COLOSSUS
COLLABORATIVE SYSTEM OF SYSTEMS

DELIVERABLE D 1.1

Quality and Risk Management Plan

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WorkPackage N°: WP1
Due date of deliverable: 30.05.2023
Actual submission date: 17.07.2023
Document ID: D 1.1 - Quality and Risk Management Plan - v1-0.docx

Grant Agreement number: 101097120
Project acronym: COLOSSUS
Project title: Collaborative System of Systems Exploration of Aviation Products, Services and Business Models
Start date of the project: 01/02/2023
Duration: 36 months
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DOCUMENT INFORMATION

Document ID	D 1.1 - Quality and Risk Management Plan - v1-0.docx
Version	1.0
Version Date	15.06.2023
Author	Nabih Naeem and Nazlican Cigal
Dissemination level	PU

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DOCUMENTS HISTORY

Version	Date	Modification	Authors
0.1	30.05.2023	Document initialization	Nabih Naeem
0.2	05.06.2023	Document modification	Nazlican Cigal & Nabih Naeem
0.3	06.06.2023	Document modification	Nazlican Cigal & Nabih Naeem
1.0	15.06.2023	Implement feedback & finalization	Nazlican Cigal & Nabih Naeem

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GLOSSARY

Acronym	Signification
AB	Advisory Board
ABM	Agent-Based Modelling
IPR	Intellectual Property Right
KPI	Key Performance Indicator
OEM	Original Equipment Manufacturer
SoS	System of Systems
SC	Steering Committee
WP	Work Package

1. EXECUTIVE SUMMARY

1.1. Introduction

The following document presents the quality and risk management plan tailored for COLOSSUS project, encompassing comprehensive guidelines and protocols to ensure effective project execution and mitigation of potential risks. This quality and risk plan outline the proactive measures and strategies implemented to ensure the success of the COLOSSUS project. The plan focuses on effective risk management, including early testing, working group meetings, milestone tracking and redundant analysis capabilities to mitigate potential challenges in design, optimization, IT frameworks, data exchange and partner collaboration. In addition, a comprehensive review process involving Work Package (WP) leads and a review board has been established to maintain high quality standards for project deliverables. The establishment of an Advisory Board (AB) facilitates valuable feedback and insights for continuous improvement. By implementing this plan, the partners aim to mitigate risks, meet the quality objectives and deliver effective results.

1.2. Brief description of the work performed and results achieved

The deliverable presents a quality and risk management plan that has been compiled from the project proposal and adjusted to align with the project's status at the time of document delivery.

1.3. Deviation from the original objectives

1.3.1. Description of the deviation

Despite its initial deadline of May 30, 2023, the completion of deliverable D1.1 faced a delay and could be finalized on June 15, 2023.

1.3.2. Corrective actions

There was no need for any corrective measures.

2. WORK PERFORMED

2.1. Identification of Risks in the Work Plan

The primary objective of the COLOSSUS is to drive progress towards the future by creating a solid basis for the development of a system-of-systems design approach. This approach aims to offer effective solutions for intermodal transport and wildfire fighting. The project seeks to achieve this transformative breakthrough through the utilization of cutting-edge optimization techniques, collaborative methodologies, and information technologies driven by knowledge. These efforts are characterized by their ambitious targets as the project aims to design aviation products and services in a fully holistic approach. The primary concern at the top level is the possibility of not fully achieving these targets. The objective of the risk management approach is to proactively identify issues at an early stage, employ risk mitigation strategies, and explore alternative solutions. Therefore, this section provides a comprehensive list of risks associated with each work package, outlining potential challenges and vulnerabilities throughout the project's execution.

2.1.1. WP 1 - Project Management & Coordination

No risk mitigation is established for WP1.

2.1.2. WP 2 - Business Models, Scenarios & Assessments

Risk 1: Inconsistent database among partners.

- Level of Likelihood: Medium
- Level of Severity: Low
- Proposed Risk-Mitigation Measures: Establish central documentation at the beginning of the project. Plan synchronization phases on common data to ensure consistency.

Risk 2: Optimization is indicating unrealistic solutions for complex scenarios.

- Level of Likelihood: Medium
- Level of Severity: Medium
- Proposed Risk-Mitigation Measures: All variable changes are modeled and monitored to understand optimization progress. Validation tasks are led by industrial partners to ensure realistic and feasible solutions are achieved.

