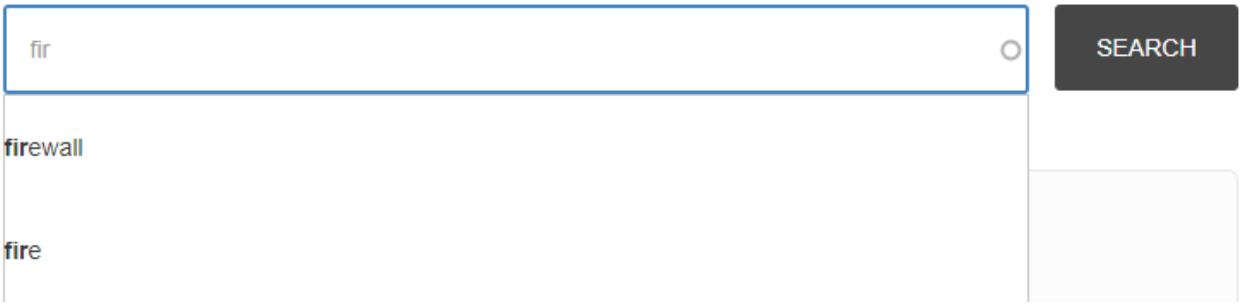


Figure 6 Search with autocomplete

## 2.2 Risk Analysis Module

The Risk Analysis module can be accessed by clicking on Risk Analysis on the main navigation bar, available only to the logged in user, providing links and short descriptions for the three risk cases.


Figure 7 Risk Analysis cases

By clicking on each risk case, the user is taken to an input page, specific for the selected risk case.

