



COoperative Cyber prOtectiOn for modern power grids

D10.2 Risk Analysis – Version 1

Distribution Level	PU
Responsible Partner	AUTH
Prepared by	Angelos Marnerides, Kyriaki-Nefeli Mamalaki, George Kryonidis, Irina Ciornei, Filip Holik, Alex Stefanov, Viktor Papadopoulos, Elvira Sanchez Ortiz, Luna Morena Diaz
Checked by WP Leader	Angelos Marnerides (UCY)
Verified by Reviewer #1	Charis Demoulas (AUTH) 28/05/2024
Verified by Reviewer #2	Maria Michael (UCY) 09/06/2024
Approved by Project Coordinator	Angelos Marnerides (UCY) 12/06/2024



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Definition of Acronyms

API	Application Programming Interface
CA	Consortium Agreement
CD	Continuous Delivery/Deployment
CI	Continuous Integration
COCOON	COoperative Cyber prOtectiOn for modern power grids
COMML	Control Measurements and Monitoring Layer
CPN	COCOON Programmable Node
CNN	Convolutional Neural Network
CTI	Cyber Threat Intelligence
CVE	Common Vulnerability Exposure
DL	Deep Learning
DRES	Distributed Renewable Energy Resources
EC	European Commission
DSO	Distribution System Operator
ENISA	European Union Agency for Cybersecurity
EE-ISAC	European Energy Information Sharing and Analysis Centre
ETSI	European Telecommunication Standards Institute
GA	Grant Agreement
GA	General Assembly
GDPR	General Data Protection Regulation
HL	Highly Likely
ICS	Industrial Control Systems
IEC	International Electrotechnical Commission
IIoT	Industrial Internet of Things
IOL	Instrumentation & Orchestration Layer
IoT	Internet of Things
ISO	International Standardization Organization
IIPM	Innovation & Intellectual Property Manager
IPR	Intellectual Properties Rights
Im	Qualitative Impact
KPI	Key Performance Indicator
L	Likely
LSTM	Long Short-Term Memory
NC	Near Certainty
NFV-MANO	Network Function Virtualization Management and Orchestration
OSINT	Open-Source Intelligence
PC	Project Coordinator
PDP-EEs	Programmable Data Plane - Execution Engine
PMB	Project Management Board
PO	Project Officer
Prob	Probability
PV	Photovoltaics
R	Remote
RNN	Recurrent Neural Network
SBC	Single Board Computer
SFCs	Service Function Chains
TM	Technical Manager
TMB	Technical Management Board
UCY	University of Cyprus
UL	Unlikely
WP	Work Package
μNFs	Micro Network Functions

Executive Summary

The purpose of this deliverable is to present the first Version of Risk Analysis of the COCOON Project based on the implementation progress within the first six-months (M1-M6). In the dynamic landscape of research and innovation, risk management is a vital component of successful project management. Hence, the aim is to setup the rules and methodology for continuous monitoring of the project implementation progress and to reevaluate the risk analysis initially presented in the COCOON proposal based on the experience gained in these first six-months of the project.

The adopted approach follows the same risk quantification method used in the proposal-phase. Nonetheless, it herein addresses possible risks at Task and Sub-Task levels and their evolution six months into the implementation phase. As part of the framework for continuous monitoring and assessment of the risks a critical path of project implementation was proposed to serve as the foundation for our risk management approach. By identifying the sequence of activities with the least amount of slack, we can focus our risk mitigation efforts on the most time-sensitive and impactful aspects of the project.

The proposed COCOON risk management process aimed to be clear, structured, and integrated into the project lifecycle. As such, it encompasses four key stages: identification, monitoring, analysis, and handling. By continuously identifying and monitoring potential risks, the Project Coordinator (PC), the work package (WP) leaders and Task leaders' team can proactively analyse their implications and devise appropriate mitigation strategies.

The initial risk assessment, conducted at the outset of the project, revealed a set of potential risks across various domains, including technical, financial, and regulatory. Six months into the implementation, we have re-evaluated these risks and found that the majority of them remain relevant, with some having evolved in terms of their likelihood or impact.

These risks are assessed, and mitigation actions are proposed for the reduction or elimination of the risks. In general, this document is based on the Grant Agreement (GA) terms and conditions, its Annexes, as well as the Consortium Agreement (CA) specifications and requirements. Via risk analysis higher assurance is provided on i) full understanding of the risks and possible obstacles the partners might face when carrying out their project tasks and ii) stronger collaboration among the consortium members, individuals, and groups so that these risks are mitigated. Finally, D10.2 is intended to be utilised by the project coordinator, the WP leaders and Task Leaders to monitor the identified risks and appropriately apply mitigation actions if and when necessary.

