



**D2.4: Innovation Schedule and Risk Management Plan**

**CYBECO**

Supporting Cyberinsurance from a Behavioural Choice Perspective

**D2.4: Innovation Schedule and Risk Management Plan**

**Due date: M6**

**Abstract: Deliverable D2.4 presents an innovation schedule referring to the delivery of relevant project innovations and defines a risk management plan accompanied by concrete mitigation activities to address the risks linked to the CYBECO project implementation.**

Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
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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<b>Prepared by</b>	Nikolaos Vasileiadis(TREK)
<b>Contributors</b>	Aitor Couce (CSIC-ICMAT)
<b>Checked by</b>	David Rios (CSIC-ICMAT)
<b>Approved by</b>	
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### Document Change Log

Each change or set of changes made to this document will result in an increment to the version number of the document. This change log records the process and identifies for each version number of the document the modification(s) which caused the version number to be incremented.

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# 1 Introduction

## 1.1 Objective and Scope

The objective of this deliverable is to produce an innovation schedule regarding the innovative outputs and results of the CYBECO project, to address the need for extending the outreach of these outputs and results and to develop a risk management plan listing all risks linked to the implementation of the project and addressing them through concrete mitigation activities' planning.

## 1.2 Document Structure

The document consists of two main sections:

1. The first one presents the innovation schedule and more specifically the following:
  - a. List of innovative elements of the CYBECO project;
  - b. Schedule for the delivery of planned innovations;
  - c. Participation in the Innovation Radar initiative.
2. The second section presents the Risk Management plan of the CYBECO project and in detail:
  - a. It identifies and analyses risks;
  - b. It defines mitigation activities to address such risks.

## 2 Innovation Schedule

Scheduling innovation constitutes a substantial part of the CYBECO project planning included in the Description of Action. The Description of Action has defined research actions which will lead to the delivery of several innovations in the fields of cyberinsurance and cybersecurity.

Planning within the DOA consists of achievable innovations matched to a series of activities and tools that will lead to the delivery of these innovations within the CYBECO project implementation time plan.

The Innovation Schedule presented in this deliverable, builds on the DOA planning, by reiterating and organizing the CYBECO innovations and by adjusting the schedule of delivery of the project innovations to the real project needs. The activities that lead to the production of the innovations are grouped in Work Packages while the milestones defined in the DOA set the starting and ending point of different learning cycles.

With regard to the resources that need to be allocated and the execution of the plan for the delivery of the innovation it should be noted at this point that the consortium has extensive experience in converting innovative ideas into successful products, by applying a systematic and structured approach to the process from R&D towards commercialization.

More specifically, members of the consortium conducted in the past extensive relevant studies regarding the analysis of innovation successes in fields such as that of industrial technologies, which resulted in the formulation of a systematic framework that covers all activities of an innovative project and the related success markers according to the TRL of each activity.

This innovation management framework is presented in figure 1 where it can be observed that different stages of innovation management activities are defined on the basis of the TRL of the project outputs. Thus, as the project evolves the innovation management practice is adapting to the needs of the corresponding TRL level. For example, the way we approach innovation management cannot be the same when the project research is just starting with that of the stage in which a market-ready solution is about to be launched.



