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Project Acronym: FlexCHESS

Deliverable 6.4

FlexCHESS

Horizon Europe Programme
Research and Innovation Action

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D 6.4 Quality assurance plan and risk management

Flexibility services based on Connected and Interoperable Hybrid Energy Storage

Deliverable details	
Work Package Title	**Management and Project Coordination**
Task Number	**6.3**
Deliverable Number	**6.4**
Deliverable Title	**Quality Assurance Plan and Risk Management**
Revision Number	**4**
Responsible Organization	**RDIUP**
Author(s)	**Habib Nasser, Khaoula Mouhand (RDIUP)**
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Version	**Authors**	**Actions**
V0	Khaoula MOUHAND, Habib NASSER (RDIUP)	To be reviewed internally by RDIUP
V1	Reviewed by Oussema NASSER (RDIUP)	To be reviewed by MIW and EL
V2	Reviewed by Pablo BARRACHINA (MIW) and Ursula KRISPER (EL)	To be improved by RDIUP
V3	Improved by RDIUP	To be submitted
V4	Revised by RDIUP	To be re-submitted

Contributing partners	
1.	AIX MARSEILLE UNIVERSITY – France (Coordinator)
3.	RDIUP – France

4.	ARCELIK A.S. – Turkey
5.	ELEKTRO LJUBLJANA PODJETJE ZADISTRIBUCIJO – Slovenia
6.	CIP CITIZENS IN POWER – Cyprus
7.	LA SOLAR ENERGIA SOCIEDAD COOPERATIVA – Spain
8.	My Energia ONER, S.L. – Spain
9.	IREN SPA – Italy
10.	IREN ENERGIA SPA – Italy
11.	UNIVERSITA DEGLI STUDI DI GENOVA – Italy
12.	ULUDAG ELEKTRIK DAGITIM ANONIM SIRKKETI – Turkey

Associated partners	
1.	TOSHIBA EUROPE LIMITED –UK
2.	CARDIFF UNIVERSITY –UK.

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Glossary

Partner Names Abbreviations

Abbreviation	Description
AMU	AIX MARSEILLE UNIVERSITY
ALWA	ALGOWATT
RDIUP	RDIUP'
ARC	ARCELIK A.S.
EL	ELEKTRO LJUBLJANA PODJETJE ZADISTRIBUCIJO
CIP	CITIZENS IN POWER
LASOLAR	LA SOLAR ENERGIA SOCIEDAD COOPERATIVA
MIW	My Energia ONER, S.L.
IREN	IREN SPA
IEN	IREN ENERGIA SPA
UNIGE	UNIVERSITA DEGLI STUDI DI GENOVA
UEDAS	ULUDAG ELEKTRIK DAGITIM ANONIM SIRKKETI
TOSHIBA	TOSHIBA EUROPE LIMITED
CU	CARDIFF UNIVERSITY

Abbreviations and Acronyms:

Abbreviation	Description
AI	Artificial Intelligence
ADR	Automated Demand Response
API	Application Programming Interface
BESS	Battery Energy Storage System
CA	Consortium Agreement
CAPEX	Capital Expenditure
CDF	Common Data Format
CHESS	Combined Heat and Power Hybrid Energy Storage Systems
CoAP	Constrained Application Protocol
D.	Deliverable
DER	Distributed Energy Resource
DL	Deliverable Leader
DLT	Distributed Ledger Technology
DOA	Description of Action
DSO	Distribution System Operator
DT	Digital Twin
EB	Executive Board
EC	European Commission
eIDAS	Electronic Identification, Authentication, and Trust Services
EO	Expected Outcomes
ESS	Energy Storage Systems
EU	European Union

Abbreviation	Description
EV	Electric Vehicles
GA	General Assembly
GDPR	General Data Protection Regulation
HESS	Hybrid Energy Storage Systems
IPR	Intellectual Property Rights
KB	Knowledge Base
KPI	Key Performance Indicator
ML	Machine Learning
MoM	Minutes of Meeting
MS	Microsoft
MQTT	Message Queuing Telemetry Transport
NIS	Network and Information Systems
No	Number
OEO	Open Energy Ontology
OKB	Open Knowledge Base
OPEX	Operational Expenditure
OPSD	Open Power System Data
PC	Project Coordinator
PMT	Project Management Team
PO	Project Officer
PU	Public
QA	Quality Assurance
QAP	Quality Assurance Plan
QRM	Quality and Risk Manager
RES	Renewable Energy Sources
RMP	Risk Management Plan
RT	Real Time
SGAM	Smart Grid Architecture Model structure
SME	Small and Medium-sized Enterprises
SOA	State Of the Art
SO	Strategic Objective
SPT	Smart Planning Tool
STM	Scientific and Technical Manager
T.	Task
TRL	Technology Readiness Level
UK	United Kingdom
VESS	Virtual Energy Storage Systems
VPP	Virtual Power Plant
VSoC	Virtual State of Charge
WI	Wider Impact
WP	Work Package
WPL	Work Package Leader

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Executive Summary

This deliverable 6.4 titled “Quality Assurance Plan and Risk Management” developed within WP6 “Management and Project Coordination”, operates as a guide for FlexCHESS partners. As it highlights the quality processes and the risk mitigation approach that will coordinate the FlexCHESS progresses.

Within this document, we established essential procedures, processes, and best practices, as well as a set of quality guidelines for project deliverables and the responsibilities of consortium members. It is considered as a handbook for verifying quality and supporting project progress while ensuring the release of high-quality outputs.

Additionally, the document aims to identify and manage potential risks that may occur throughout the project’s realization. It outlines key risks, their monitoring and control, along with a comprehensive risk assessment and mitigation strategy.

Th D6.4 report is built on the experience acquired in VPP4ISLANDS project, and it is based on the provisions specified in FlexCHESS Grant Agreement (GA) and Consortium Agreement (CA). It fosters collaboration among consortium members, ensuring smooth project execution in alignment with the Gantt chart and EU regulations for research and innovation reporting.

The Quality Assurance Plan and Risk Management act as a cross-verification process applicable to all WPs within the project.

Introduction

FlexCHESS face challenges, difficulties, and changes, thus, a quality approach is required. This deliverable operates as a reference, outlining the essential practices, procedures, and regulations, for a unified and structured approach towards a successful implementation and completion of our activities in FlexCHESS.

To uphold proper standards of outcomes quality and actively manage potential risks, this document contains two key components: (1) The Quality Assurance Plan and (2) The Risk Management Plan.