The risk management efforts have proven effective in maintaining vigilance over the project's potential vulnerabilities within this first semester of the project implementation. The fact that most risks have remained consistent indicates that our initial assessment was accurate and that our mitigation strategies have been successful in preventing new risks from emerging. Moving forward, we will continue to monitor and manage risks to ensure the successful completion of the project, and this process and outcomes will be reported in the following deliverables of this sequence of Risk Analysis of COCOON (version 2 and version 3).

1. Introduction

The aim of the Deliverable D10.2 is to describe the risk management strategy that has been established by the consortium in order for the project to achieve its objectives and reach effectively the planned project outcomes. The main goal is to identify at an early-stage possible implementation risks that may hamper the realization of the project and at the same time to follow a concrete approach to manage them.

The concept of risk as outlined in the ISO 31000 standard¹ states that risk is the potential impact of unpredictability on project objectives, which can be either positive or negative. Every action taken towards achieving project goals carries a degree of risk that must be properly addressed and managed to ensure successful project outcomes.

Within the realm of risk management, on one hand, uncertainty arises when there is a lack of knowledge or understanding regarding an event, consequence, or likelihood. On the other hand, risk management is a structured set of activities and methods designed to mitigate risks that could hinder a project's ability to achieve its goals. The risk management process is an integrated part of the overall project management approach, as detailed in the previous deliverable, D10.1 (Project management plan – version 1) and it will be assessed throughout the project's lifecycle and reported appropriately in other upcoming deliverables D10.5 (Risk Analysis – version 2) and D10.6 (Risk Analysis - version 3).

1.1 Deliverable Scope

In this initial version of the COCOON's Risk Analysis the review and assessment of the risks denoted in the GA is conducted. Specifically, it revises the list of project risks and their quantification as it was defined at an early stage (during the proposal phase). This initial list of risks appears in the GA (Table: LIST OF CRITICAL RISKS).

Using our experience and tracking the implementation process within each of the WPs and Tasks active in the first six months of the project, those risks are reviewed and refined in this document, and presented per WP. Risk analysis becomes more challenging when there are solutions that deal with more than one risk, or risks that need more than one mitigation action. Consequently, a risk management activity will be developed every six months within the project, following the principles described in this document. In particular, this specific deliverable is based on the experience gained in the first six-months (M1-M6) of the project lifetime and also considering the addition of a new partner that also obtained the coordinator role (UCY) following an amended version of the GA.

1.2 Document Structure

This deliverable is structured in five sections. The first chapter provides the introduction and the relationship of this deliverable with other activities and deliverables of the project. To increase awareness of the technical aspects of the project, a critical path of the COCOON project implementation has been established as a foundation for risk management, as outlined in Section 2. This critical path is essential for identifying the key activities and milestones necessary for the COCOON project to achieve its objectives and serves as the basis for further risk analysis and response. A clear and structured risk management process, including identification, monitoring, analysis, and handling, has been established in Section 3. This process began during the proposal preparation phase, continued throughout the first six months of implementation and are the scope of this deliverable, and will be utilized throughout the project's lifecycle, and reported accordingly in the following versions of the risk analysis deliverables. Section 4 provides a summary of the application of the risk management process within the first six months of the project, while Section 5 concludes this deliverable.

¹ ISO 31000 (2009): Risk management, online: <http://www.iso.org/iso/home/standards/iso31000.htm>

2. Critical Path of the COCOON Project

The COCOON project's critical path has been established to provide a clear understanding of the major activities and milestones within the project lifetime. The critical path outlines the target completion time for the project and highlights the critical activities that could potentially jeopardize the project's objectives. These critical path items are primarily represented by project milestones, which merges significant and critical accomplishments throughout the project's lifecycle (e.g., on-time implementation and submission of corresponding deliverables).