Risk 3: Results of design tasks cannot be published due to IPR issues.

- Level of Likelihood: Low
- Level of Severity: Low
- Proposed Risk-Mitigation Measures: All design tasks are set up from scratch to avoid potential IPR conflicts. Confidential data will not be used in publications to ensure compliance with IPR requirements.

Risk 4: Difficulties for the industry and consortium to use AGILE & COLOSSUS developed framework technologies.

- Level of Likelihood: Low
- Level of Severity: Low

- Proposed Risk-Mitigation Measures: An incremental development approach is used, allowing for gradual adoption and learning of the AGILE & COLOSSUS developed framework technologies. A training roadmap is planned to provide necessary education and support for the successful deployment of the new digital technologies.

Risk 5: Poor interest and low involvement of stakeholders in validating selected KPIs and metrics.

- Level of Likelihood: Medium
- Level of Severity: Medium
- Proposed Risk-Mitigation Measures: Start involving the necessary stakeholders right from the beginning of the project to avoid their low involvement and guarantee the success of the project. Benefit from partners' contact networks consisting of cooperation partners in previous or current projects, active members of associations and organizations.

Risk 6: Limited data availability: Environmental and cost-benefit impact assessments are dependent on a variety of external data sources, which might not be available at an appropriate level of detail and actuality.

- Level of Likelihood: Medium
- Level of Severity: Low
- Proposed Risk-Mitigation Measures: Early conceptualization of possible alternative data sources, proxy variables, and model simplification for the case of insufficient data availability. The framework embeds uncertainty modeling. Furthermore, the framework possesses a high level of scalability, allowing for the seamless incorporation of supplementary information.

2.1.3. WP 3 - Transformative Digital Collaborative Technology Framework

Risk 1: Limitations in the IT frameworks prohibit the integration of developed digital engineering technologies.

- Level of Likelihood: Low
- Level of Severity: Medium
- Proposed Risk-Mitigation Measures: COLOSSUS is planned with interoperability at the core. Early interface definitions and functionalities identification are planned. Developed solutions are IT framework independent.

Risk 2: Automated data exchange cannot be established in time due to company firewalls restrictions.

- Level of Likelihood: Low
- Level of Severity: Low
- Proposed Risk-Mitigation Measures: Set up analysis servers outside company firewalls, leveraging infrastructures available at academic partners to facilitate the data exchange process.

Risk 3: Inconsistent database among partners. (Refer to WP 2 – Risk 1)

This risk is the same as the one mentioned in the WP 2 section regarding inconsistent databases among partners. It is important to address this risk in both WP 2 and WP 3 to ensure accurate and reliable data exchange between the project partners.

Risk 4: Optimization is indicating unrealistic solutions for complex scenarios. (Refer to WP 2 – Risk 2)

This risk is shared with WP 2, as it involves optimization techniques for complex scenarios. The challenge lies in ensuring that the optimization process does not produce unrealistic or impractical solutions. To address this risk, all variable changes will be carefully modeled and monitored to gain a better understanding of the optimization progress. Validation tasks will be led by industrial partners to ensure that the solutions generated are realistic and feasible. This risk and its corresponding risk-mitigation measures are relevant to both WP 2 and WP 3, emphasizing the importance of achieving practical optimization outcomes.

Risk 5: Delay in providing requirements by OEM for the use cases.

- Level of likelihood: Low
- Level of severity: Low
- Proposed risk-mitigation measures: To mitigate the risk of delays in receiving the required specifications from the OEM for the use cases, multiple partners within the consortium are capable of providing industry-relevant requirements, ensuring that there are alternative sources for gathering the necessary information. Furthermore, considering that this is an exploration project, the framework has already incorporated uncertainty modeling, allowing for flexibility and adaptation in case of any delays in obtaining specific requirements from the OEM.

Risk 6: Difficulties for the industry and consortium to use AGILE & COLOSSUS developed framework technologies. (Refer to WP 2 – Risk 4)

It is important to note that WP3 shares Risk 4 with WP2 where the difficulties faced by the industry and consortium in utilizing AGILE & COLOSSUS developed framework technologies. To address this risk, an incremental development approach is adopted, allowing for a gradual adoption and learning process of the AGILE & COLOSSUS framework technologies within WP3. A training roadmap is also planned specifically by WP3 to provide the necessary education and support for the successful deployment of these digital technologies.