The Quality Assurance Plan is aimed at ensuring steady project advancement and maintaining high-quality standards. That can be reached through well-defined roles and responsibilities, quality control for project deliverables, verification of project milestones, clear communication channels between partners, and a reliable resolution framework.
It begins by outlining the responsibilities of partners overall project quality and deliverables. It further elaborates on the processes to ensure top-tier for outcomes and milestones. Additionally, it addresses the internal communication protocols not covered by other project documentation, presents the conflict resolution approach, and sets out the project's progress indicators.

On the other hand, the risk management plan focuses on detecting potential critical risks and assessing the risk exposure levels, continuously monitoring risks, and proposing mitigation strategies to manage these risks effectively.

This deliverable 6.4 is classified as 'Public' (PU), grating access to FlexCHESS partners, European Commission, and external stakeholders.

The main objective of this plan is to serve as a practical guide for the Project Coordinator (PC) and the partners, ensuring that quality and risk reviews are carried out at appropriate milestones. It is also considered as a reference to clarify the responsibilities of all partners contributing to the project communication, deliverables, and project outcomes. The plan is applicable to all activities with the project, and all participants are expected to follow the approved guidelines.

In the following sections, the deliverable is composed of three plans: (1) the Quality Assurance Plan (QAP), (2) the Risk Management Plan (RMP) and (3) conclusions. In the first section, various requirements and guidelines are drafted by defining criteria, methods, and responsibilities of involved partners. This chapter mainly includes the drafting and assessment of deliverables, conflict management, and the application of key performance indicators (KPIs) for quality oversight. The second chapter will concentrate on risk management activities, outlining the methods and procedures for addressing unforeseen changes and modifications within the project.

This deliverable is also updated to highlight the new key actions taken by the consortium and modifications carried out to ensure an appropriate execution of FlexCHESS after ALWA withdraw.

Finally, lessons learnt, and conclusions are provided to enhance and improve the quality of the project execution.

Quality Assurance Plan

To achieve our gools and guarantee a successful execution of activities, the Quality Assurance strategy is particularly essential. This strategy is primary intending at ensuring the highest quality in the outcomes of our FlexCHESS activities. In this direction, we defined clearly the roles and responsibilities of partners regarding the project structure. In the upcoming sections, we present the various quality assurance roles within FlexCHESS, as well as the attributions of roles among partners across WP, activities, and deliverables.

B roles' definitions, the plan embraces various components, including a structured review process to validate the quality of deliverables, verification means for FlexCHESS milestones, appropriate cooperation among partners, and a fair conflict resolution process. Our plan includes all these processes under one collective framework. Additionally, the risk management is an important piece of quality assurance. Thus, the evaluation of our project's risks, implementations and achievements, during regular meetings, will showcase the essential insights for quality assurance. These assessments operate as a guide, leading to the successful completion of the project.

Consolidating all these practices allows to form a cohesive plan dedicated to reach better quality and ensuring success during our project lifetime.

4. Quality Assurance Roles

The table 1 details the key roles within the FlexCHESS project allowing an improved-quality assurance. It is essential to note that all consortium partners committed to deliver good quality findings, results, milestones, and deliverables.

Table 1: Quality Assurance Roles

Partner	Responsibility
Project Coordinator (PC): Seifeddine Ben Elghali (AMU)	He leads the GA meetings and acts as the project representative to the European Commission (EC). He oversees project management with a strong emphasis on maintaining quality standards, collects, consolidates, and reviews participant data every two months, prioritizing data quality assurance. He also prepares annual submissions to the EC, with a focus on incorporating quality metrics.
Scientific and Technical Manager (STM): Prof. Jianzhong Wu (CU)	He guides scientific decision-making, ensuring research integrity and high-quality standards, and technical challenges by applying corrective measures to uphold quality. Ensures timely completion of technical and scientific goals, reinforced by strict quality controls.

	He follows technical integration and open science, prioritizing quality assurance throughout the process.
Quality and Risk Manager (QRM): Ursula Krisper (EL)	She tracks technical and administrative risks reported by WPLs, with a focus on mitigating risks to ensure quality assurance. She provides the PC with updates on potential quality issues and offers recommended solutions. She follows the implementation of quality procedures and conducts routine audits to ensure compliance with established standards.
GDPR, Data and Ethics Manager (GDEM): Dr. Habib NASSER (RDIUP)	He ensures personal data quality, accessibility, integrity, protection, and security, adhering to GDPR, ePrivacy, policies, and procedures. (Previously, it was led by ALWA)
Exploitation and Innovation Manager (EIM): Khaoula Mouhand (RDIUP)	She follows the key project outcomes, exploitation and marketing, fostering quality of information and ensures innovation meets rigorous quality criteria. She handles and tracks IPRs and KERs with a quality assurance perspective. (Previously, it was the role of Constantina Stavrou (CIP))
Work Package Leader (WPL)	Direct and oversee work packages (WPs), prioritizing high-quality outputs and timely delivery of deliverables. Ensure the effective implementation and coordination of various tasks within the WP, with a strong emphasis on quality control measures.
Deliverable Leader (DL)	Define the table of contents, collect data for the deliverable, while managing quality assurance processes. Coordinate efforts to ensure alignment with overall quality goals. Responsible of submitting the deliverable in time.
Task Leader	Handle tasks execution within the WP, promoting and ensuring the importance of quality in realisation and implementing measures to uphold requirements. Follow and oversee the reporting of deliverables, ensuring a consistent approach to quality. Coordinate activities realization, conducting regular quality checks. Reports to WPL as necessary, emphasizing any quality-related challenges or successes.
Reviewer (New Role)	Review the deliverables, give feedback and submission decision for the evaluated document (evaluation form) and provide improvement and highlight the missing parts.

5. WPs and Tasks roles

In alignment with our engagement to maintaining the greatest quality levels throughout the FlexCHESS project, we have established a comprehensive framework for partners' responsibilities. Each work package (WP) is managed by a designated partner known as the Work Package Leader (WPL). Furthermore, WPs are subdivided into specific activities, each managed by a TL. These tasks involve the participation of one, several, or all partners, promoting a collaborative environment. This approach ensures clear rules of responsibility and expertise in task execution. By leveraging the collective strengths of our consortium, we not only enhance our efficiency but also uphold the rigorous quality guidelines that FlexCHESS is aiming to reach out.

Table 2 illustrates the key partners' roles in the WPs and their respective activities. This is considered as a living-reference to promote transparency and foster the cooperative efforts committed to provide appropriate outcomes. In this section, mainly T3.4 and T3.6 are now led by AMU to take over the activities and roles of ALWA. Also, RDIUP is now leading Task T6.4 "Data management plan" to ensure a smooth continuity of project execution.