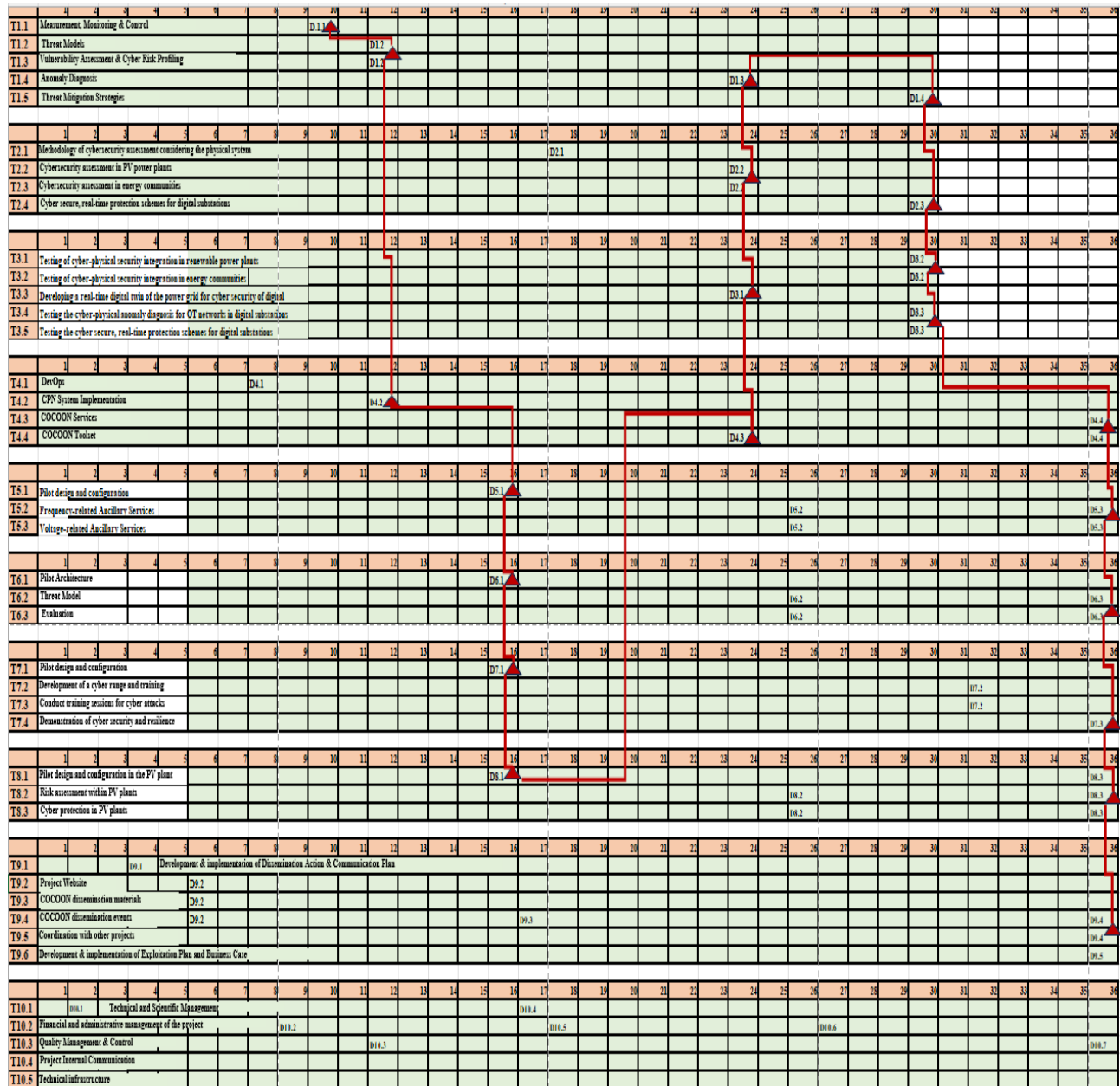


Fig. 1 COCOON's critical path

Fig. 1 illustrates the essential activities required to achieve the project's planned objectives on schedule. The timeline shows that the project's focus areas vary throughout its duration. The critical path analysis enables the consortium to predict whether the project will be completed on time and to keep the project's completion on track as it progresses. It also ensures that the deliverables are ready as scheduled and the milestones are achieved timely. It can be said that the analysis of the critical path helped to identify critical activities and it

will allow the COCOON's consortium to establish the basis of further risk analysis and response. A summary of the project milestones is presented in Table. 1.

In addition to the critical path, risks may arise in different WPs and could impact the project's development if not handled promptly and carefully. Therefore, the continuous monitoring and assessment of risks play a crucial role throughout the project's lifecycle. The following sections focus on the risk management process established within the project.