Risk 7: Incompatibility of the data format of the system technologies with the needed data format of the aircraft design environment.

- Level of Likelihood: Low
- Level of Severity: Low
- Proposed Risk-Mitigation Measures: Utilization of a consistent and well-defined data format, e.g., CPACS, to ensure compatibility between system technologies and the aircraft design environment.

2.1.4. WP 4 - Integrated Aircraft Design

Risk 1: Limitations in the IT frameworks prohibit the integration of developed digital engineering technologies. (Refer to WP 3 – Risk 1)

Risk 2: One partner does not deliver results in the design and optimization processes.

Likelihood: Low
Severity: Medium
Proposed risk-mitigation measures: To mitigate this risk, a proactive approach has been adopted. Early tests, workgroup meetings, and the establishment of project milestones are planned to identify any potential problems with the partner's performance. Additionally, redundant analysis capabilities are available if needed, ensuring that the design and optimization processes can continue smoothly.

Risk 3: Automated data exchange cannot be established in time due to company firewalls restrictions. (Refer to WP 3 – Risk 2)

Risk 4: Inconsistent database among partners. (Refer to WP 2 – Risk 1)

Risk 5: Optimization is indicating unrealistic solutions for complex scenarios. (Refer to WP 2 – Risk 2)

Risk 6: Results of design tasks cannot be published due to IPR issues. (Refer to WP 2 – Risk 3)

Risk 7: Delay in providing requirements by OEM for the use cases. (Refer to WP 3 – Risk 5)

Risk 8: Difficulties for the industry and consortium to use AGILE & COLOSSUS developed framework technologies. (Refer to WP 2 – Risk 4)

Risk 9: Poor interest and low involvement of stakeholders in validating selected KPIs and metrics. (Refer to WP 2 – Risk 5)

Risk 10: Limited data availability: Environmental and cost-benefit impact assessments are dependent on a variety of external data sources, which might not be available at an appropriate level of detail and actuality. (Refer to WP 2 – Risk 6)

Risk 11: Incompatibility of the data format of the system technologies with the needed data format of the aircraft design environment. (Refer to WP 3 – Risk 7)

Risk 12: Inconsistency of the models of the preliminary and detail design.

- Level of Likelihood: Medium
- Level of Severity: Medium
- Proposed Risk-Mitigation Measures: Continuous information exchange about the modeling methods and ensuring data compatibility between the preliminary and detail design phases. Additionally, at least three iterative loops between the aircraft level and SoS levels are planned to enhance the fidelity of models and consider uncertainties.

2.1.5. WP 5 - Holistic System-of-Systems Engineering

Risk 1: Limitations in the IT frameworks prohibit the integration of developed digital engineering technologies. (Refer to WP 3 – Risk 1)

Risk 2: One partner does not deliver results in the design and optimization processes. (Refer to WP 4 – Risk 2)

Risk 3: Automated data exchange cannot be established in time due to company firewalls restrictions. (Refer to WP 3 – Risk 2)

Risk 4: Inconsistent database among partners. (Refer to WP 2 – Risk 1)

Risk 5: Optimization is indicating unrealistic solutions for complex scenarios. (Refer to WP 2 – Risk 2)

Risk 6: Results of design tasks cannot be published due to IPR issues. (Refer to WP 2 – Risk 3)

Risk 7: Delay in providing requirements by OEM for the use cases. (Refer to WP 3 – Risk 5)

Risk 8: Difficulties for the industry and consortium to use AGILE & COLOSSUS developed framework technologies. (Refer to WP 2 – Risk 4)

Risk 9: Poor interest and low involvement of stakeholders in validating selected KPIs and metrics. (Refer to WP 2 – Risk 5)

Risk 10: Limited data availability: Environmental and cost-benefit impact assessments are dependent on a variety of external data sources, which might not be available at an appropriate level of detail and actuality. (Refer to WP 2 – Risk 6)

Risk 11: Incompatibility of the data format of the system technologies with the needed data format of the aircraft design environment. (Refer to WP 3 – Risk 7)

Risk 12: Inconsistency of the models of the preliminary and detail design. (Refer to WP 4 – Risk 12)

Risk 13: The System of Systems design space, consisting of vehicle and operational design spaces, is larger than can be explored with available computational resources

- Level of Likelihood: Medium
- Level of Severity: Medium
- Proposed Risk-Mitigation Measures: Reduction of SoS design space using common sense assumptions, Efficient implementation of ABM, use of Surrogate Modeling and consideration of required fidelity levels.