Table 2: Partners' responsibilities - WPs and Tasks (From proposal)

WPs and Tasks		**Leader**	**Participants**
WP1. Requirements and Specifications of FlexCHESS solutions		**RDIUP**	
T. 1.1	Needs and flexibility requirement	TOSHIBA	All partners
T. 1.2	Definition of FlexCHESS concepts	CU	All partners
T. 1.3	Definition of flexibility services	ALWA	RDIUP, AMU, MIW, Pilot sites
T. 1.4	Technical specifications	RDIUP	All partners
T. 1.5	Use cases and scenarios	AMU	All partners
WP2. Development of Interoperable HESS		**TOSHIBA**	
T. 2.1	Interoperability communication layer	ARC	RDIUP, TOSHIBA
T. 2.2	Blockchain-based tokenization & cybersecurity mechanisms	RDIUP	
T. 2.3	Connected HESS	TOSHIBA	AMU, RDIUP
T. 2.4	Smart plug for third party appliances	ARC	
WP3. Open Flex-Platform		**AMU**	
T. 3.1	Short term Forecasting tool	AMU	RDIUP
T. 3.2	RT Digital twin	TOSHIBA	AMU, CU, RDIUP, ALWA
T. 3.3	High-Level Decision Support Systems	AMU	RDIUP
T. 3.4	Flexibility Services Provider	AMU	TOSHIBA, AMU
T. 3.5	Smart Energy Management tools	TOSHIBA,	AMU, CU

T. 3.6	Open Knowledge Platform	AMU	TOSHIBA, ARC, AMU, RDIUP, CU
WP4. Demonstration & Validation		**EL**	
T. 4.1	Lab Validation	AMU	UNIGE, RDIUP
T. 4.2	Preparation, demonstration, and validation of use cases	CU	Pilots
T. 4.2.1	Preparation of pilots	CU	LASOLAR, MIW, AMU, EL, UDEAS, IREN, IEN
T. 4.2.2	Demonstrations	UEDAS	All pilot sites
T. 4.3	Socio-economic Assessment	CIP	RDIUP, LASOLAR, MIW
T. 4.4	Impact of flexibility on power systems	UNIGE	All pilot sites
T. 4.5	Comparative studies and replicability of FlexCHESS	UNIGE	RDIUP, MIW, all pilot sites
WP5. Dissemination, communication, and Exploitation of results		**CIP**	
T. 5.1	Dissemination and Communication plan	AMU	All partners
T. 5.2	Dissemination and Communication activities	CIP	All partners
T. 5.3	Energy Community and living lab building	CIP	RDIUP, LASOLAR
T. 5.4	Joint actions	CIP	RDIUP
T. 5.5	Incentive-based business model	RDIUP	All partners
T. 5.6	IPR & Exploitation strategies	RDIUP	All partners
WP6. Management and project coordination		**AMU**	
T. 6.1	General and financial management	AMU	All partners
T. 6.2	Technology and scientific management	CU	AMU
T. 6.3	Quality assurance and risk management	RDIUP	All partners
T. 6.4	Data management plan	RDIUP	All partners
T. 6.5	Reporting and monitoring of the project progress	AMU	All partners
T. 6.6	Ethics requirements	AMU	All partners

6. Deliverables

The DL coordinates the production of each deliverable, while TLs are responsible for ensuring the timely creation of high-quality outputs. To achieve these goals, TLs will be responsible for the drafting process alongside linked partners, contributors, and

peer-reviewers. This collaborative method ensures a clear and quality-driven development process for each deliverable.

The table 3 outlines the leader and due date of the deliverables production. This acts as a living-reference to promote transparency and streamline the collective efforts contributed to reaching our high-quality deliverables. After the leaving of ALWA, AMU took the responsibility to report and lead the production of D3.4 “Flexibility Services Provider” and D3.6 “Open Knowledge Platform”. RDIUP ensured the final drafting of the “Data Management Plan » already well started by ALWA.

Table 3: Partners' responsibilities – deliverables

D. Related No	D. No	Deliverable Name	Leader	Due Date
D1.1	D1	A report on needs and flexibility requirements	TOSHIBA	28/02/23
D1.2	D2	Report on FlexCHESS concept	CU	28/02/23
D1.3	D3	Report on flexibility services	ALWA	31/03/23
D1.4	D4	Report on the technical requirements	RDIUP	31/05/23
D1.5	D5	Definition of FlexCHESS’ use cases and scenarios	AMU	31/08/23
D2.1	D6	Report on systems interoperability & communication layer architecture specifications	ARC	31/05/24
D2.2	D7	Report on blockchain-based platform	RDIUP	30/09/24
D2.3	D8	Report on connecting HESS	TOSHIBA	30/09/24
D3.1	D10	Short term Forecasting tool	AMU	31/07/24
D3.2	D11	RT Digital twin	TOSHIBA	31/07/24
D3.3	D12	High-Level Decision Support Systems	AMU	30/09/24
D3.4	D13	Flexibility Services Provider	AMU	30/09/24
D3.5	D14	Smart Energy Management tools	TOSHIBA	30/09/24
D3.6	D15	Open Knowledge Platform	AMU	30/11/24
D3.7	D9	Report on CHESS-plug usage, data collection and communication with FlexCHESS platform	ARC	30/09/24
D4.1	D16	Validation report and user manual of FlexCHESS solutions	AMU	31/01/25
D4.2	D17	A report on the optimal adaptation of DERs within FlexCHESS and the key requirements of efficient deployment of FlexCHESS nodes	CU	31/01/25
D4.3	D18	Report on pilot sites results	UEDAS	31/07/25
D4.4	D19	Socio-economic Assessment	CIP	31/07/25
D4.5	D20	Impact of flexibility on power systems	UNIGE	30/11/25

D4.6	D21	Comparative studies and replicability of FlexCHESS	UNIGE	30/11/25
D5.1	D22	Dissemination and Communication plan	AMU	28/02/23
D5.2	D23	Dissemination and Communication activities	CIP	31/01/24
D5.3	D24	Energy Community and living lab building	CIP	30/09/24
D5.4	D25	Joint actions	CIP	31/05/25
D5.5	D26	Incentive-based business model	RDIUP	30/11/24
D5.6	D27	IPR & Exploitation strategies	RDIUP	30/11/25
D6.1	D28	Kick-off report and detailed roadmap	AMU	28/02/23
D6.2	D29	A quality assurance framework	CU	31/01/23
D6.3	D30	Completing QA for technical and scientific tasks	CU	31/01/23
D6.4	D31	Quality Assurance Plan and risk assessment	RDIUP	30/11/23
D6.5	D32	Data Management Plan	ALWA and RDIUP	30/11/24
D6.6	D33	Project management plan	AMU	31/01/23

6.1. Deliverables' Production

Each deliverable will be initiated and validated via a common rigorous process. Figure 1 depicts an overview of the key steps and timelines for the appropriate definition and production of deliverables.