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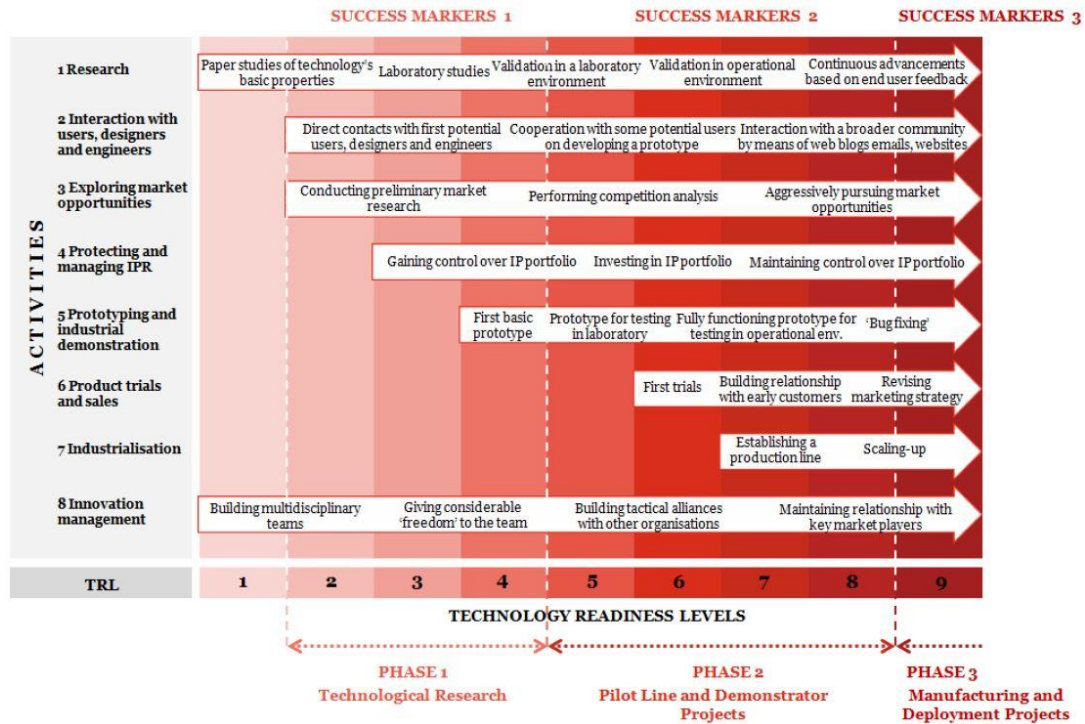


Figure 1: Innovation Management Framework

The following sections present the CYBECO innovations and the schedule of innovations for CYBECO.

Last but not least, the potential of extending the outreach for CYBECO innovations through the participation in the Innovation Radar is also examined within this deliverable.

### 2.1 CYBECO Innovations

Before presenting and listing the expected CYBECO project innovations it is useful to review the definition of innovation. This may be done in many different ways. The definition that will be used in this deliverable is the one established by the Innovation Union, an initiative of the EC. Consequently, innovation is defined as *the creation of new or significantly improved products and processes, including marketing and organizational processes, that add value to markets, governments and society* ([1]).

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CYBECO is a project that creates innovative products, methods and processes adding value to markets, governments and the society. The innovative products and processes of CYBECO are the following:

1. In terms of product innovation:
  - a. CYBECO will provide a **cyber-security model that facilitates optimal cyber security investments to an organisation, including cyber insurance**. Through multi-agent influence diagrams, the model can depict the decision-making problem faced by an IT owner who needs to decide its IT security portfolio and cyber insurance, in face of several threats, including some due to potential adversaries. A key innovative element of the model is that it incorporates modelling of intentionality (intentional and not random, attacks) in cyber security, while structured expert judgment (SEJ) methods that will be used in the risk assessment phase will allow to calibrate and debias experts in cyber-attacks in forecasting threats and their impact.
  - b. The CYBECO Toolbox will provide advice to the IT owner about the **appropriate IT security portfolio and cyber insurance** also demonstrating the CYBECO model building, assessment and solution. The Toolbox will not be limited to inventories of cyber insurance methodologies, will be user-friendly for all relevant stakeholders, will focus on cyber security models, indicators and guidelines as well as on suitable methods and methodologies to **measure results and to validate research models**. The validation of research models also constitutes an innovation. Finally, the Toolbox will also foresee the dissemination and promotion of cybersecurity good practices and recommendations emanated from the CYBECO research outcomes, supporting the sustainable engagement of research and market stakeholders.
  - c. The CYBECO model goes a step beyond cyber security models available in the market which tend to be somewhat simplistic and focus at most in one of the phases of cyber security risk management. **The model and the Toolbox will provide advice on IT security investments to IT owners based on technical and economic information that has formed the basis for intensive modelling to ensure optimal output.**
2. In terms of methods innovation:
  - a. The CYBECO project will further expand methodologies in **Adversarial Risk Analysis and SEJ**, with a focus on computational developments and models to forecast adversarial threats and their consequences.
3. In terms of process innovation:
  - a. CYBECO will mitigate cyber risks by **properly modelling and combining the choice behaviour of cyber threats (risk generation), the choice behaviour**

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of insurance companies (risk assessment) and the choice behaviour of IT owners (which includes risk transfer options as cyber insurance).