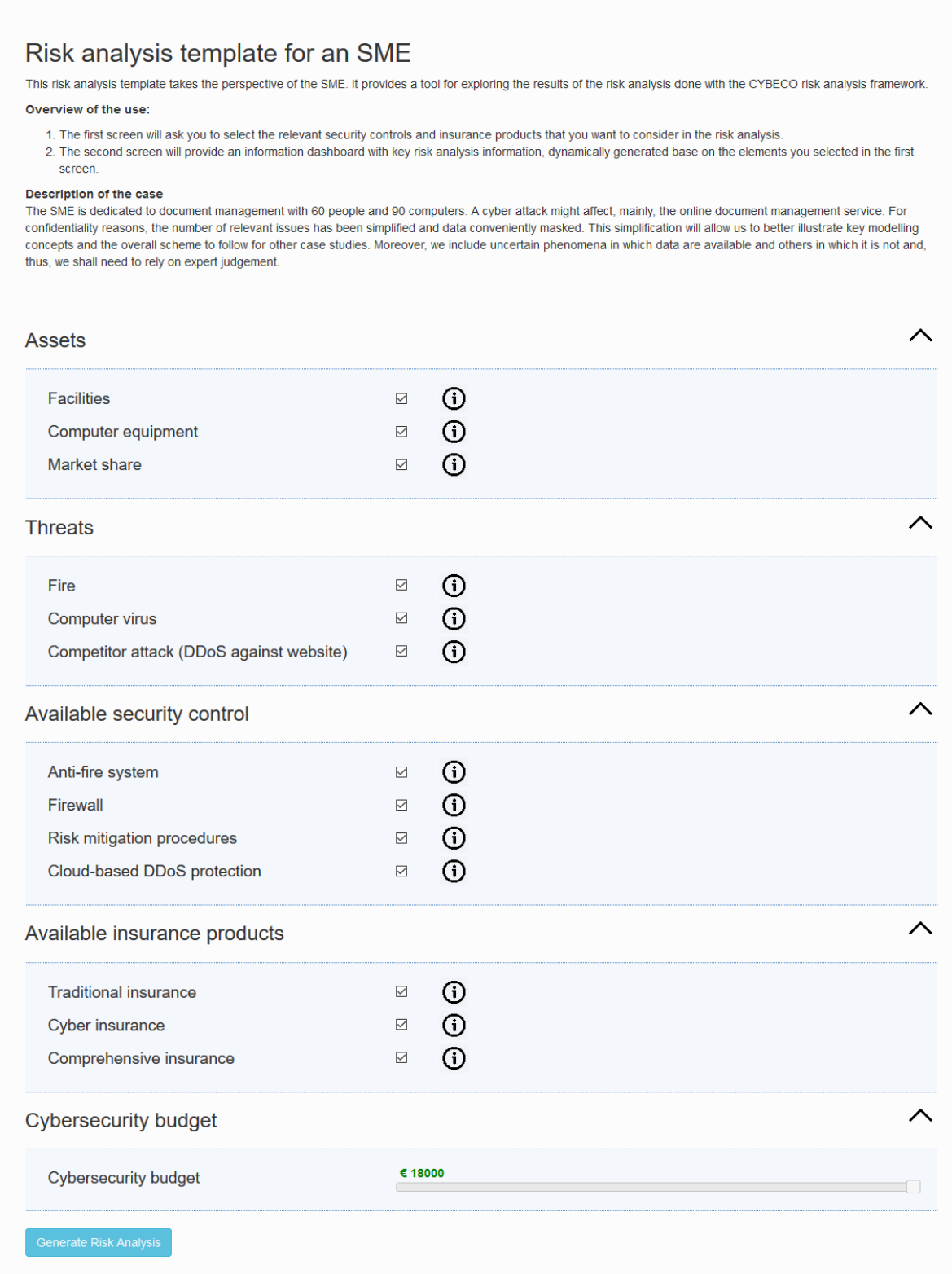


Figure 8 Risk case 1: Input screen

At the top of each input page, the user can read a description of the case, and then he or she can make the desired choices before proceeding to generate the risk analysis results. Hovering the over the information symbol can provide some extra information and a link to the knowledge base entry for that term.

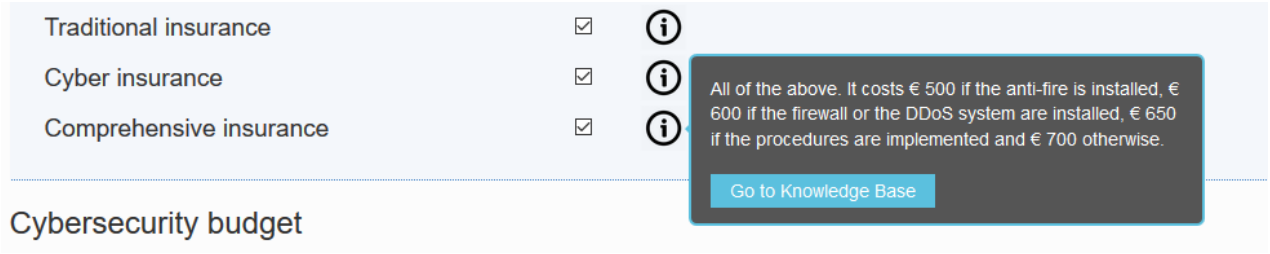


Figure 9 Insurance packet selection

Clicking on Generate Risk Analysis button will take the user to the results page.