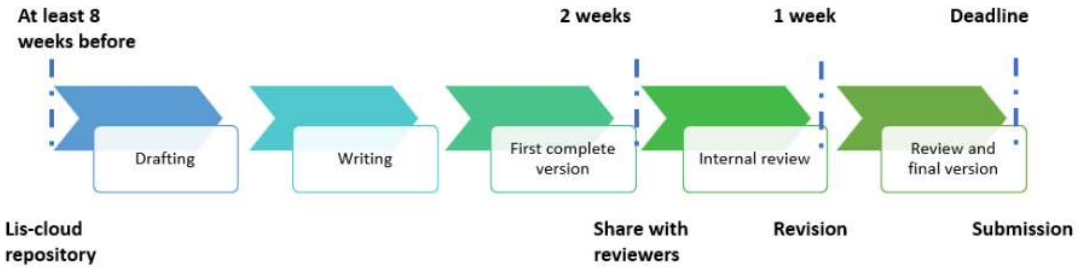

Figure 1: Deliverables' Production Process

The DLs should initiate the process at least 8 weeks prior to the deadline by defining the table of contents and structuring the deliverable in agreement with the DOA and in consultation with the WPL, implicated partners, and the PC. Afterward, the DLs collect and evaluate the contributions from the involved leaders.

The author(s) of deliverables will focus on providing high-quality content to produce these reports. Based on the received inputs, the author(s) will provide a complete version of the deliverable to be shared with reviewers for feedback and improvements.

The review period takes one week. Based on received feedback, the DL will address the comments and improve the quality of the deliverable in one week, preparing a final document for validation by the WPL and/or the PC. Then, the PC submits the final PDF version to the EC, and unless it is confidential, PC allows the sharing publicly of the approved deliverable on the FlexCHESS website in accord with the dissemination rules. Additionally, PC will announce the submission of the deliverables via the general mailing list, informing all partners.

This specific process enables authors and DLs to detect early possible deviations, transmit issues and delays requiring resolutions for successful deliverable production. Any necessary intervention should be coordinated via the WPL and/or the PC.

6.2. Deliverables' Reviewing Process.

Deliverables, considered as formal documents to the EC, go through a rigorous verification process to maintain and enhance the quality of our work in alignment with EC guidelines. For optimal editing and functionality, it is recommended that these documents be edited using MS Word with track changes, as the online Cloud platform may restrict certain template functionalities.

Responsibilities within the consortium are clearly defined. The DL manages all actions related to the deliverable, working closely with task participants, while WPLs oversee activities, ensuring deadlines are met and the quality is upheld. Regular progress reports are provided to the PC. If any issues or conflicts arise, the DL can consult the WPL, who may then engage the QRM.

The FlexCHESS consortium has implemented a robust quality assurance process for reviewing project deliverables. Reviewer assignments are recorded in a shared spreadsheet, accessible via the FlexCHESS Cloud platform. As a general rule, deliverables follow the standard production process (see. Figure 1). Deliverables are distributed to reviewers roughly two weeks before the submission deadline to allow sufficient time for review and improvement.

To ensure that deliverables meet the predefined goals and address end-user expectations, a peer review process is defined. A quality evaluation form has been created to guide reviewers in this verification process.

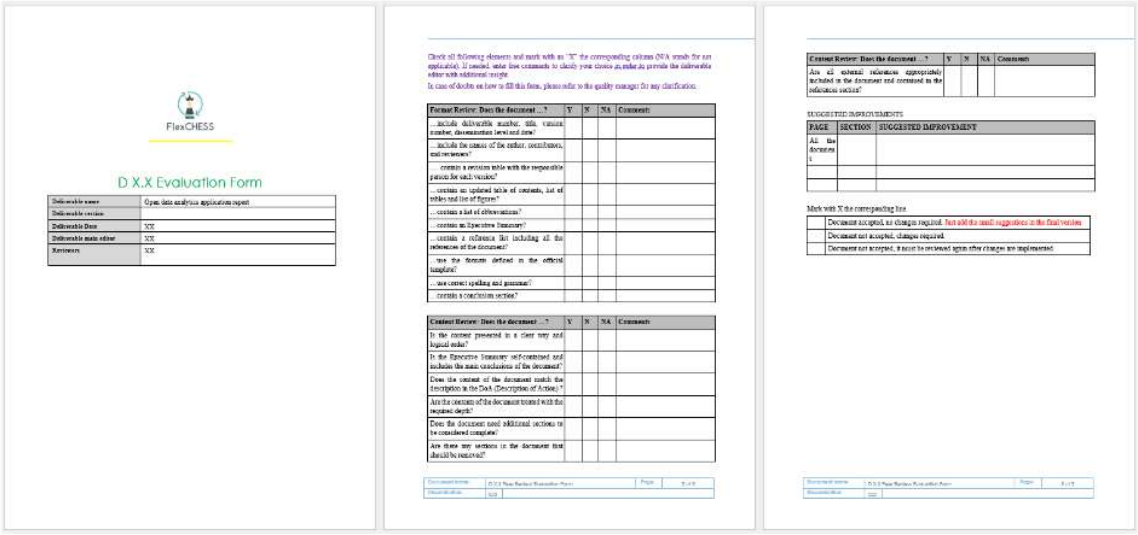

Figure 2: Evaluation form of Deliverables provided by RDIUP

Post peer-review, the DL is responsible for addressing all comments and requests outlined in the peer review report. Then the PC conducts the final review, ensuring that deliverables align with the DAO, project goals, content quality, and the correct use of established templates and logos. Following this, the PC submits the deliverable to the EC through the Participant Portal. Public deliverables are then subsequently published on the project's website and disseminated to a broader audience.

Additionally, the PC plays a crucial role in supporting the DLs, task leaders, or WPLs in resolving any challenges or difficulties encountered during the production process, and actively working to ensure the smooth seamless development of deliverables. Regarding the new consortium modification, AMU will replace ALWA to review D.15 and D.26 and RDIUP will review the D.27

The Table 4 details the reviewers of each deliverable as summarised below.

Table 4: Deliverables' peer-reviewers (shared in the project Lis-cloud work space).