- b. The assessment of the model and the Toolbox will be supported by the **design and analysis of online behavioural economic experiments and investigations of those factors affecting cybersecurity and cyber insurance adoption**. Experiments will be performed with the model and tool dealing with issues like willingness to pay and policy compliance by IT owners, pricing and segmentation for insurance companies, so as to eventually refine the model and tool, as well as identify the most appropriate cyber insurance policies.
  - c. **A methodology to assess cyber insurance-based policy nudges, building from the results and method of policy nudge analysis in other areas of Cybersecurity** will be developed and will lead to cyber-security policy improvement.
4. In terms of marketing innovation:
- a. CYBECO enhances the growth of the cyberinsurance market by helping the development of both the supply and the demand sides of cyberinsurance services. This will be achieved by **including behaviour of cyber threats in risk assessment through adversarial risk analysis**, in order to support insurance companies in estimating (dependent) risks and setting premiums (supply side), and by using behavioural experiments to simulate and improve insurance decisions of IT owners, thereby enhancing decision support on risk transfer (demand side).

In conclusion and on the basis of the elements presented above, the innovations of the CYBECO project can be listed as follows:

- The methodology for the cyberinsurance modelling framework;
- The cyberinsurance modelling framework;
- The cyberinsurance use-cases and scenarios;
- The use-case evaluation of the methodology and framework;
- The CYBECO Toolbox;
- The behavioural-economic experiments analysing the cyberinsurance tools;
- The cyberinsurance policy recommendations.
- Methods to design cyber insurance products.

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- Consulting services built around the methods and toolbox developed.

### 2.1.1 Schedule of Innovations

The schedule of innovations is built on the basis of the delivery of CYBECO innovations. The following table presents the schedule for the delivery of these innovations and their link to the project's milestones.

Table 1: Schedule of innovations

<i><b>CYBECO Innovation</b></i>	<i><b>Delivery Date (month)</b></i>	<i><b>Relevant Project Milestone</b></i>
Methodology for Cyberinsurance Modelling Framework, including design of cyberinsurance products	M12	MS3
Cyberinsurance Modelling Framework	M24	MS6
Cyberinsurance Use-Cases and Scenarios	M12	MS3
Use-Case Evaluation of the Methodology and Framework	M24	MS6
CYBECO Prototype 1.0	M12	MS3
CYBECO Prototype 2.0	M24	MS6
Behavioural-Economic Experiments	M18	MS5
CYBECO Policy Recommendations	M24	MS6
CYBECO related consulting services	M24	MS6

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### 2.2 Participation to the Innovation Radar of the EC

The Innovation Radar is an initiative of the European Commission focused on the identification of high potential innovations and the key innovators behind them in FP7, CIP and Horizon 2020 projects. It supports innovators by suggesting a range of targeted actions to assist them in fulfilling their potential in the market. It is an initiative that involves:

- Assessing the maturity of innovations developed within the FP7 and H2020 projects and identifying high potential innovators and innovations (using a model developed by JRC-IPTS);
- Providing guidance during the project duration in terms of the most appropriate steps to reach the market;
- Supporting innovators through EU (and non-EU) funded entrepreneurship initiatives to cover specific needs concerning networking, access to finance, Intellectual Property Rights, etc.

The Innovation Radar covers all ICT research and/or innovation projects that the Commission has launched under Horizon 2020 and ICT projects launched under FP7 and CIP. Innovators participating in one of these projects can benefit and this can also be the case for CYBECO. The potential innovations and/or innovators are identified with the help of external innovation experts and based on objective criteria discussed in project reviews. The best innovators are promoted through the Digital Single Market webpages in order to gain visibility among potential investors, users and buyers.

The Innovation Radar prizes are announced every year since 2015. During 2017 the Innovation Radar prize categories were the following:

- Industrial and Enabling Tech;
- Excellent Science;
- Best Young SME;
- Best early stage innovation;
- Tech for Society.

The CYBECO project can participate either in the 2018 or in the 2019 Innovation Radar initiative. The application for participation consists of the following steps:

1. Identify and select the prize category depending on the categories that will be announced for either 2018 or 2019.



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2. Answer the Innovation Radar questionnaire which is issued by the DG Connect and contains the following pieces of information:
  - a. The project officer and the project review phase;
  - b. The title, description, delivery time-plan and characteristics of the innovation for which the project applies to the Innovation Radar;
  - c. The ownership of the innovation;
  - d. Actions to improve market readiness of the innovation produced;
  - e. Data about the market within which the innovation will be launched.