MS	Milestone Name	WP	Means of Verification	Due Date
MS1.1	CPN Control, Measurement & Monitoring algorithmics	WP1	D1.1	M10
MS1.2	Threat models, pilots implementation requirements and vulnerability and risk profiling algorithmics	WP1	D1.2	M12
MS4.1	COCOON system and software architecture	WP4	D4.1, D4.2	M12
MS5.1	Completed Secure Energy Communities Pilot Design & Configuration	WP5	D5.1	M16
MS6.1	Completed Secure Regional Electricity Data Pilot Design & Configuration	WP6	D6.1	M16
MS7.1	Digital Substation Security Pilot Design and Configuration	WP7	D7.1	M16
MS8.1	Completed Secure DRES Deployments Pilot Design & Configuration	WP8	D8.1	M16
MS2.1	Final power grid estimation methodology for PV installations and energy communities	WP2	D2.1, D2.2	M24
MS3.1	Digital Twin configuration for Digital Substations	WP3	D3.1	M24
MS4.2	CPN and Toolset implementation	WP4	D4.3	M24
MS1.3	Unified DL and DRL-based cyber-security	WP1	D1.3, D1.4	M30
MS2.2	Final real-time protection for substations	WP2	D2.3	M30
MS3.2	Cyber-physical integration for DRES deployments, secure energy communities and substations	WP3	D3.2, D3.3	M30
MS3.3	Real-time protection for a substation over Digital Twin	WP3	D3.3	M30
MS4.3	COCOONv.1 stable release	WP4	D4.4	M36
MS5.2	Secure Energy Communities Demonstrator	WP5	D5.2, D5.3	M36
MS6.2	Secure Regional Electricity Data Demonstrator	WP6	D6.2, D6.3	M36
MS7.2	Digital Substations	WP7	D7.2, D7.3	M36
MS8.2	Completed Evaluation in Secure DRES Deployments	WP8	D8.2, D8.3	M36
MS9.1	COCOON Demonstrator Conference & Exploitation Plan	WP9	D9.4, D9.5	M36

Table. 1 List of the COCOON's Milestones

3. Risk management process and analysis

The COCOON project places strong emphasis on coupling risk identification with risk analysis such as to mitigate potential problems in an iterative matter. This section focuses on the risk management procedure that systematically applies management policies, processes, and practices to the COCOON project activities. Within COCOON, a risk management framework has been established, consisting of three main pillars that continually interact and correlate: (i) risk identification, (ii) risk analysis and monitoring, and (iii) risk handling. The risk management process was aligned with the project's objectives and could be adjusted if required due to changes in research objectives. The risk management procedure was established at the early stages of the project implementation, and it will accompany it throughout its lifecycle.

External stakeholders, such as the European Commission (EC) and other related projects, along with the project environment (e.g., regulations), could influence the causes of risks, impacting consortium collaboration and project execution. Therefore, a risk management plan was established to set up procedures and tools for effective communication and interaction within the consortium to perform risk management activities (identification, monitoring and analysis, handling). A clear framework for communicating identified risks was needed, including the assignment of responsibilities within the consortium. Additionally, easy-to-use tools were established to assist partners in performing assigned risk management activities for analysis, monitoring, and handling.

Throughout all the above steps, the project's objectives were placed within the main focus. How these steps were integrated into the project and how they would support mitigating negative consequences would be described in the following subchapters.

3.1 Risk Identification

The risk identification phase focuses on uncovering risks before they turn into problems. This is an iterative process which also includes the identification of possible causes and consequences. Participants in risk identification include subject-matter experts, WP leaders, the Innovation & Intellectual Property Manager (IIPM), the Technical Manager (TM), and the Project Coordinator (PC). For all identified risks, efficient contingency plans (resource reallocation, fallback, contingency measures) will be implemented immediately.

The process of identifying potential risks that could impact the project's success began during the proposal phase. The initial critical risks were documented and categorized into three groups: (i) technical, (ii) business, and (iii) management. This classification was conducted to ensure that the most relevant consortium members were assigned to closely monitor and mitigate the corresponding risks. For instance, the technical category includes risks that could significantly affect the project's execution and requires both the technical team's attention (e.g., WP leaders, the TM) as well as the managerial team (e.g., PC). The second one about business is linked to project exploitation activities; thus, it should be examined by the IIPM.

In the development of innovative research and technology, like the COCOON project, it is crucial to balance innovative value creation with risk management. Thus, to effectively identify and assess risks in such a specialized field, it is essential to have a team of experts with both technical and industry knowledge. The COCOON consortium brings together 12 partners, including research centres and universities, technology and testbed providers, end-users, and industrial partners, to ensure a comprehensive understanding of potential risks in the project's research.