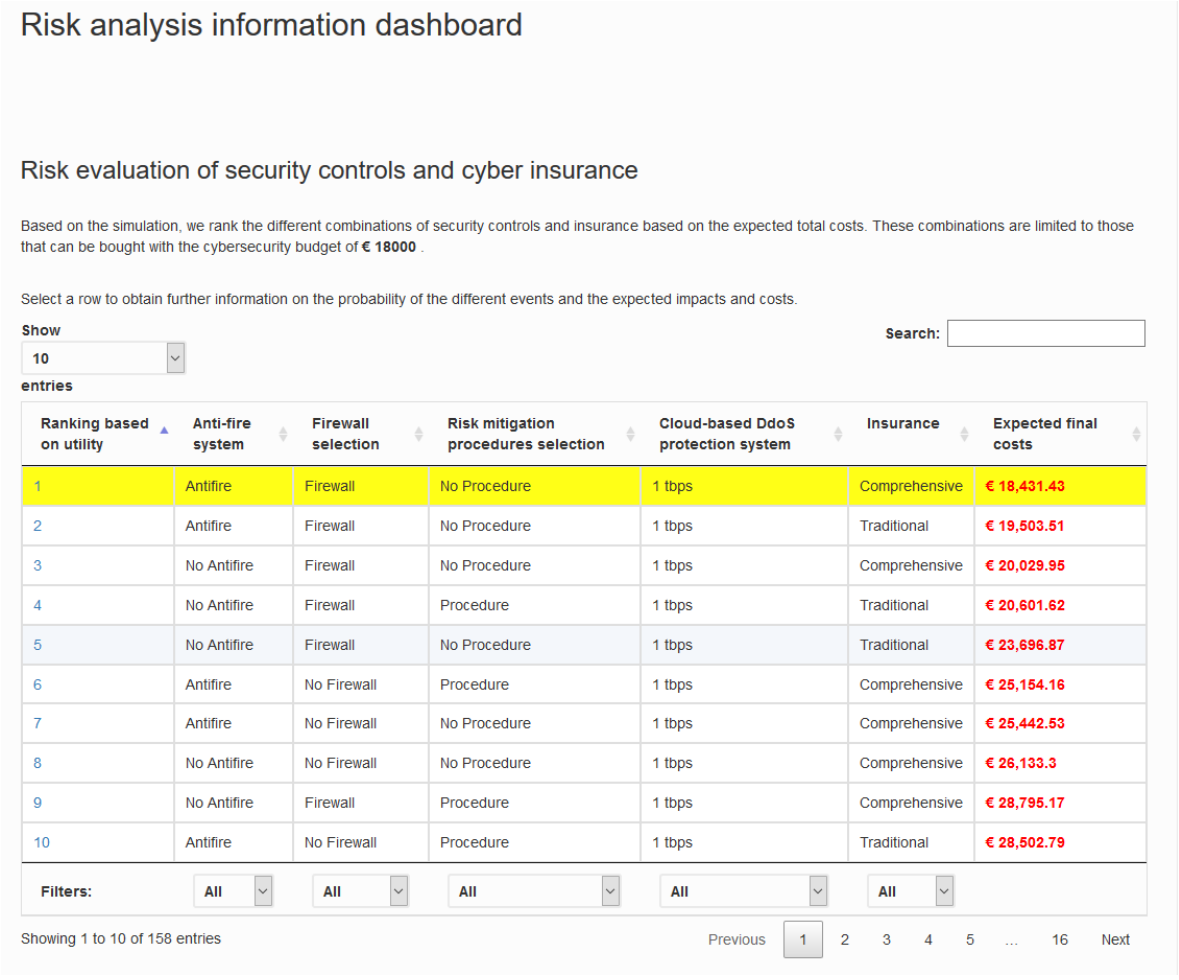


Figure 10 Risk Analysis results, portfolio ranking table

The table on the results page contains all the cases that are related to the user's input. This table can be sorted based on any of its columns and it can also be filtered in order to include specific only choices.

Following this table there is a graphical representation of some indicative results of the risk case, displaying the correlation between the ranking based utility and the expected total costs.

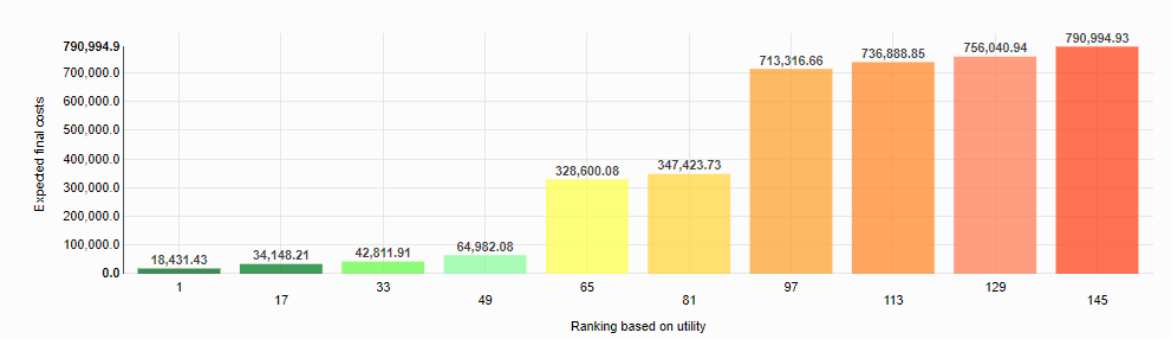


Figure 11 Insurance costs diagram

By selecting an entry on the results table, the user is navigated below the chart, where more detailed information about this specific result can be found.