2.1.6. WP 6 - Dissemination & Exploitation

Risk 1: Results of design tasks cannot be published due to IPR issues. (Refer to WP 2 – Risk 3)

2.2. Quality Management Process

The management framework of the COLOSSUS project has been established to ensure optimal coordination of research activities while maximizing cost-effectiveness, ultimately leading to the successful attainment of project objectives upon its completion. The comprehensive management structure, illustrated in Figure 1, comprises various essential bodies responsible for distinct facets of project oversight. These include the Project Coordinator Team, which assumes the central role in coordinating project activities, the Steering Committee, the Technical Committee composed of the Project Coordinator and the Work Package Leaders, the Dissemination/Exploitation Committee, and the Advisory Board. This well-defined management framework fosters streamlined decision-making, seamless coordination, and active partner engagement throughout the entire project lifecycle.

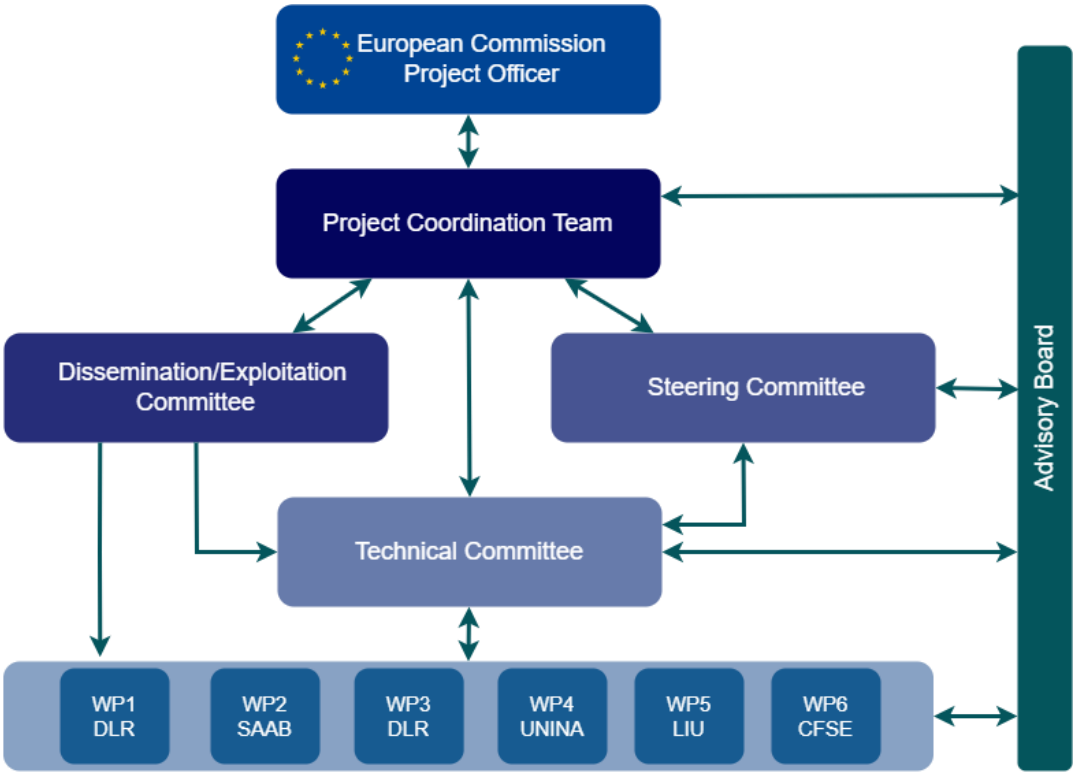

Figure 1: COLOSSUS project management structure

The project has established a robust quality management process to ensure the high quality of its outputs. For each milestone and deliverable, a thorough review process is conducted involving the WP leads. This formal review process begins 14 days before the deadline, allowing sufficient time for comprehensive evaluation. Prior to formal submission, the deliverable or milestone must successfully pass the review of the members of the review board.