Deliverable No	Reviewer 1	Reviewer 2	Due Date
D.1	LASOLAR	EL	28/02/23
D.2	AMU	UNIGE	28/02/23
D.3	CIP	TOSHIBA	31/03/23
D.4	IREN	ARC	31/05/23
D.5	UNIGE	EL	31/08/23
D.6	IREN	TOSHIBA	31/05/24
D.7	MIW	CU	30/09/24
D.8	AMU	ARC	30/09/24
D.9	LASOLAR	TOSHIBA	30/09/24
D.10	LASOLAR	UEDAS	31/07/24
D.11	CU	ALWA	31/07/24
D.12	UNIGE	UEDAS	30/09/24

D.13	AMU	CU	30/09/24
D.14	MIW	ARC	30/09/24
D.15	AMU	ARC	30/11/24
D.16	IREN	UEDAS	31/01/25
D.17	AMU	EL	31/01/25
D.18	UNIGE	CU	31/07/25
D.19	MIW	UEDAS	31/07/25
D.20	TOSHIBA	CU	30/11/25
D.21	IREN	EL	30/11/25
D.22	CIP	RDIUP	28/02/23
D.23	LASOLAR	ARC	31/01/24
D.24	LASOLAR	RDIUP	30/09/24
D.25	MIW	UEDAS	31/05/25
D.26	CIP	AMU	30/11/24
D.27	CIP	RDIUP	30/11/25
D.28	CIP	RDIUP	28/02/23
D.29	AMU	RDIUP	31/01/23
D.30	IREN	ALWA	31/01/23
D.31	MIW	EL	30/11/23
D.32	UNIGE	TOSHIBA	30/11/24
D.33	AMU	RDIUP	31/01/23

6.3. Deliverables' Dissemination

Effectively disseminating project results is essential for raising awareness of the project and making its outcomes accessible to stakeholders and a wider audience. According to the EC guidelines, all project outcomes and findings, including the deliverables, must feature the EU emblem and include the following text in accordance with Art. 29.4:

> *"This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No°101096946".*

For all public 'PU' deliverables and disseminations, the following disclaimer is required:

> *"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or* European Climate, Infrastructure and Environment Executive Agency (CINEA). *Neither the European Union nor the granting authority can be held responsible for them".*

Additionally, the Copyright for these documents remains with the FlexCHESS Partners. The project and EC logos must be prominently displayed. Further details and guidelines can be found in the project's dissemination plan.

7. Milestones and means of Verification.

In regular WP meetings, the WPLs present a detailed progress report on activities, covering key milestones and potential risks. Any unexpected deviations are addressed, with explanations provided. As updates, TOSHIBA is the responsible of the ML5 “RT Digital Twin”, and AMU took the leading of MLs 6 and 7, respectively for “Flexibility service providers” and open Knowledge platform.

Table 5: List of Milestones and corresponding means of verification (from FlexCHESS proposal).

No.	Milestone Name	WP	Leader	Means of verification	Due month
1	Definition of technical requirements	WP1	RDIUP	Final version of D1.4	6
2	Definition of FlexCHESS’ use cases and scenarios	WP1	RDIUP	Final workshop on scenarios definition and D1.5	9
3	Development blockchain-based platform	WP2	RDIUP	Alpha version of DT already tested	20
4	Development of connecting HESS	WP2	TOSHIBA	Submission of D2.3	22
5	RT Digital twin	WP3	TOSHIBA	Submission of D3.2	20
6	Flexibility Services Provider	WP3	AMU	Submission of D3.5	22
7	Open Knowledge Platform	WP3	AMU	Integration workshop and Deliverable D3.6	24
8	Preparation of pilots	WP4	EL	Deliverable D4.2	26
9	Validation FlexCHESS solutions	WP4	EL	Demonstrations and D4.3	32
10	Incentive-based business model	WP5	CIP	Business model workshop and D5.5	36
11	IPR & Exploitation strategies	WP5	CIP	Deliverable D5.6	36
12	Kick-of meeting	WP6	AMU	Agenda and Report on kick-of meeting	1

Consistently monitoring the achievement of results and closely tracking project milestones are effective strategies for improving overall project quality. By keeping a careful watch on both the outcomes attained and the advancement towards key milestones, the project consortium can proactively tackle challenges, guarantee alignment with project goals, and make timely improvements, all of which ensure the project's overall success.

8. Consortium Communication Strategies

Regular meetings are practical means to discuss and carry out quality assurance efforts of the FlexCHESS project, supported by detailed documentation in the form of Minutes of Meetings (MoMs). These official records summarize discussions, decisions, and action items, acting as essential references to ensure that participants are aligned on discussions and accountable for the actions agreed upon. MoMs are crucial for monitoring progress, ensuring accountability, and preserving the overall quality of project results.

Consortium partners regularly meet, at least monthly, via online conference tools for progress meetings facilitated by the Project Coordinator (PC). During these sessions, each WPL shares updates on their respective WP progress, encouraging collective discussions about project advancements, identifying synergies, and assessing areas where collaborative support is needed.

The General Assembly (GA) meetings, conducted yearly both in-person and online, serve as key forums to discuss upcoming major tasks and strengthen collaboration throughout the consortium.

In addition to consortium-wide meetings, partners participate in bilateral WP meetings. WPLs are responsible for organizing these monthly meetings, providing a focused platform to monitor WP progress, examine tasks, and support on deliverable production.

In WP1, RDIUP has organized bi-weekly meetings to track the progress of each task and scheduled separate discussions for specific topics. Addressing minor deviations in report preparation has been crucial for enhancing the quality of deliverables, making this approach highly effective.

Ad hoc meetings are also scheduled as necessary, focusing on specific deliverables based on partner requirements, further improving the flexibility of our communication process.

This meeting structure has led to strong partner engagement, consistent commitment, and high satisfaction levels. Effective communication between the PC and WPLs is essential for the smooth execution of the work plan and timely resolution of any emerging issues. WPLs collaborate closely with task leaders to ensure WP objectives are fully aligned with the broader project objectives.

9. Conflict Resolution Approach

Maintaining coordination within the FlexCHESS consortium, particularly as we steer technical, scientific, and business cooperations, requires an efficient conflict resolution process. Our strategy features a multi-tiered process designed to resolve conflicts promptly and smoothly.

Initially, conflicts and disagreements will be handled informally through open discussions among FlexCHESS partners and explicit communication between the involved actors. Any agreements or resolutions from these discussions will be formalized through traceable tools and documents such as emails, letters, or agreed-upon meeting minutes.

If informal resolution proves unsuccessful, the issue will be raised to the Work Package Leader (WPL), who will organize a general WP meeting to address the problem. If the conflict persists, it will be elevated to the Project Coordinator (PC), who will work with the implicated parties to reach a resolution.

In cases where efforts with the PC do not lead to a common accord, the issue may be further raised, potentially involving the Project Officer (PO) to enable an effective decision.