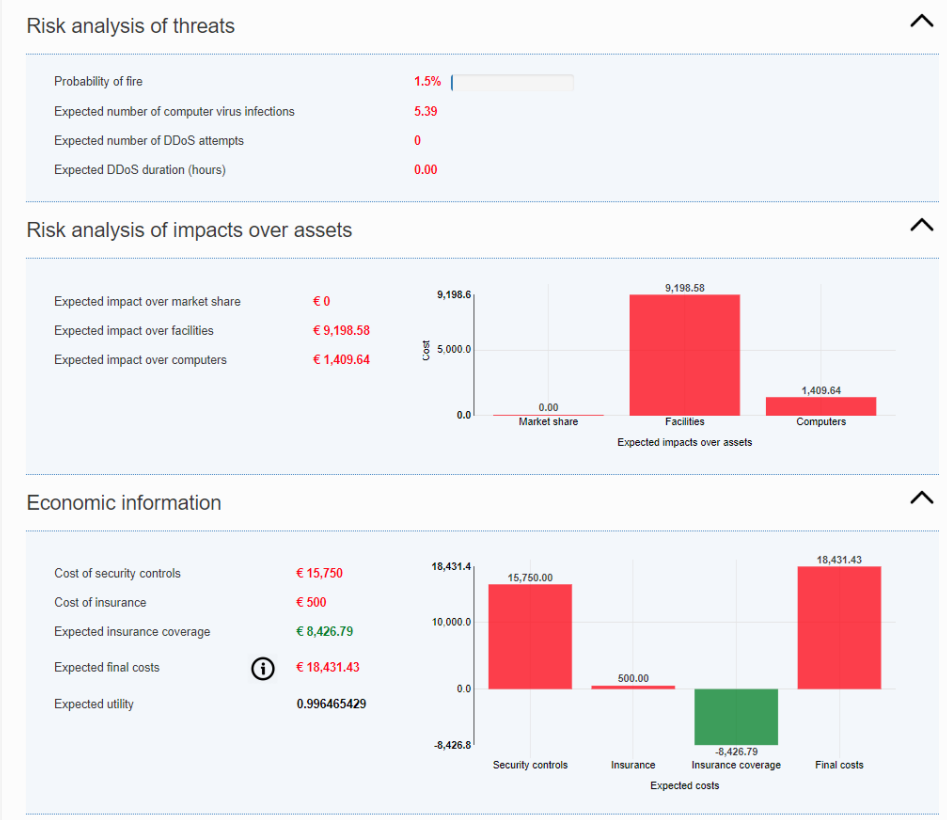


Figure 12 Risk Analysis information

All fields and charts change dynamically upon selecting a new entry on the table, allowing a more detailed view of each result. The user can return to the input page by clicking on the Return to input page button, where the previously made selections are still there, making small input changes possible without much effort.

The Insurance Perspective Risk Case provides a different input page.

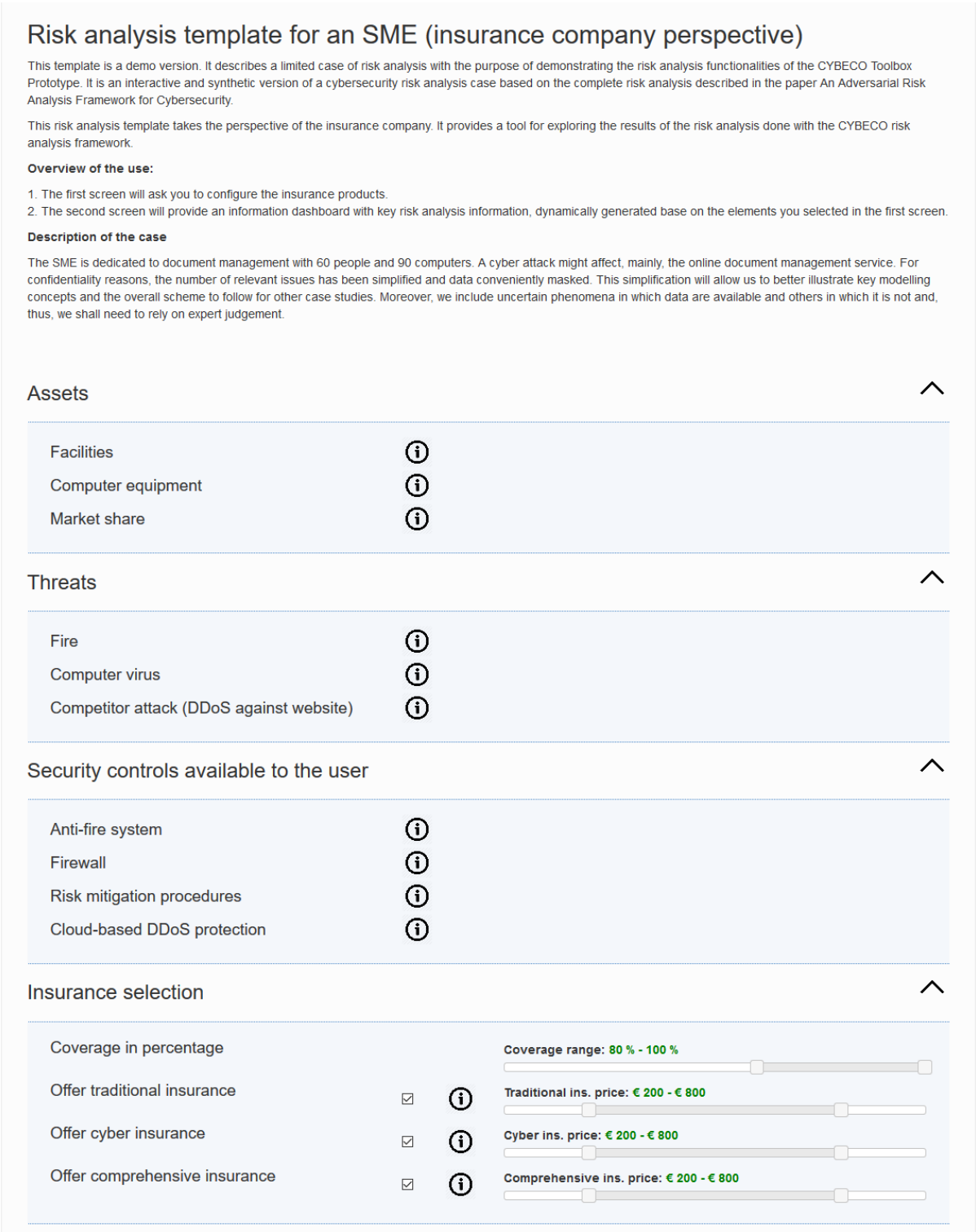


Figure 13 Risk Case 2 input screen

In this case the user can select the coverage range for the insurance, what type of insurance should be included in the results along with their price range.