The process of identifying potential risks is ongoing and not limited to the proposal preparation phase. To ensure constant vigilance, the COCOON consortium has designated the WP leaders as risk managers for their respective WPs. As experts in their fields, the WP leaders are best equipped to identify and address any risks that may arise.

3.2 Risk analysis and monitoring

The risk analysis and monitoring process is ongoing and repetitive, with regular evaluations of identified risks and their progress. Mitigation measures are also reassessed and updated as needed. The PC will gather internal reports every six months to continuously track the project's advancement. With regards to risks monitoring, the internal reporting will serve as continuous internal quality control and risk monitoring and assessment tool. Risk assessment includes the evaluation of the already stated risks according to the status of the project by the WP leaders (e.g., for the first phase of the project the starting point are the risks identified at the proposal stage). Being a continuous process, additions of unforeseen or potentially upcoming risks might also be expected. Those inputs will be included in the overall **COCOON Risk Monitoring Tool**, which is a live document hosted in the project's common repository, and which allows all partners to add new risks at any time. A screenshot of the “live” spreadsheet of the COCOON Risk Monitoring Tool is provided in the Annex.

The presented risk monitoring tool will be maintained updated, and its status will be assessed and reviewed at consortium meetings. Furthermore, for each identified risk, the risk monitoring tool provides information on the following: (a) risk number, (b) responsible partner, (c) description of risk, (d) category, (e) proposed contingency plan, (f) the date of last evaluation, (g) risk status (e.g., active or not), (h) probability, (i) impact. Hence, if risk is materialised there is a set of other information required such as “what has happened, why is it (not) relevant at the moment, if it was subject to the application of risk mitigation measures and if not, why, consequences, etc”.

The **risk analysis** in COCOON involves evaluating the risk attributes, and prioritizing (ranking) the risks. Evaluating risk attributes involves establishing values for probability (i.e., likelihood the risk event will occur) and the impact (i.e., estimation of the consequence of a risk in terms of significance for the project). The risk probability can be defined, determined, measured objectively or subjectively and can be expressed either qualitatively or quantitatively. The probability may be dependent on various factors like the project environment, consortium characteristics, external effects, technological breakthroughs etc. On the other hand, the possible impact and its level of severity define the effects and consequences the COCOON project may face in case of risk occurrence. The impact may be influenced by various risk triggers arising from the project environment, consortium characteristics, external effects, technological breakthroughs among others. In addition, it may affect the technological and financial performance as well as the schedule of the project.

COCOON implements the scoring system provided in Table. 2 below.

Probability (Prob)	Qualitative Impact (Im)
01 – 20 % = Remote (R)	1 = Insignificant
21 – 40 % = Unlikely (UL)	2 = Minor
41 – 60 % = Likely (L)	3 = Moderate
61 – 80 % = Highly Likely (HL)	4 = Major
81 – 99 % = Near Certainty (NC)	5 = Catastrophic

Table. 2 COCOON risk scoring system

3.3 Risk handling

Once a risk is evaluated as having a major or catastrophic impact and high or near certainty likelihood of occurring, the risk handling and response process is initiated. The WP leader collaborates with the TM and the PC to determine if countermeasures are necessary and at which project level the risk should be addressed. If the risk has a minimal impact on the project and can be managed by the WP leader, it will be handled at that level. However, if the risk is expected to have a significant impact on the project, the TM and IIPM or the General Assembly (GA) will be involved. In the case of substantial risks or major delays, the coordinator will also inform the Project Officer (PO) and provide a brief assessment of the situation.

4. COCOON risk updates

Through the first round of assessment between M1-M6, the PC has analysed and refined specific risks as originally described in the GA with the WP and Task leaders and tried to evaluate the potential overall risks. A list of risks and mitigation actions for each WP is presented in Table. 3 as identified during M1-M6 of the project based on the outlined risks in the GA. This list will be continuously revised during project execution by the WP leaders and discussed on each Project Management Board (PMB) meeting.