This conflict resolution process ensures an efficient approach to handling disputes, beginning with open dialogue and progressing through an organised escalation process. Established in communication, collaboration, and adherence to project regulations, this strategy intends to keep productivity and ensure the project's success.

10. Project Progress Indicators

Our approach involves actively managing project metrics and KPIs. The principal tool for monitoring project progress and assessing performance is the set of project KPIs predetermined within the Grant Agreement.

Dynamic project development and realisation requires continuous evaluation and adjustment based on updated conditions, cost factors, and adherence to the schedule. Monitoring and evaluation of project indicators are conducted annually during both internal and official project reporting within the consortium. The results of performance measurement and evaluation are included in progress reports submitted to the EC, with the PC overseeing their preparation and gathering input from each partner. The PC also schedules monthly online meetings where WPLs provide detailed progress reports. This proactive approach enables early identification of deviations from planned project targets, whether delays or early completions, and assesses their impact on overall project quality. These evaluations operate as a key metric for determining the project's success upon its completion.

All indicators within FlexCHESS are presented quantitatively to ensure objective measurement, while being complemented by qualitative insights.

To ensure the effectiveness of the monitoring system, each indicator is SMART:

Specific: Clearly defining what will be measured, the geographical area of measurement, units, etc.

Measurable: Ensuring the project can collect accurate information to measure progress.

Achievable: Aligning with anticipated changes and ensuring realistic results.

Relevant: Covering all key activities of the project.

Timed: Stating when specific milestones should be achieved.

Particular attention will be given to monitor and follow the TRL progress of each service, technology, and methodology, to ensure they achieve the targeted TRL 7 by the project's conclusion.

FlexCHESS surpasses the current state-of-the-art (SOA) in both academic research and industry by delivering an open-access, cloud-based platform. This Open Platform integrates AI and data-driven services, enabling the co-creation of CHESS and enhancing flexibility provision from CHESSs. With a dedicated focus on the HESS sector, FlexCHESS seeks to introduce innovative solutions, targeting an average TRL of 7. These solutions are rigorously designed to address the unique needs and challenges within the HESS sector.

It is important to note, that the TRL 'Shared knowledge base for VESS' is now led by AMU instead of ALWA.

Table 6: Revised FlexCHESS's Technology Readiness Levels (TRLs).

Technologies	Partners and WP	TRL	Expected improvements and progresses
Real-time digital twins for distributed hybrid energy storage optimisation	TOSHIBA WP3	5→7	Real-time digital twins for hybrid storage. Integration of battery digital twin with heat storage models in a real-time energy management system for HESS.
Energy management system for distributed hybrid energy storage optimisation	TOSHIBA AMU WP3	5→7	System efficiency improvements through optimisation using combined hybrid energy storage digital twins. Adaptation of storage charge/discharge based on overall goals to maximise efficiency.
VESS concept	CU WP3	5 →7	CU will enhance CHESS outcomes through the VESS concept. The integration of the VESS within the CHESS-Node will maximise the green flexibility provision.
VSoC estimator of VESS	CU WP3	5 →7	CU will define metrics to assess VESS operational flexibility (i.e., VSoC). Available power and energy capacities of the VESS will allow VPP to optimally manage its internal resources' uncertainty. The VSoC estimator will become an API integrated into the cloud or as a software and it will be demonstrated in WP5.

CHESS-plug	ARC WP2	6→7	Smart plug features will be enhanced and different types of data collection options (such as energy consumption, temperature, current, voltage, etc.) will be developed, and different energy optimization scenarios will be created.
Data analytics / Machine learning for HESSs	AMU WP3	6→7	Improve the scalability and modularity of our data analytics applications. Validate a novel concept of mixed algorithms to extract valuable information and ML-based Functional data analysis to learn for curves in real-time. These advanced solutions are useful for computational use cases
Decision making for VESSs	AMU WP3	5→6	In WP4, AMU will develop a specific ML for flexibility index to shift from KPI to a smart and predictive indicator. That facilitates eligibility analysis, decision making process and increases the profitability of FlexCHESS installations by providing operational flexibility to the grid.
Smart contract for Flexibility	RDIUP WP2	5→7	RDIUP develops a platform based on blockchain (TRL5) for rewarding levelling and ensure traceable, recorded and secured contracts and transactions between actors. The solution needs to be highly scalable, which is a new challenge for RDIUP.
Innovative system for forecasting	AMU WP3	5→7	A specific sky system will be developed by AMU to increase the prediction of RES production and make the installation more flexible and optimize their energy management according to predefined multi-objectives.
Shared knowledge base for VESS	AMU WP3	5→7	Toshiba, AMU, RDIUP, CU have content and knowledge about VESS and CHESS, but they are not structured or normalised. FlexCHESS will develop the first shared KB for VESS. Knowledge will be mainly based on data collected in this project.

After describing the Technology Readiness Levels (TRLs), the next step is to detail the evaluation indicators of the main component of FlexCHESS solutions: “The Cloud FlexPlatform”. This evaluation takes a dual approach, examining both external aspects, which focus on the platform's performance from the user's experience and expectation, and internal factors, which analyse the platform's underlying architecture and functionality. The following section presents a comprehensive set of

characteristics for both external and internal quality assessments of the Cloud FlexPlatform, which can be applied to the assessment of other digital tools:

- **The External Quality Assessment** of the FlexPlatform encompasses various critical performance indicators. Firstly, “Performance” is evaluated through metrics like Response Time, which measures the duration taken for the platform to react to user requests, and throughput, assessing the volume of data processed within a specific timeframe. In terms of “Reliability”, the assessment includes “Availability”, gauging the uptime and consistency of the platform's services, alongside “Fault Tolerance”, which evaluates its capacity to recover from failures without incurring substantial downtime. The platform's Scalability is scrutinized by examining its “Elasticity”, measuring the ability to adjust resources based on demand, and “Load Balancing”, which ensures optimal distribution of workloads for effective resource utilization. Security measures such as “Data Encryption” protect sensitive information during transmission and storage, while Identity and Access Management assesses control mechanisms for resource access. Compliance with industry standards and regulations is verified through Regulatory Compliance, ensuring adherence to relevant guidelines, and “Data Residency”, which guarantees legal compliance regarding data storage locations. “Usability” is evaluated through the clarity of the User Interface and the comprehensibility of available documentation. Finally, the assessment of “Cost Efficiency” includes evaluating Resource Optimization to minimize costs and ensuring Transparent Pricing for users. Together, these aspects provide a comprehensive overview of the FlexCHESS digitalization quality and effectiveness.
- On the other hand, The **Internal Quality Assessment** of the FlexPlatform focuses on various critical aspects to ensure optimal functionality. “Performance” is monitored via Resource Utilisation, identifying potential bottlenecks in internal resource usage, and Code Efficiency, which evaluates the platform’s code effectiveness regarding processing and resource consumption. In terms of Reliability, the assessment includes examining Error Handling capabilities and the effectiveness of Logging and Monitoring mechanisms for internal operations. The platform’s Scalability is assessed through its Architectural Flexibility, ensuring adaptability to changing requirements, and the capacity for Distributed Computing, which evaluates performance in handling distributed tasks. Security measures involve Vulnerability Scanning to identify weaknesses within the platform and robust Authentication Mechanisms for user access control. The Maintainability aspect includes evaluating Code Readability for ease of maintenance and ensuring effective Version Control systems are in place. Flexibility is assessed through the design of APIs for internal communication and Configuration Management, evaluating how easily adjustments can be made. Lastly, the assessment includes Monitoring and Analytics, focusing on internal performance metrics to highlight areas for improvement and implementing Anomaly Detection mechanisms to proactively identify potential issues. Together, these factors