The results are again presented in a table, which offers the same sorting and filtering functionality as the one of the first risk case.

## Risk analysis template for an SME (insurance company perspective)

This template is a demo version. It describes a limited case of risk analysis with the purpose of demonstrating the risk analysis functionalities of the CYBECO Toolbox Prototype. It is an interactive and synthetic version of a cybersecurity risk analysis case based on the complete risk analysis described in the paper An Adversarial Risk Analysis Framework for Cybersecurity.

This risk analysis template takes the perspective of the insurance company. It provides a tool for exploring the results of the risk analysis done with the CYBECO risk analysis framework.

**Overview of the use:**

1. The first screen will ask you to configure the insurance products.
2. The second screen will provide an information dashboard with key risk analysis information, dynamically generated base on the elements you selected in the first screen.

**Description of the case**

The SME is dedicated to document management with 60 people and 90 computers. A cyber attack might affect, mainly, the online document management service. For confidentiality reasons, the number of relevant issues has been simplified and data conveniently masked. This simplification will allow us to better illustrate key modelling concepts and the overall scheme to follow for other case studies. Moreover, we include uncertain phenomena in which data are available and others in which it is not and, thus, we shall need to rely on expert judgement.

## Risk analysis template for an SME (insurance company perspective)

### Risk evaluation of security controls and cyber insurance

Based on the simulation, we rank the different combinations of security controls and cyber insurance based on the expected total costs. The security controls are those selected by the user if Select a row to obtain further information on the probability of the different events and the expected impacts and costs.

Show 10 entries

Search:

| Ranking based on utility | Traditional insurance price | Cyber insurance price | Comprehensive insurance price | Coverage | Insurance product selected | Expected final costs for insurance company |
|---|---|---|---|---|---|---|
| 1 | € 400 | € 400 | € 400 | 100 % | Comprehensive | € 57,549.31 |
| 2 | € 100 | € 100 | € 100 | 100 % | Comprehensive | € 12,018.95 |
| 3 | € 600 | € 100 | € 600 | 90 % | Cyber | € 44.46 |
| 4 | € 400 | € 100 | € 600 | 90 % | Cyber | € 45.39 |
| 5 | € 200 | € 100 | € 200 | 90 % | Cyber | € 49.73 |
| 6 | € 200 | € 100 | € 400 | 90 % | Cyber | € 43.53 |
| 7 | € 800 | € 100 | € 1,000 | 90 % | Cyber | € 50.04 |
| 8 | € 600 | € 100 | € 1,000 | 80 % | Cyber | € 42.46 |
| 9 | € 800 | € 100 | € 800 | 80 % | Cyber | € 33.64 |
| 10 | € 100 | € 100 | € 400 | 70 % | Cyber | € 5.85 |

Filters: All | All | All | All | All

Showing 1 to 10 of 546 entries

Previous 1 2 3 4 5 … 55 Next

Figure 14 Risk case 2 results screen

Selecting a specific result will again take the user to a more detailed analysis of that entry. That information is again updated every time the user selected a new entry from the table.