WP1 risks & reviews			
Risk	Im	Prob	Contingency Plan
R1.1 Refinement of PDP-EEs for network primitives not compatible with vendor hardware.	4	R	Partners have already developed such algorithmic system modules for Industrial IoT setups in programmable networked devices. In the remote event, alternatives through the P4 language will be implemented.
R1.1 review: This objective has been assessed by the WP leader and its corresponding risk verified to remain as originally proposed adhering to the original contingency plan.			R1.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R1.2 Orchestration of SFCs for synthesis of μ NFs not optimal in terms of network performance.	3	UL	Members have already implemented orchestration frameworks over ETSI NFV MANO applicable for resource-constrained IoT devices. In the unlikely event, partners will couple orchestration with vendor-specific frameworks.
R1.2 review: same as the review R1.1			R1.2 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R1.3 Graph-based provenance composition for risk profiling not computationally effective	3	R	Partners have implemented such approaches in the context of ICS and also IoT botnet profiling. Thus, it is a remote probability. If it however occurs, partners will integrate standardized OSINT data-driven APIs.
R1.3 review: same as the review R1.1			R1.3 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R1.4 DL-based cyber-physical diagnosis not optimal or functional.	3	UL	Partners have developed such schemes in the context of energy systems for aggregators and also for digital IEC 61580 substations. In the unlikely event partners will not utilize the synthesis of CNN and LSTM but will integrate alternative DL formulations such as RNNs.
R1.4 review: same as the review R1.1			R1.4 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R1.5 No cyber threat intelligence (CTI) is available for power grids.	3	UL	We will use publicly available data from ENISA, EE-ISAC (European Energy Information Sharing and Analysis Centre) and ENCS. ENISA provides a sector specific threat landscape. Furthermore, we will use vulnerability information reported publicly in CVE.
R1.5 review: same as the review R1.1			R1.5 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
WP2 risks & reviews			
Risk	Im	Prob	Contingency Plan
R2.1: State estimation methodology shows large inaccuracies when the used raw data are below the initially anticipated amount.	3	UL	The minimum required raw data for given accuracy will be derived based on accuracy-vs-amount of data analysis. If the additional data proves to pose a high computational burden and jeopardize the real-time performance of the system, model-predictive methods will be introduced for state estimation.
R2.1 review: This objective has been assessed by the WP leader and its corresponding risk verified to remain as			R2.1 contingency plan review: This risk has been re-assessed by the WP partners and its contingency plan remains the same.

originally proposed adhering to the original contingency plan.			
WP3 risks & reviews			
Risk	Im	Prob	Contingency Plan
R3.1: Mismatched configuration of COCOON solutions	3	UL	COCOON innovations will be revised, tested and validated by technical experts, ensuring and controlling the potential unsuitably matches on the COCOON solutions.
R3.1 review: This objective has been assessed by the WP leader and its corresponding risk verified to remain as originally proposed adhering to the original contingency plan.			R3.1 contingency plan review: This risk has been re-assessed by the WP partners and its contingency plan remains the same.
WP4 risks & reviews			
Risk	Im	Prob	Contingency Plan
R4.1: Low-level COMML and IOL modules do not optimally interface.	3	R	Partners already have prototypes interfacing such functionalities and the risk is remote. In case of the remote risk event, standardized NFV frameworks will be employed to achieve such functionalities.
R4.1 review: This aspect has been assessed by the WP leader and its corresponding risk verified to remain as originally proposed adhering to the original contingency plan.			R4.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R4.2: COCOON solution not achieving corresponding blackbox tests during software development and delaying TRL increase.	3	UL	Partners have had experience through other industrial projects to operate under a DevOps framework. Thus, this is unlikely. In case of unfortunate delays, an Agile development process will be implemented to reduce the timeframes between building the repository and testing it.
R4.2 review: This aspect has been discussed and the DevOps process has already been deployed up to M6 – the setup for software blackbox testing has been established and tests of the COCOON will be supported by Continuous Integration (CI) and Continuous Development (CD) automated pipelines. Blackbox testing might be affected but with appropriate adjustment of automation tools it will be easily fixed. The risk was UL and now is R and contingency plan refined.	3	R	R4.2 new contingency plan: If blackbox testing is not effective, re-adjustment of CI/CD pipelines will be conducted.
WP5 risks & reviews			
Risk	Im	Prob	Contingency Plan
R5.1: Configuration for AS emulation with the IKE setup is not functioning.	3	R	Partners have implemented similar services for interfacing with DRES deployments within the EASY-RES H2020 project. In the extremely unlikely event, conventional cloud IIoT routines will be employed.
R5.1 review: this risk has been re-assessed by the WP partners and it remains the same.			R5.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R5.3: The energy community has financial loss during the experimental phases.	3	UL	This is a risk that is unlikely to occur since the experiments will include segregated AS instrumentation over the network without affecting all PV installations. However, this risk will be discussed and a detailed contingency plan will be defined in the Grant Agreement.
R5.3 review: this risk has been re-assessed by the WP partners and it remains the same.			R5.3 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
WP6 risks & reviews			
Risk	Im	Prob	Contingency Plan