create a comprehensive framework for assessing and enhancing the internal quality of the FlexPlatform.

Risk Management Plan

In the dynamic setting of a project, unexpected risks may arise, posing real challenges to the seamless progression of our work. Our Risk Management Plan is carefully crafted to identify and proactively mitigate these critical risks, ensuring the project's overall success and the delivery of high-quality results.

The Risk Management Plan (RMP) is composed three essential components:

- Critical Risk Assessment and Analysis: This process focuses on identifying various types of risks that may arise during the project and evaluating their exposure ratings. The (i) represents Likelihood, while (ii) denotes Impact.
- Risk Monitoring: This entails a comprehensive evaluation to determine the likelihood of each identified risk and to assess its potential effects on the project.
- Risk Mitigation Strategies: This includes contingency actions designed to effectively manage the identified risks. These strategies specify individual responsibilities, outline the scope of the contingency measures, and detail the procedures to be implemented for addressing and mitigating potential risks.

By implementing these key principles, our RMP acts as a proactive guide, allowing that we not only anticipate and understand potential challenges but also have appropriate strategies in place to manage them smoothly.

11. Risks Assessment and Analysis

Erreur ! Source du renvoi introuvable.7 presents potential risks identified within the FlexCHESS project. This proactive identification of challenges establishes a solid foundation for effective risk management. The PC will conduct regular monthly reviews to assess the accuracy of these detected risks. This ongoing evaluation ensures that the Risk Management Plan remains living and responsive, facilitating continuous enhancement as the project progresses.

During the project execution, the consortium encountered a challenging situation with ALWA. In response, the PC and WPLs anticipated the potential risk by organizing a series of meetings to assess the situation and devise a solution for taking over the activities and tasks initially assigned to ALWA. These proactive measures enabled the consortium to mitigate the risk effectively, ensuring the continuity of the project before ALWA's official withdrawal.

Table 7: List of revised critical risks and their exposure rating ((i): Likelihood ; (ii): Impact))

Risk No	WP No	Description
1	WP6	**Withdrawal of Partners:** For several unforeseen reasons, even external consortiums, a partner could decide to stop its participation and officially leave the FlexCHESS project. ((i) Low, (ii) Medium)

2	WP3	**Difficulty in Combining Models**: The challenge of effectively combining electricity and heating models together to define appropriate workflow for charging/discharging. ((i) Low, (ii) Medium).
3	WP3	**Insufficient Computational capacities:** Insufficient computational capabilities and performance for Real-Time digital twin functionalities. ((i) Low, (ii) Medium)
4	WP3	**Data Collection and knowledge elaboration Challenges**: Difficulty in collecting sufficient and reliable data from pilots, leading to the generation of poor results and outcomes, affecting prediction accuracy and decision-making. ((i): High, (ii): Medium)
5	WP2	**Higher Cost in Public Blockchain**: Costs of public blockchain increase, and the difficulty of exploiting the rewards generated. ((i) Medium, (ii) Low)
6	WP2	**Transaction Rates in Blockchain:** The transaction processing speed of the selected blockchain may fall short of meeting real-time operational requirements, potentially causing delays in system performance. ((i): Low (ii): Medium)
7	WP3	**Cyber-attacks to the cloud services:** Risk of security failures and vulnerabilities of the platform against cyber-attacks. ((i): Low (ii): Medium)
8	WP2	**Integration Challenges with Heterogeneous Technology:** HESS and smart appliances using heterogeneous technology and protocols (such as proprietary software with limited functionalities) may be difficult to integrate with the FlexCHESS infrastructure. ((i): Medium, (ii): Low)
9	WP3	**Integration Complexity**: Modules may fail in data exchange and layers interoperability, and/or it may be difficult to integrate the solution in the pilot test cases. ((i): Medium, (ii): Medium)
10	WPs2,3	**Centralized Control Challenges:** The level of central control in the pilot system may introduce challenges related to latency and security, which could potentially compromise the decentralized approach. ((i): Low, (ii): Medium)
11	WP4	**Flexibility Services testing and validation challenges:** Difficulty in testing flexibility services (e.g. frequency control) due to regulatory fences ((i): Medium, (ii): Medium)
12	WP4	**Risk of Grid's Electric Blackout:** Possibility of provoking electric issues for grid-tied systems. ((i): Low, (ii): High)
13	WP5	**Lack of involvement:** Lack of engagement among businesses, aggregators, and consumers. ((i): Low, (ii): High)
14	WP5	**Difficulty to define sustainable Business Model:** Challenges in building a profitable business model tailored for CHESSs. ((i): Low, (ii): High)

12. Risks Monitoring

To effectively manage risks during the project lifecycle, a comprehensive approach to risk analysis and monitoring is essential. This includes not only the continuous tracking of known risks but also the proactive identification, documentation, and evaluation of any unforeseen risks that may arise.

Additionally, it is crucial to manage the established risk reserve judiciously, ensuring that resources are allocated effectively to mitigate potential risks. This involves regular reviews and timely adaptations to the risk management strategy as required.

An integral part of risk analysis is the collection of lessons learnt during the project lifetime. By documenting challenges, experiences, and achievements, FlexCHESS can build a valuable knowledge base for future risk detection and assessment efforts needed. This proactive learning method improves the project's robustness and adaptability in the face of emerging risks.

The responsibility for risk analysis and monitoring lies with key project stakeholders, including the PC, WPLs, and task leaders. Their continuous vigilance and collaborative efforts ensure a proactive response to evolving risks, fostering a culture of risk awareness and mitigation throughout the project. Regular communication and feedback loops are vital for facilitating swift responses to emerging risks and refining the risk management strategy as necessary.