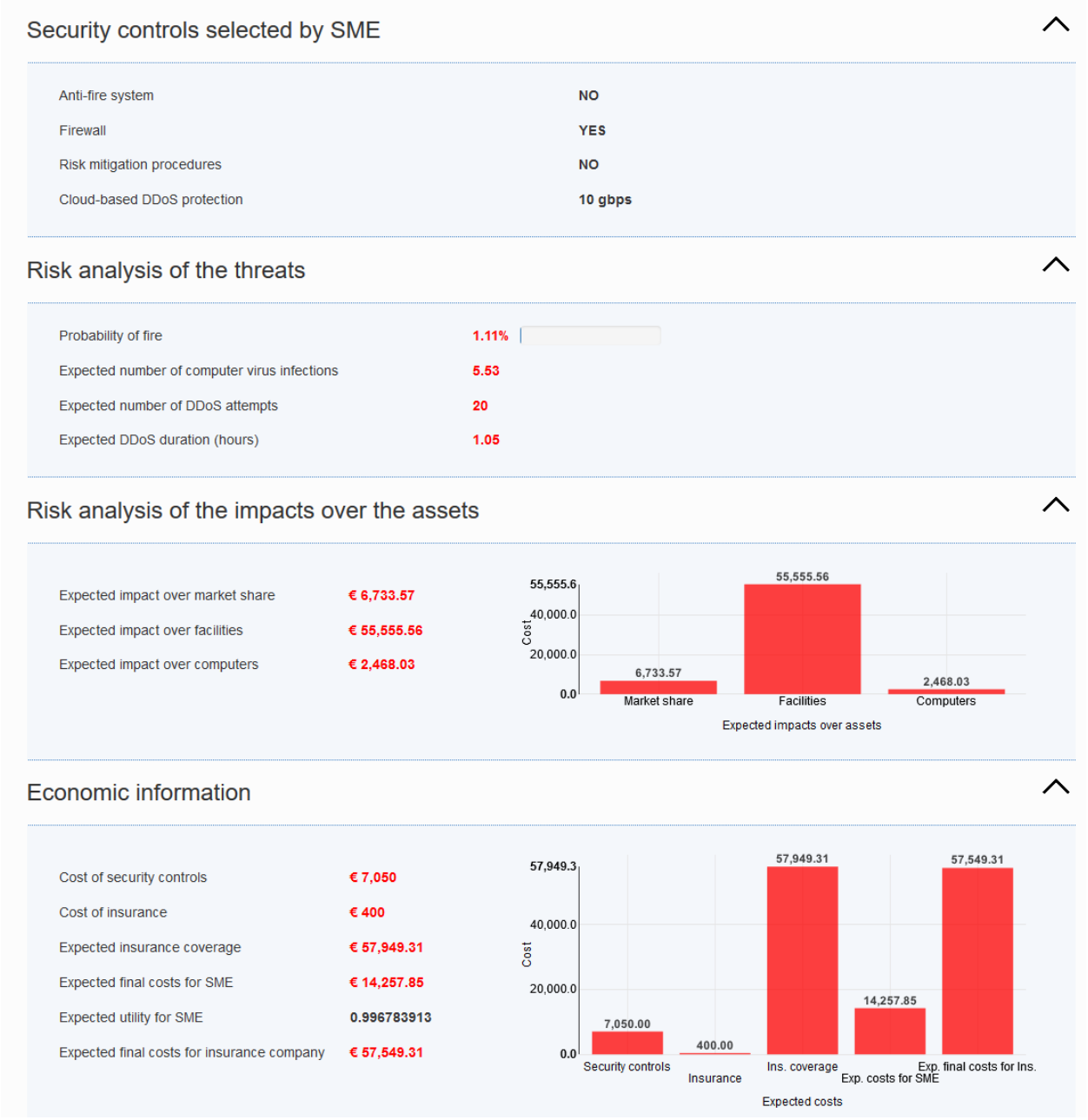


Figure 15 Results screen: Risk Analysis information

Clicking the Return to input page button, will of course again take the user to the previous page, where his or her selections are still active.

While the previous two risk cases are Knowledge based, the third one is R Server Based, offering analysis for customizable cases. In this risk case, the user can provide a more detailed input, which will then be analyzed by the R Server, and return the results.