R6.1: Data related to South-East Europe grid stability processes are exposed publicly.	4	R	This is a quite unlikely event, since all data will be anonymized and compliant to GDPR during processing and presentation of results.
R6.1 review: this risk has been re-assessed by the WP partners and it remains the same.			R6.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R6.2: Experimentations interface with critical SEL operations.	3	R	This is quite unlikely since all experimentations and trials will be built with appropriate segregation properties.
R6.2 review: this aspect is now not related at all since experimentations will be conducted in a completely independent and setup that replicates the actual SEL operations. Hence this risk is not applicable and will not be included in next risk analysis.	N/A	N/A	No contingency plan since this risk will not be considered anymore.
WP7 risks & reviews			
Risk	Im	Prob	Contingency Plan
R7.1: Relevant DSO team is not available to attend the training sessions	3	UL	Partners will engage in the first year of the project with all DSOs in the consortium. We will plan and schedule the training sessions with all DSOs well in advance. In case one DSO team is not available, we have 2 other DSO teams to run the training sessions.
R7.1 review: this risk has been re-assessed by the WP partners and it remains the same.			R7.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R7.2: Unexpected problems with the implementation / operation of the solutions at demo-site	3	UL	Initial effort and planning will be placed during the first phase of the demonstration campaign to develop comprehensive deployment and monitoring plans. This will mitigate the risk of later difficulties implementing the solutions and tools. Potential risks will be first analysed in under laboratory conditions and through the digital twin.
R7.2 review: this risk has been re-assessed by the WP partners and it remains the same this aspect will be validated post M12.			R7.2 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
WP8 risks & reviews			
Risk	Im	Prob	Contingency Plan
R8.1: Interface with PV installation and the CPN is not functioning.	3	R	Partners have already implemented routines for interfacing SBCs with Internet-enabled PV installations and the risk is remote. In the unlikely event, the SBCs will couple with the firewall serving these installations.
R8.1 review: this risk has been re-assessed by the WP partners and it remains the same since this aspect will be validated post M12.			R8.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R8.2: Experimentation affects the PV plants generation reporting and AS instrumentation.	3	UL	The WP8 pilot setup has already been fully designed to have stable networking capabilities that can be used as alternatives in scenarios where AS instrumentation is impacted. The interface with CPNs will be based on standard protocols, thus this scenario is unlikely.
R8.2 review: R8.1 review: this risk has been re-assessed by the WP partners and it remains the same since this aspect will be validated post M16.			R8.2 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
WP9 risks & reviews			
Risk	Im	Prob	Contingency Plan
R9.1: Project facing technology replacement issues; project results become obsolete	3	UL	The project will be engaged in a continual technology watch effort through its interface with the scientific community, which will last till the very end of the project throughout all WPs. This risk will be met by involving all research partners of the project into design tasks ensuring that designs are kept in line with the most advanced developments.

R9.1 review: this risk has been re-assessed by the WP partners and it remains the same.			R9.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R9.2: Consortium ability to disseminate and exploit project knowledge	4	UL	The variety of partner backgrounds and their roles across the various levels of power transmission, distribution and aggregation include a large network of stakeholders that will ensure dissemination across the energy sector at an EU-wide level.
R9.2 review: this risk has been re-assessed by the WP partners and it remains the same.			R9.2 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
General Management (WP10) risks & reviews			
Risk	Im	Prob	Contingency Plan
R10.1 Some partners with responsibilities in a certain WP leave the project.	4	R	COCOON is internally capable of redistributing the work among the remaining partners. This would eventually require partners to hire missing resources.
R10.1 review: this risk has been re-assessed by the WP partners and it remains the same. A new partner (UCY) was added following an amendment and the risk remains with the same score.			R10.1 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R10.2 Consortium partners cannot agree because of different interests.	4	UL	The studied project management structure foresees clear conflict resolution and decision procedures to resolve this quickly.
R10.2 review: this risk has been re-assessed by the WP partners and it remains the same.			R10.2 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R10.3 Research and development gets into a sidetrack due to unclear vision and goals.	4	UL	Short catch-up sessions between WP leaders and the TM will be in place twice a month to prevent such issues. T10.4 is purposely designed to establish clear pathways for the technical work in advance.
R10.3 review: this risk has been re-assessed by the WP partners and considered the change to a new coordinator (UCY). The risk remains the same as before.			R10.3 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.
R10.4 Risk of partners not delivering cost estimates and deliverables on time.	2	L	Internal deadlines within the consortium are set well before the defined deadlines. Also, names and contact information of responsible research persons, financial persons and legal persons are collected from each partner, reminders will be sent before the internal deadlines.
R10.4 review: this risk has been re-assessed by the WP partners and it remains the same.			R10.4 contingency plan review: this risk has been re-assessed by the WP partners and its contingency plan remains the same.