### 3 Risk Management Plan

CYBECO is a quite complicated and demanding project with a relatively short duration of two years. Its success highly depends on the effectiveness of the risk management process. Its objective is to provide a process and techniques for the evaluation and control of potential project risks, focusing on their precautionary diagnosis and handling. Risks in CYBECO are managed by a careful risk management procedure and cross-partner risk awareness based on proven techniques (such as the Project Management Institute's 2009) and a disciplined way of handling reduction and prevention of risks, managing risks diligently to avoid common pitfalls to large research and software projects. Four major activities are put forward to handle risks in CYBECO, enacted through a continuous closed cycle, which will be iterated for each project milestone:

- Risk Identification: Determining the risks that may affect the project and documenting their characteristics.
- Risk Assessment: Prioritizing risks by assessing and combining their probability of occurrence and impact and analysing their potential effect on project objectives. During risk analysis, various risk attributes are evaluated to establish values for the probability of the occurrence of the event and the degree of its impact.
- Risk Response Planning: Developing options and actions to enhance opportunities and reduce threats to project objectives.
- Risk Monitoring and Control: Implementing risk response plans and tracking identified risks throughout the project.

#### 3.1 Identification of Risks

We have presented the CYBECO scientific and technical outputs. In an innovation project such as this, there are however a number of potential risks that may prevent us from achieving such targets. By breaking down the project into manageable work tasks and recruiting partners with the appropriate and complementary expertise, these risks should however be minimal. A provisional risk assessment has been carried out and will be followed and revised throughout the project by the steering committee that will also perform any tasks necessary to solve the problems that may arise.

The risks initially identified during the risk assessment can be categorized in technical risks and management-related risks. Technical risks can be listed as follows:

- Insufficient acceptance of the CYBECO solution based on user experience;

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- Technological, functional and technical requirements limitation;
- Technology integration more involved than expected;
- Lack of harmonisation of the experiments to be run in different countries;
- Impossibility of recruiting sufficient subjects to participate in the experiments;
- High computational complexity in models.

Management-related risks can be listed as follows:

- Communication difficulties within the partnership;
- Slow or inadequate mobilisation of the Consortium;
- Delayed production of deliverables;
- Partner cost deviations;
- Non-availability of key personnel;
- Withdrawal of partners from the project mid-term;
- Disagreement which could arise between the partners;
- Financial issues and issues with the validation of cost statements;
- Difficulties in identifying experts willing to provide expert judgements.

These lists will be updated as the project progresses.

### 3.2 Risk Assessment

The critical risks assessment estimates the probability of the occurrence of the project's critical risks and their potential degree of impact. This list will evolve as the project progresses and will be regularly updated on each project milestone based on the risk management procedure summarized above. This assessment will be rerun as the project progresses.



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Table 2: Critical risks analysis

<i>Description of risk</i>	<i>Initial likelihood</i>	<i>Impact</i>
Insufficient acceptance based on user experience	Low	High
Communication difficulties	Low	Low
Slow or inadequate mobilisation of Consortium	Low	Medium
Delayed production of deliverables	Medium	Medium
Partner cost deviations	Medium	Low/ Medium
Technological, functional and technical requirements limitation	Medium	Medium
Non-availability of key personnel	Low	Medium
Withdrawal of partners from the project mid-term	Low	Low
Disagreements which could arise between the partners	Low	Medium
Financial issues and issues with the validation of cost statements	Low	Low
Technology integration more involved than expected	Medium	High
Lack of harmonisation of the experiments to be run in different countries	Low	Medium
Impossibility of recruiting sufficient subjects to participate in the experiments	Low	High
High computational complexity in models	Medium	High
Difficulties in identifying experts willing to provide expert judgements.	Medium	High

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### 3.3 Risks Mitigation Planning

Risk analysis helps in developing a risk mitigation and/or contingency strategy to avoid the risks or minimize their influence on project objectives. Table 3 summarizes the critical risks of the project, the probability of their occurrence, and their potential degree of impact together with mitigation and/or contingency actions to be adopted to avoid or minimize their influence on project objectives.