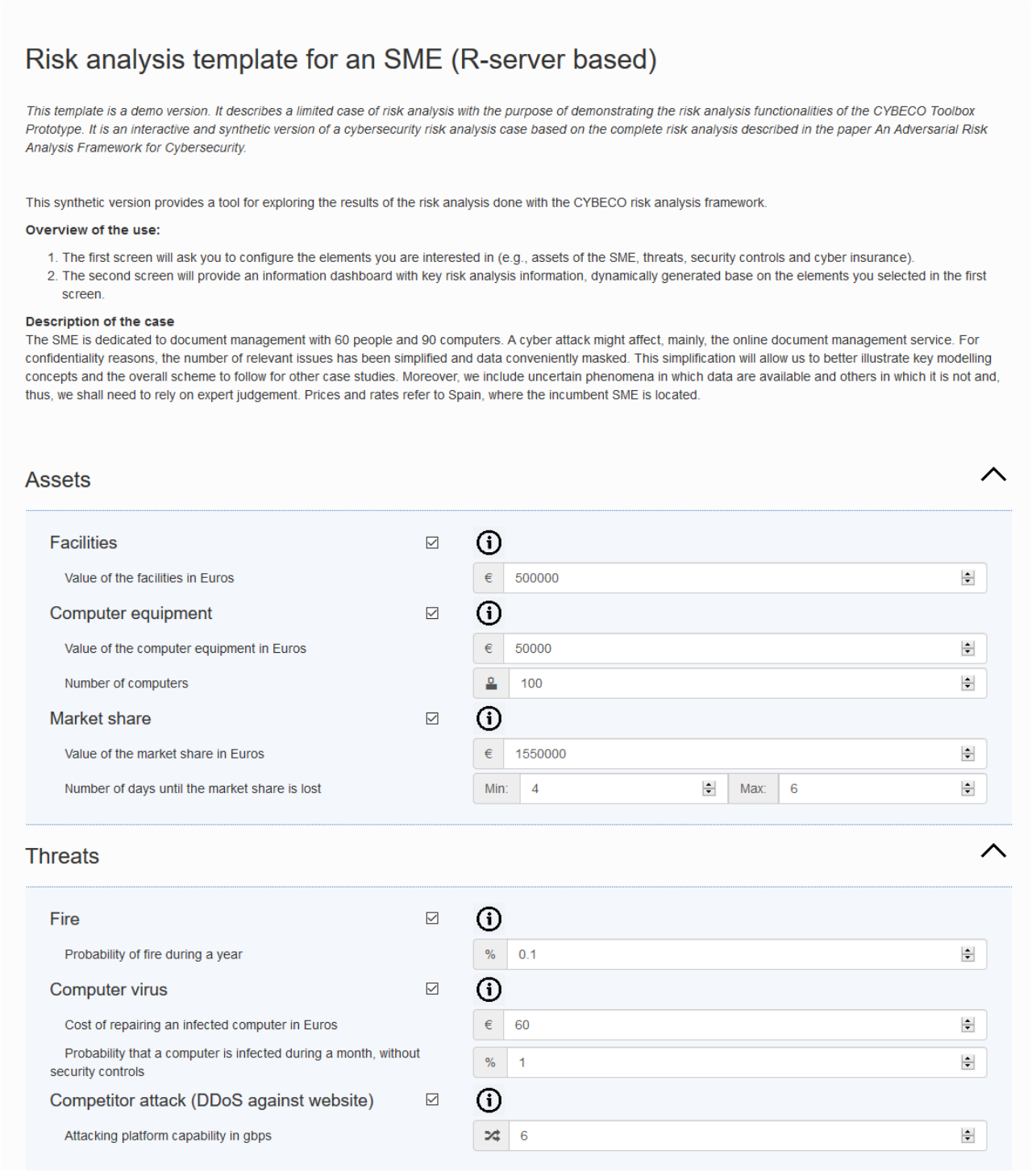


Figure 16 R-server based input screen

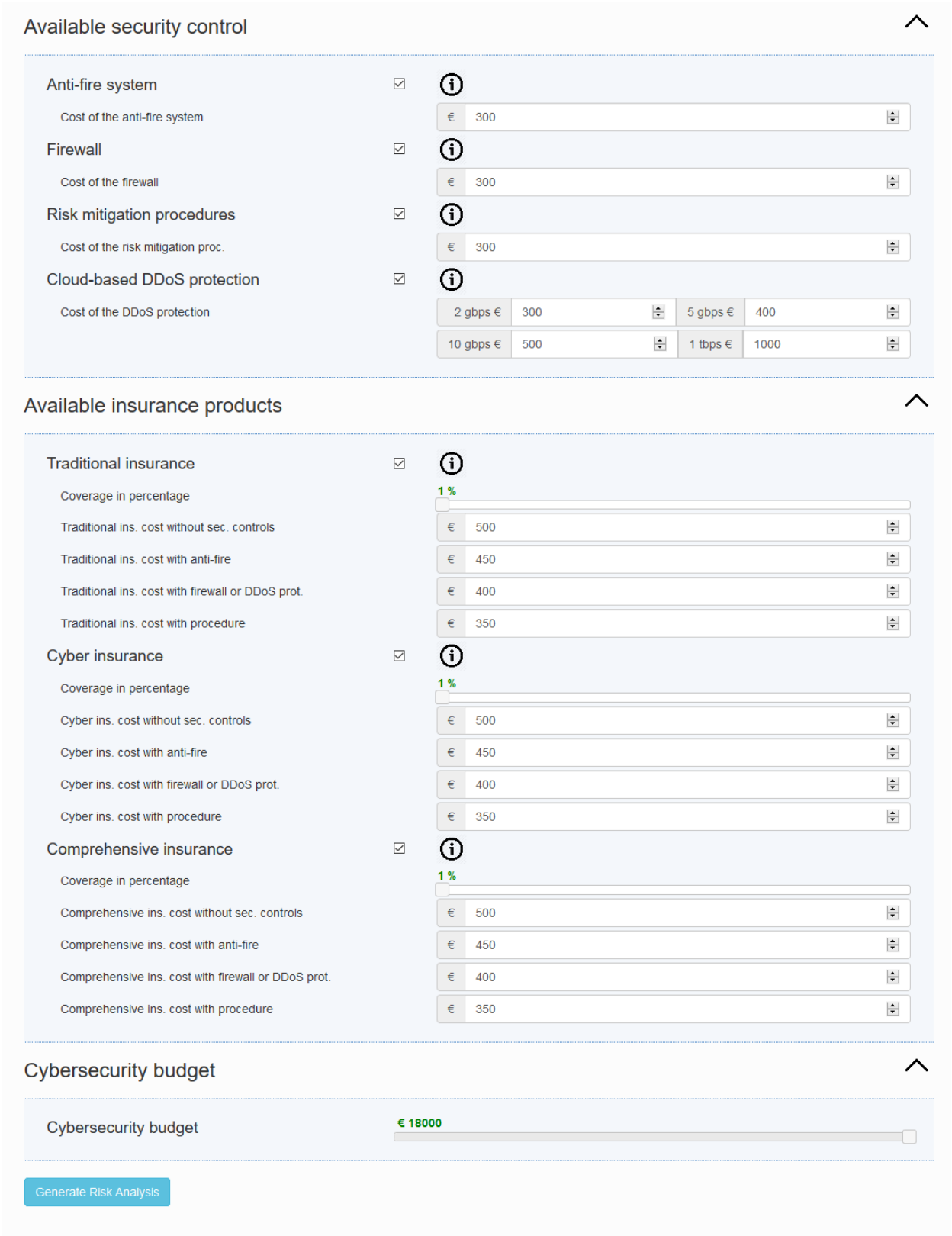


Figure 17 R-server based input screen (part 2)

After filling these fields, the user will be taken to the results page, where the results are again organized in a table, and clicking each one will offer more information for that entry.