Table. 3 COCOON's risks and risk reviews

5. Conclusion

This deliverable proposed an effective risk management process and risk analysis framework for the COCOON project which is crucial for successful project delivery in the research and innovation sphere. Specifically, this report has re-examined the initial risks stated in the Grant Agreement and their progression six months into our ongoing project. We also proposed the evaluation of the risks based on the project's critical path, which identifies the most time-critical tasks and underpins our risk management strategy. This allows us to prioritize mitigation efforts for the most impactful project elements.

The proposed COCOON's risk management process is systematic and integrated throughout the project. It includes three stages: (i) identification, (ii) monitoring and analysis, and (iii) handling, with the aim to continually identifying and monitoring risks. Therefore enable further analysis based on their implications and hence adopt suitable mitigation strategies or update/adapt these strategies based on the needs.

The herein initial risk management plan has reviewed and refined the original risks as outlined in the original proposal and Grant Agreement at a project as well as at a WP level. Mitigation actions for the reduction or elimination of these risks have also been proposed. Specifically, we initially identified various technical, financial, and regulatory risks at WP level. After six months, we reassessed these risks with a more refined granularity at Task and subtask level, finding that most remain pertinent.

In summary, our risk management efforts have effectively monitored potential project vulnerabilities in the first six months of the project rollout. The consistency of identified risks suggests that our initial assessment was accurate and mitigation strategies have prevented new risks.

Annex

The Fig. 2 below shows a sample of the Risk Assessment tool to be used as part of the COCOON Risk analysis process.

Risk Evaluation Form					Current assessment of risk					
Risk Nr.	Responsible Partner	Description of risk	Category (Technical/Business/Management)	Proposed Contingency plan (Avoid – Reduce – Contingency – Transfer – Accept – Share)	Date of last evaluation	a) Is the risk still relevant? (Yes/No)	b) Probability How likely will the risk occur?	c) Severity/ Impact	d) Did the risk materialise? (Yes/No)	e) Please provide a short update of the risk: (e.g.: What has happened? , Why is it (not) relevant at the moment?, etc.)
R1.1	UCY	Refinement of PDP-EEs for network primitives not compatible with vendor hardware.	Technical	Partners have already developed such algorithmic system modules for Industrial IoT setups in programmable networked devices. In the remote event, alternatives through the P4 language will be implemented.	5/6/2024	Yes	R	4	No	R1.1 review: This objective has been assessed by the WP leader and its corresponding risk verified to remain as originally proposed adhering to the original contingency plan.
R1.2	UCY	Orchestration of SFCs for synthesis of μ NFs not optimal in terms of network performance.	Technical	Members have already implemented orchestration frameworks over ETSI NFV MANO applicable for resource-constrained IoT devices. In the unlikely event, partners will couple orchestration with vendor-specific frameworks.	5/6/2024	Yes	UL	3	No	R1.2 review: same as the review R1.1
R1.3		Graph-based provenance composition for risk profiling not computationally effective	Technical	Partners have implemented such approaches in the context of ICS and also IoT botnet profiling. Thus it is a remote probability. If it however occurs, partners will integrate standardized OSINT data-driven APIs.	5/6/2024	Yes	UL	3	No	R1.3 review: same as the review R1.1
R1.4		DL-based cyber-physical diagnosis not optimal or functional.	Technical	Partners have developed such schemes in the context of energy systems for aggregators and also for digital IEC 61580 substations. In the unlikely event partners will not utilize the synthesis of CNN and LSTM but will integrate alternative DL formulations such as RNNs.	5/6/2024	Yes	UL	3	No	R1.4 review: same as the review R1.1
R1.5		No cyber threat intelligence (CTI) is available for power grids.	Technical	We will use publicly available data from ENISA, EE-ISAC (European Energy Information Sharing and Analysis Centre) and ENCS. ENISA provides a sector specific threat landscape. Furthermore, we will use	5/6/2024	Yes	UL	3	No	R1.5 review: same as the review R1.1

Fig. 2 Sample of the COCOON Risk Assessment TOOL