Table 3: Critical risks mitigation planning

<i>Description of risk</i>	<i>Initial likelihood</i>	<i>Impact</i>	<i>Proposed risk-mitigation measures</i>
Insufficient acceptance based on user experience	Low	High	Propose other ways of exploiting model and prototype, e.g. through consulting services.
Communication difficulties	Low	Low	A management structure where all partners are represented has been defined in the Project Handbook (D2.1). Roles and responsibilities are clearly defined in the Project Handbook together with communication flow and mechanisms for this purpose. The Project Manager proactively promotes communication between partners by creating an atmosphere of trust and confidence.
Slow or inadequate mobilisation of Consortium	Low	Medium	Roles, responsibilities and procedures have been clearly defined within the management structure and have been detailed in the Consortium Agreement which was signed by all partners as well as in the Project Handbook.
Delayed production of deliverables	Medium	Medium	Proactive management. Templates for deliverables were established at project Kick-off. Deliverable responsibilities timelines for their production set-up are clearly identified in the Quality Management plan which was integrated in the Project Handbook. Furthermore, all partners have participated in previous EU funder research projects.
Partner cost deviations	Medium	Low/ Medium	Setting the effective reporting periods and accurate control mechanisms to detect deviations at an early stage (within the Project Handbook) allowing the subsequent coordination for mitigation measures when necessary. The Project Management Board

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			will be the means for raising solutions to possible conflicts.
Technological, functional and technical requirements limitation	Medium	Medium	To be identified as early as possible and during the system requirements definition for alternative solutions to be investigated
Non-availability of key personnel	Low	Medium	Non-academic partners view this project as essential for their operations and, thus, have committed the required personnel. Academic partners are big research institutes where the key personnel can be substituted by colleagues who are also involved in that topic. In cases where this option might be not possible work can be shifted to other consortium partners.
Withdrawal of partners from the project mid-term	Low	Low	There has also been a deliberate attempt to involve more than one organisation providing a degree of back-up should a partner withdraw for whatever reason.
Disagreements which could arise between the partners	Low	Low	The management structure and steering group of the project will give the same weight to each partner in the decision-making process. The Consortium Agreement will contain rules for conflict resolution and arbitration procedures. Most partners have cooperated in previous projects.
Financial issues and issues with the validation of cost statements	Low	Low	The transfer of payments from the Coordinator to the partners will be made upon the completion of a certain number of criteria. The tasks to be undertaken have been divided with identified outputs and deliverables to be met. Thus, each participant will have an individual plan for payment that will be laid down in the Consortium Agreement.
Technology integration more involved than expected	Medium	High	Simplified versions of some of the components may be adopted.
Lack of harmonisation of the experiments to be run in different countries	Low	High	The master experiment will be developed in English. Double translation (English-National Language - English) by two independent translators with cross-checking of initial and final English versions. Adaptation of the economic incentives to the purchasing power at each country.
Impossibility of recruiting subjects to	Low	High	Cooperation with international online panels and professional networks and association.

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participate in the experiments			This mitigation strategy has been successful in previous online international experiments, such as those in BICYBER.
High computational complexity in models	Medium	High	We actually had to discard initial versions with GeNIe and some Bayesian network modules in R to develop our own R algorithms. First versions of Algorithms in R already developed and being validated by WP5. They have been tested at the ICMAT HPC installation with relevant reductions (may be parallelised in a very natural way). Templates being developed to facilitate model building and even precomputation of some parts.
Difficulties in identifying experts willing to provide expert judgements.	Medium	High	Use students from Master in Cybersecurity. Seek advise from the Advisory Board.

### 3.4 Risks Monitoring and Control

The risks monitoring and control process consists of the following steps.

Before each major stage of the project commences, the project manager will assure that a full risk assessment is performed. This will follow the process of identification, evaluation (ranking in terms of likelihood and impact) and response planning. The risks will then either be accepted or appropriate prevention or reduction plans put in place, according to the management philosophy of 6 sigma by defining the problem, measuring and analysing them in order to improve management and control.

Alternatively, a contingency plan could be put in place and a contingency trigger assigned. The impact of the risk will then be assessed and contingency resources planned. Whenever a major change to the project occurs, the risk assessment will be revised accordingly. This will detail the identified risks, their likelihood and impact, contingency plans, the risk owner and the contingency trigger. If a risk contingency has been activated then the details and outcome of it will also be recorded.



## **Acronyms and Abbreviations**

1. CIP - Competitiveness and Innovation Framework Programme
2. CYBECO - Supporting Cyberinsurance from a Behavioural Choice Perspective
3. DOA - Description of Action
4. EU - European Union
5. FP7 - Framework Programme 7
6. ICT - Information and Communication Technologies
7. JRC-IPTS - Joint Research Centre - Institute for Prospective Technological Studies
8. R&D - Research and Development
9. TRL - Technology Readiness LEVEL



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- [1]. "Innovation Union: A pocket guide on a Europe 2020 initiative", European Commission, Belgium, 2013.