# 3 CYBECO Toolbox v1.0 Implementation Details

The CYBECO Toolbox is developed in Drupal[1] 8, an open-source PHP software that includes a content management platform and a development framework. Drupal is modular, highly extendable and allows for the creation of custom complex document types and entities.

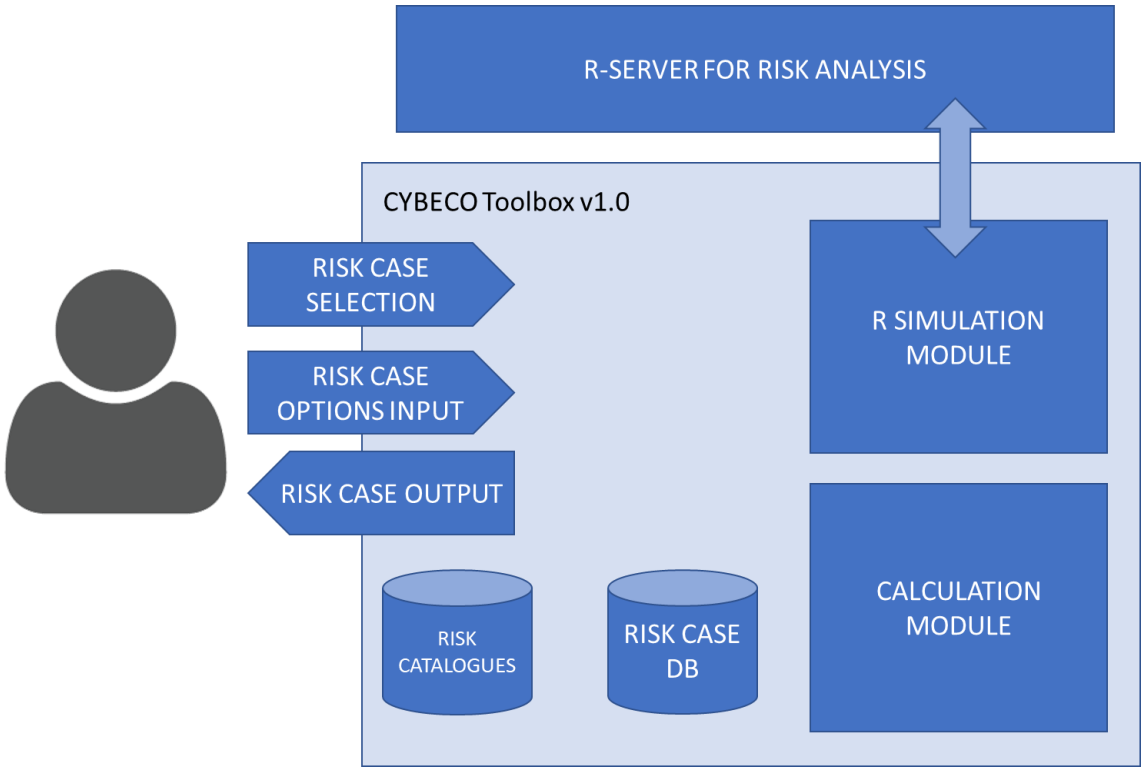


Figure 18 CYBECO Toolbox Architecture

CYBECO Toolbox KB

The KB entities are designed as custom Drupal content types[2]. The content of the KB is organized using the Drupal built-in taxonomy module that can be used to connect, relate and classify the various KB entities. Moreover, extra Drupal modules have been used for the provision of the search engine.

[1] https://www.drupal.org/about
[2] https://www.drupal.org/docs/7/understanding-drupal/content-types

Calculation Module

The Risk cases are implemented in the calculation module, which is designed and developed as a custom Drupal module. The module uses the Model-View-Controller (MVC) architectural pattern that separates the application into three main logical components: the model, the view, and the controller. Each of these components are built to handle specific development aspects of an application.

The implemented risk cases results are pre-simulated and stored in the Database (Risk Case DB in figure 17).

R-Simulation Module

The R-Simulation module will be available in the Toolbox version 2.

Server technologies

The software is installed in a dedicated Ubuntu Linux Server[3] in a Virtual machine. Apache[4] and Mysql[5] will are used for the web server and the database server, respectively.

[3] https://www.ubuntu.com/server
[4] https://httpd.apache.org/
[5] https://www.mysql.com/