13. Risks Mitigation Strategies

Table 8 outlines the risk management strategy formulated by the FlexCHESS consortium. It details the anticipatory and corrective plans, contingency measures, and mitigation guidelines designed to treat the identified risks discussed in the previous section. This specific strategy reinforces our engagement to proactively manage challenges, guarantying the robustness and success of the FlexCHESS execution.

Table 8: Revised mitigation measures

Risk No	WP No	Proposed Mitigation Measures
1	WP6	**Withdrawal of Partners**: This risk is mitigated by establishing robust contractual agreements that outline procedures for handling conflicts or cases of non-compliance, formalized through the signing of a Consortium Agreement (CA). In cases where intervention is required, the WPLs and PC will coordinate efforts to propose alternative solutions. These solutions may involve reallocating responsibilities and activities (As the case of ALWA), either partially or entirely, to other partners within the consortium as a preventive or corrective measure.
2	WP3	**Difficulty in Combining Models:** Numerous assumptions are made during the modeling process, and certain parameters are disregarded, which may lead to biased outcomes when

		integrating multiple heating and electricity models. To mitigate this risk, WP3 will focus on thoroughly studying the coupling of these models, ensuring that potential biases are identified and addressed early in the process.
3	WP3	**Insufficient Computational Resources:** This risk is relieved via the utilization of adequate resources for RT data streaming. TOSHIBA has strong experiences to ensure the deployment of the developed RT Digital Twin.
4	WP3	**Data Collection and knowledge elaboration Challenges:** LaSolar, UEDAS, IREN and EL have e-meters allowing easier data gathering. Additionally, RDIUP, TOSHIBA and AMU have modules enabling data transformation and mining from the digital twin.
5	WP2	**Cost Escalation in Public Blockchain**: We will explore the use of blockchain platforms with lower (or limited free) transaction fees. Additionally, batch processing and off-chain mechanisms will be employed to minimize the number of costly transactions. Regular monitoring of gas fees and cost optimization strategies will ensure resource efficiency.
6	WP2	**Transaction Rates in Blockchain:** Optimizing the blockchain framework, using batch processing to reduce transaction frequency, and implementing off-chain solutions for non-critical data. Continuous monitoring and load balancing will help better manage traffic.
7	WP3	**Cyber-attacks to the Platform:** Hybrid security techniques will be deployed (JWT, encryption, pseudonymization). Data minimization will be adopted. All necessary corrective measures will be taken to enhance the security of the platforms and APIs. Regular backups will be performed.
8	WP2	**Integration Challenges with Heterogeneous Technology**: CHESS-plug will provide a unified hardware module which facilitates communication to the FlexCHESS infrastructure, essentially acting as a gateway for heterogeneous technology components which seamlessly integrates them into the larger infrastructure.
9	WP3	**Integration Complexity:** An integration plan will be defined in WP1. The interoperability is addressed and designed early by-design. A common data models and variables have been defined in WP1. RDIUP has a large experience in integrating various modules and codes (e.g. VPP4I-Node in VPP4ISLANDS)
10	WP2	**Central Control Challenges:** An interoperable communication and information layers, according to SGAM architecture, will be proposed to ensure effective connection of distributed CHESSs with existing centralized systems.
11	WP4	**Flexibility Services Experimentation Challenges:** Many assets are installed and managed by the DSO partners in their area, and several flexibility services (e.g. peak shaving and shift loading) can be easily tested. Also, FlexCHESS can firstly

		test and perform in parallel the flexibility services in the RT digital twin to compare the outcomes.
12	WP4	**Risk of Electric Blackout for Grid-tied Systems:** Before demonstration, SPIDER HIL Platform (AMU) will define a risk management and prepare corrective actions to avoid this risk. The RT digital twin can also be used to predict and mitigate this issue.
13	WP5	**Lack of Interest**: To mitigate this risk, we will encourage target groups to participate in FlexCHESS workshops and events, while also promoting end-user engagement through accessible open services and information. Also, the project will showcase that CHESSs are profitable.
14	WP5	**Difficulty Defining a Sustainable Business Model:** To mitigate this, RDIUP will include rewarding systems and identify use of coupons in local market to define the business model and guarantee the durability of the FlexCHESS. DSS (WP3) can be used to maximize the savings of optimal CHESS sizing.

During this first project period, key lessons learnt can be exploited as a source for continuous improvement and future project implementations, reinforcing the commitment to excellence and effective risk management, as follows:

- The importance of early and continuous risk identification cannot be overstated. Regular monitoring and assessment have proven crucial in mitigating potential challenges before they escalate.
- Maintaining proper communication among consortium partners is vital for collaboration. Regular meetings and documentation, such as Minutes of Meetings (MoMs), foster accountability and ensure alignment on project objectives.
- Adapting strategies and processes based on real-time feedback and project dynamics enhances resilience. Being open to refining methodologies allows for better alignment with evolving project needs.
- Actively involving and engaging stakeholders, including end-users, in the development process helps to ensure that project outcomes are relevant and valuable. This engagement has facilitated smoother implementations and increased stakeholder satisfaction.
- Recording lessons learned and best practices throughout the project lifecycle contributes to a valuable knowledge base for future activities. This practice aids in refining processes and improving project outcomes.
- Embedding quality assurance measures into every aspect of the project ensures consistent adherence to guidelines, ultimately leading to higher quality outputs and enhanced project execution.

Conclusion:

In summary, this deliverable D6.4 outlines comprehensive frameworks for Quality Assurance Plan (QAP) and Risk Management Plan (RMP) within the FlexCHESS project, emphasizing the importance of maintaining high standards and proactively addressing potential challenges.

The QAP determines the frameworks and strategies designed to uphold and enhance the quality of the project's outputs throughout its lifecycle. It defines guidelines, processes, and resource allocations essential for maintaining high-quality standards in project execution and deliverables.

Conversely, the RMP focuses on the proactive identification and management of potential risks prior to their occurrence, ensuring that appropriate actions and effective mitigation strategies are implemented. It outlines the procedures for identifying and tracking potential risks, assessing their exposure levels, detailing the monitoring process, and specifying the necessary steps for developing and executing contingency measures.

Through defined protocols and ongoing evaluations, the project is well-equipped to uphold its commitment to excellence while navigating complexities in technology development. The proactive measures detailed in D6.4, including robust mitigation strategies for identified risks, underscore the consortium's dedication to fostering resilience and adaptability.

As the FlexCHESS project advances, regular assessments will further refine these strategies, ensuring that both quality and risk management evolve in tandem with the project's needs, ultimately contributing to the successful delivery of outcomes that meet stakeholders' expectations.

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H2020 VPP4ISLANDS outcomes and lessons learnt

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