To facilitate effective project management and timely reporting, several measures are implemented. Partners are provided with reminders through dedicated project management tools, helping them adhere to reporting procedures and meet deadlines. The project's progress is closely monitored through regular virtual weekly/bi-weekly basis meetings at the WP level, and virtual bi-weekly meetings between the WP leads and the Project Coordination Team, as well as semi-annual in-person meetings with the entire Consortium. These meetings serve as valuable opportunities to assess the project's advancement, identify any potential risks of delay, and establish appropriate mitigation plans.

The coordination of periodic and final reports is entrusted to DLR, who collaborates closely with the WP leaders to consolidate the relevant data as a lead of WP1. This ensures the accuracy and reliability of the reports. Furthermore, DLR completes the necessary validations before uploading the reports to the EU Portal.

In terms of the deliverable completion timeline, a specific timeline is followed to ensure efficiency. The deliverable is expected to be completed two weeks (10 work days) prior to the deadline. During the first five working days, the author(s), the WP leads and relevant stakeholders identified by the deliverable's WP lead, review the deliverable. Any requested changes from the first review phase are implemented within three working days. Subsequently, the second phase of review takes place, involving the project coordinator, review committee, and lead author, and is completed within two working days. Finally, the deliverable is finalized and uploaded to the EU Portal by the project coordinator. To gather valuable feedback from a wider range of stakeholders, an AB is

formed. This board provides insights and perspectives that contribute to the overall success of the project. The review process of the deliverables is demonstrated in Figure 2.

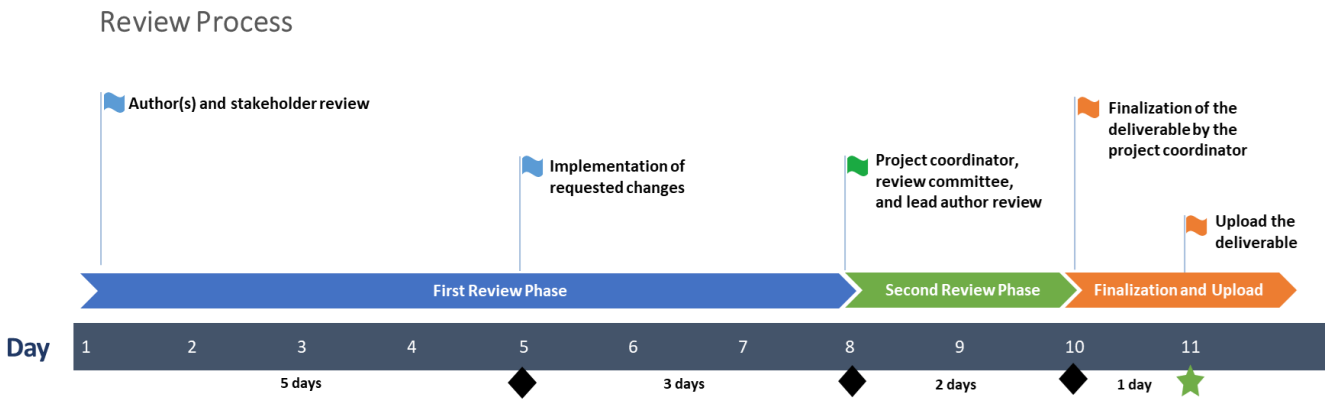

Figure 2: Review process of the deliverables

3. Conclusion and Outlook

In conclusion, this report documents the implemented measures to ensure the success of the COLOSSUS project. The identification and mitigation of potential risks enable the project partners to effectively address challenges that may arise during the project's execution. The implementation of early tests, workgroup meetings, milestone tracking, and redundant analysis capabilities play a crucial role in identifying and resolving issues related to design and optimization processes, IT framework limitations, automated data exchange, and inconsistent databases among partners.

Furthermore, the commitment to quality management is manifested through the establishment of a comprehensive review process. The involvement of WP leaders and the review board ensures that deliverables meet the required standards and demonstrate outstanding quality. The utilization of dedicated project management tools, regular meetings, and efficient communication channels contribute to timely reporting, adherence to procedures, and the overall success of the project.

4. References

[1] Collaborative System of Systems Exploration of Aviation Products, Services and Business Models. Cordis. https://cordis.europa.eu/project/id/101097120, 2023.